ONLINE SYNCHRONOUS MATRIX WARGAMING AS A MULTI-DOMAIN GOVERNMENT AND MILITARY DECISION SUPPORT TRAINING CAPABILITY

COL(USA-A-Ret) Wayne Stilwell, Phd
Stilwell Technology and Robotics, LLC
Brandy Station, VA
wayne@machineteams.com

MAJ (USA-A) Stephen Nelson
NATO ACT
Norfolk, VA
stephen.l.nelson22.mil@army.mil

ABSTRACT

The availability and application of online synchronous matrix wargaming capabilities to support multi domain government and military decision training are now significant and available. Government and military leaders need upgraded and rapidly available online wargaming capabilities to respond to difficult challenges in regional and global international discourse and crises. The military and the political competitive environment have transitioned into cyber, space, autonomous systems, and robotic capabilities that now deeply stress national-level leadership's ability to synchronize and train for crises.

Synchronous online matrix wargaming capabilities can complement existing national-level multi-domain modeling and simulation decision support training. Already available online-based synchronous matrix wargame capabilities can provide flexible, low-cost, and high-impact geographically distributed training opportunities that support the complex arguments and action-reaction chains that national-level leaders must address. Additionally, online synchronous matrix wargames can provide leaders and planners at all echelons with an ability to better grasp the implications of cross-domain efforts, better illuminate necessary preparations, and more deftly combine kinetic and/or non-kinetic efforts in the pursuit of national and coalition goals.

As a method of demonstration, the results of a theoretical Black Sea regional crisis online matrix wargame from a single NATO country's perspective are presented. During the experiment, teams of players operating in a geographically distributed online environment represented regional national and coalition government and military leadership teams. The results indicate a much-increased ability to integrate coalition and national-level multi-domain decisions and the technology also provides an inexpensive increase in capability to existing modeling and simulation capabilities.

ABOUT THE AUTHORS

Wayne Stilwell is a CEO of Stilwell Technology and Robotics, LLC, and holds US patents in robotics interoperability. He is a retired US Army simulations operations officer with NATO tours at the Joint Warfare Center in Stavanger, Norway, and the NATO Rapid Deployable Corps -Turkey in Istanbul.

Steven Nelson is an active-duty US Army FA57 simulations operations officer serving at the NATO Allied Command Transformation as a simulations staff officer. He is a graduate of the US Army Simulations Operations Officer's Course at Fort Belvoir, Virginia, and the US Army Command and General Staff College in Fort Leavenworth, Kansas.

ONLINE SYNCHRONOUS MATRIX WARGAMING AS A MULTI-DOMAIN GOVERNMENT AND MILITARY DECISION SUPPORT TRAINING CAPABILITY

COL(USA-A-Ret) Wayne Stilwell, Phd
Stilwell Technology and Robotics, LLC
Brandy Station, VA
wayne@machineteams.com

MAJ (USA-A) Stephen Nelson
NATO ACT
Norfolk, VA
stephen.l.nelson.mil@army.mil

AN INCREASED EMPHASIS ON GOVERNMENT AND MILITARY DECISION TRAINING

Government and military leaders need upgraded and rapidly available online wargaming capabilities to respond to difficult challenges in regional and global international discourse and crises. The military and political competitive environment globally has raced forward into cyber, space, autonomous systems and robotic capabilities that now deeply stress national-level leadership's ability to synchronize and train for crises. Training government and national leaders across a multi-domain spectrum of capabilities requires rapidly assembly and synchronous collaboration in a contested environment.

How do regional governments react to military actions or threats in the long term? What impacts on regional economies do cyber-attacks have (or even threats of cyber activities)? What impacts do aggressor nation behaviors have on another nation's elections? How does the placement of new weapons systems in an important geo-strategic region impact relationships between aligned and non-aligned nations? How effective are alliances at conducting diplomatic, information, military and economic actions that promote alliance and national interests?

Online synchronous wargaming capabilities are now *better available* to support multi-domain government and military decision support training. Matrix wargaming in an easily available online format is an excellent tool for government and multi-domain military decision training. Long integrated into table-top exercises and higher-level strategic simulations, matrix wargaming provides an ability to match wits against live opponents in non-kinetic as well as kinetic environments. It presents an ability to move through time on an extended basis and incorporates the ability to influence other parties to either make or avoid decisions as desired by other parties.

Diplomacy, information, economic, and military influences can be combined to present a greater realm of decision, hesitation, alliance building, and national interest pursuit. Matrix wargaming can also provide a cascading approach to training and plan development as stress points in policy and military-political seams are exposed and explored. The use of argument-based simulation for higher level political and military scenarios is not new. One can imagine Genghis Khan and his advisors sitting around a fire and drawing figures in the dirt regarding best directions and plans for the continuing campaign of conquest. Arguments would be presented and eventually a decision would be made as to the next move.

What is new is an easily accessible online synchronous matrix wargaming platform with a detailed dynamic mapping capability and message routing in direct support of wargaming information flow and turn management. The basics for building this capability are not that novel, but it seems that only now has serious effort been made to construct an easy-to-use technology for the effort.

Synchronous wargaming has traditionally been accomplished at the government level with rhythmic exercises that are slowly developed and require the physical presence of senior government leaders. Building an exercise or training event using legacy simulation or table-top wargaming for government and military leaders takes critical time to assemble. Often, deputies and subordinate leaders interact for many agencies and services to consider policy ramifications of events in a regional area of interest over a short-term crisis. While crisis management and scenario planning for shorter-term events are highly necessary, longer-term impacts of decisions cannot be effectively studied in these scenarios.

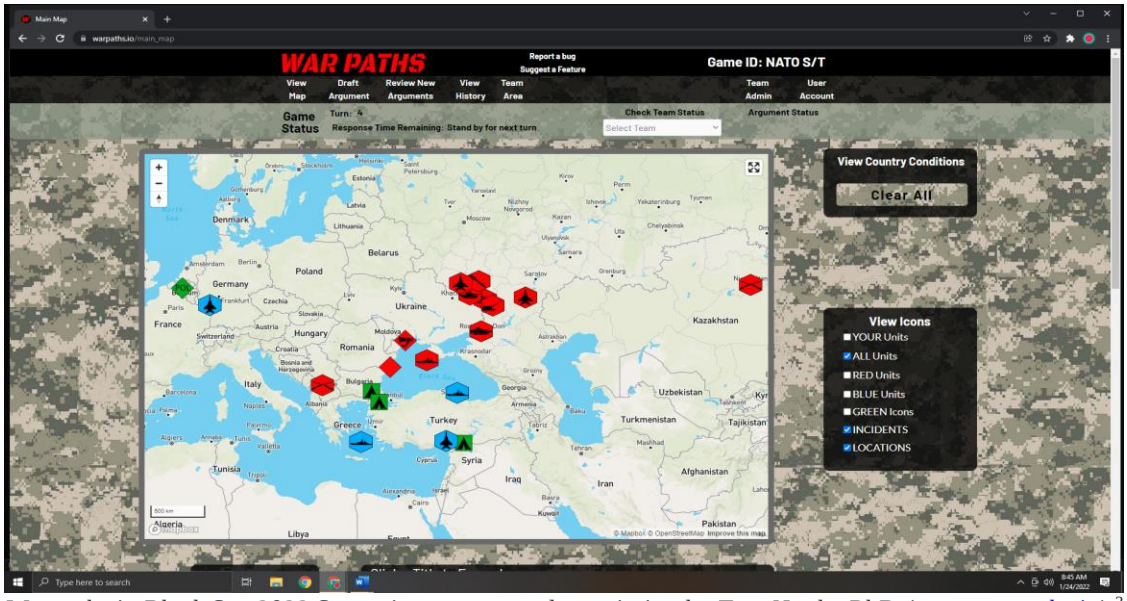
Online synchronous matrix wargaming can complement the legacy simulation and table-top wargaming capabilities as an additional capability for training and experimentation. One of the greatest simulation gaps identified in NATO has been the ability to consider longer time sequences of nation-building, stability operations, cyber warfare, space operations, and actions across the diplomatic, information, and economic realms of hybrid warfare. Kinetic and non-kinetic operations are often intermingled in long-term operations and NATO often does not yet possess the tool set to consider longer-term effects.

Online web-based systems such as Warpaths.io allow leaders to explore synchronous matrix wargaming with accessible scenario information, communication channels, and white cell adjudication and rebuttal processes. Matrix wargaming is the use of argument-based discussions between players with competing interests that are categorized on likelihood of success and then stochastically determined as successful or failed. [1]

A permutation of the rules can be described as follows. Players, in this case representing a nation or alliance, inject arguments into the wargame in the form of an action with an expected result and supporting reasons why that action will be successful. (The actions are categorized as military, information, diplomatic, or economic in nature). The argument is presented to the other players who, in turn, rebut or support the action (depending on alliances and national interests. After all debate or reason is declared final, an adjudicator grades the argument along a Likert scale ranging from very weak to very strong depending on the best beliefs of expertise on the subject. Die rolls are introduced based on the grading to produce the success or failure of an argument. For example, a very weak argument may be allowed to succeed on a roll of 1 on a six-sided die. An extraordinarily convincing argument may be allowed to succeed on a roll of 5 or lower on a six-sided die. The chance of success for a very strong argument is 5/6 or 83 percent. The chance of a very weak argument succeeding is 1/6 or 17 percent.[2]

An on-going effort in the US Army's formal simulation training at the US Army Modeling and Simulation Office has been the introduction of wargaming concepts to better enable simulations operations officers in support of strategic, operational, and tactical units.[i] A contemporary unclassified Black Sea scenario was developed to introduce players to a modern regional flashpoint with national governments and alliances complicating the efforts of all to achieve national interests. Students, as part of their coursework, evaluated matrix wargaming technology and provided feedback. Warpaths.io was used to deliver a synchronous matrix wargame with players representing regional nations, NATO, the EU, and other interested countries and parties.

Figure 1. Warpaths.io Platform Presenting a Black Sea Scenario



Warpaths.io Black Sea 2022 Scenario courtesy and permission by Tom Nagle, PhD (www.warpaths.io) [3]

AN EXPERIMENT IN ONLINE SYNCHRONOUS MATRIX WARGAMING

On 10 January 2022, 14 US Army officers and civilians participated in an online synchronous wargame using Warpaths.io as part of an academic simulation operations course. The participants were located around the globe in locations in Europe, the United States, Australia, and Asia. [4]

The scenario used for the training, Black Sea 2022, is an unclassified in-house developed matrix situation game and is guided by news events of the past two years in the Black Sea region. [5] The Black Sea region is traditionally an area of intense interaction in relations between NATO, the European Union, France, Germany, the United States, the Ukraine, Russia, and many important regional nations. A multi-domain scenario concept of diplomacy, hypersonic missile capability, events in the cyber realm, refugee crisis, civil unrest and the threat of armed conflict presented tough choices for the players representing nations and alliances.

Figure 2. Turn Order of Play

Turn Events \ Team	NATO	Turkey (guided by the White Cell)	US	France/ Germany/UK	Romania/Bulgaria /Georgia	Russia	Ukraine
Turn Beginning - Team Arguments	All players develop and submit diplomatic, military, information, and military arguments. They include expected impacts on affected countries and the region. They also propose military and other unit movements.						
Team Reactions/ Counter -argument	Players respond to other player arguments with counterarguments or supporting arguments						
White Cell Adjudication	White Cell grades each argument based on its merits and other player input. A 1XD6 is rolled and the argument is declared successful or failed. The white cell updates players on the success of arguments and their regional and national impacts. The turn ends and time moves forward.						

During each turn, players considered military, economic, and information actions and the impact of those actions on countries and the region. They also decided on unit movements, if any. Players submitted individual arguments and they also predicted the impacts on their nation and alliance, as well as the Black Sea region. They finally ordered units (military and other capabilities) to move geographically to arrive at the end of the two weeks turn (or later if they so chose to announce).

Players were divided into teams to represent NATO and the EU, Russia, the US, France/Germany/UK, Romania/ Bulgaria/Georgia, and the Ukraine respectively. The teams were provided with national interest reading and support material beforehand and were also given confidential (for exercise) guidance from their national or alliance leadership on their diplomatic and military success criteria. The game also had two full turns of arguments with adjudications pre-loaded to provide a calibration of how matrix wargaming arguments are typically structured as examples for extrapolation. Each player team was informed that they had assumed full direction of the military, diplomatic, information and economic efforts of their nation or alliance's efforts in the region. Players appraised their situation in comparison to their national or alliance's interests and their specific guidance for success and developed strategies for actions across the spectrum of influence. Once they made decisions on direction and efforts, they constructed arguments within the Warpaths.io interface and submitted them to the white cell.
The white cell, comprised of instructors and guest experts, began the process of evaluating the arguments from each of the players. The experiment continued throughout a full turn of arguments expressed by nations and alliances. The white cell adjudicated arguments based on a matrix as presented in Figure 3.

Figure 3. Argument Rating Likert Scale

Argument Rating	Die Roll Required For Argument Success (1XD6)
Very Strong	5 or less
Strong	4 or less
Average	3 or less
Weak	2 or less
Very Weak	1 only
Out of Character	Argument Rejected

Adapted from Engle's Argument Success Table found at www.wargamedevelopments.org [6]

Arguments had greater success in achieving their desired effect based on the strength of their supporting reasons. The die roll introduces an element of stochasticity to replicate real world complications. Sometimes weak arguments succeed despite their merits due to other factors or the fog of war and diplomacy. Sometimes diplomacy behind the scenes causes behaviors by nation states or alliances that does not make full sense to the casual onlooker. However, a player is not allowed to make an argument that lands fully outside the character and interests of the represented nation or alliance.

Input from other nations and alliances became problematic as the beta test discovered some software errors that were solved after the experiment, but that prevented the full value of international debate before white cell adjudication of arguments. The issues were overcome during the experiment generally by use of the chat features of Warpaths.io and there was some satisfactory discussion of the merits of particular arguments put forth by player teams.

EVALUATING THE ONLINE SYNCHRONOUS MATRIX WARGAMING PLATFORM

Evaluating the technology to support online synchronous wargaming platforms such as Warpaths.io is different than evaluating a simulation capability or an interoperable simulation federation. Though there are some similarities in evaluating the capability to address the training objectives for the selected audience and the system availability, there are additional formative and summative measures of effectiveness that should be considered.

As a product of the course exercise on the Black Sea region, the students were asked how to develop metrics of evaluation and measures of performance for such a recent technology that supports simulation operations. The experiment was also used as a beta test for an assessment of software performance under the load of a small number of active players. A preliminary methodology of evaluating the performance of the Warpaths.io technology is presented below.

Measures of Effectiveness

Time and Effort Required to Prepare for Operations – The greatest gap, in the author's opinion, extant in government and military at a strategic multi-domain level is the time required to assemble a synchronous game. Senior leaders must be scheduled and often they are simply unavailable. Legacy simulation capabilities often require weeks of preparation for readiness but often do not provide the length of scenario game time beyond an initial crisis and short-term operations.

Accessibility – The technology should be immediately available to all players on a network of choice.

Availability – The technology should be persistently and immediately available for an upload. The term "fight tonight" seems to be gaining more frequent use and training systems need to meet the ability to rapidly array into a useful capability.

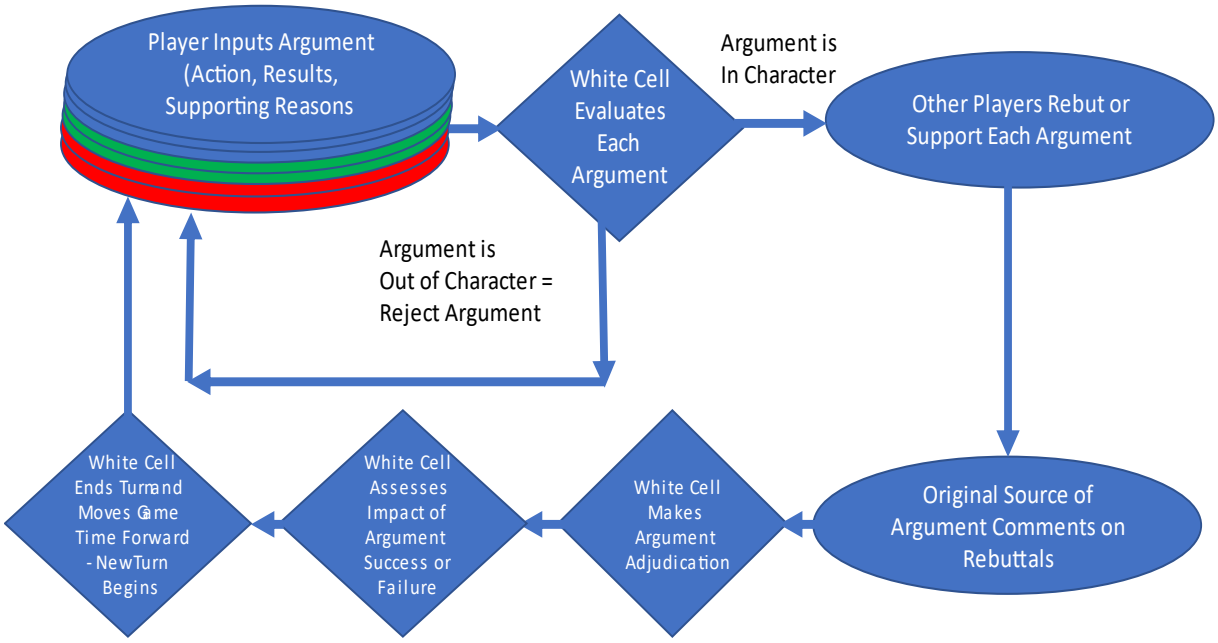
Synchronicity – Asynchronous systems are highly useful and can be used for a longer-term real-time exercise where organizations take significant time to develop positions. However, if the requirement is to bring government political and military leaders into a crisis that also has the ability to look at long-term effects of decisions, a

synchronous capability can provide great utility. The ability to mass collaborative expertise may be required in either a synchronous or asynchronous capacity. The ability to provide players making simultaneous arguments while working diplomacy and international for a back-channels can provide a more realistic scenario.

Rebuttal Capacity – National and alliance representatives need to provide counter argument discussion to the white cell as to the likelihood of success of another player's arguments.

White Cell Control Capability – The adjudication of arguments and the ability to input information from any point of view at any time is important. Players may leave early but the simulation should be able to continue with White Cell support. Players must be prevented from injecting inappropriate input. The technology should flow matrix information input from players as depicted in Figure 4.

Figure 4. Synchronous Matrix Wargame Information Flow



Scenario Access – The players should have constant access to the scenario and relevant information input windows. Some windows of input should be closed until rebuttal or adjudication are complete. Once an argument is made in a synchronous environment, it should not be retractable on that particular turn.

Scenario Updating – The White Cell should be able to update the scenario by adding documents, publish news, and inform players either individually or as a group.

Scenario Mapping – The mapping feature should allow dynamic updating of unit positions and incidents. A general impression of the platform Warpaths.io is presented in Figure 5.

Figure 5. Formative and Summative Evaluation of an Online Synchronous Matrix Wargaming Platform

Measures of Effectiveness	Metrics of Performance	Formative Grade	Summative Grade Projection
Time and Effort Required to Prepare for Operations	Is the time and effort less than legacy simulation capability?	Yes. Given a prepared scenario, the game can begin in within hours.	Highly positive. The long- term implication is that online technology for matrix wargames can provide an increased capability where a training gap likely exists for many organizations.
Accessibility	Is the system rapidly accessible via internet or local area network?	Yes. The system is immediately available online.	The system would have to be migrated to a local area network for classified use.
Availability	Does the system remain effectively available?	Yes. The system, like many online presence capabilities, is persistently available.	Unknown. The system should be tested under a much larger load of distributed players.
Synchronicity	Are all players able to engage at once?	Yes. Turn management is effective. However, not all information properly populated.	Highly positive. Players can input their arguments and communicate effectively simultaneously. The software was upgraded after the exercise and seems to be operating properly.
Rebuttal Capacity	Are players able to rebut or support the arguments of others?	Yes. There was some inability for some teams to communicate information for rebuttals.	Positive. Software was upgraded after the experiment
White Cell Control Capability	Can the White Cell communicate to all players individually and as a whole?	Yes	Highly positive
Scenario Access	Can players quickly see the base scenario documents and updates?	Yes	Highly positive
Scenario Updating	Can the scenario be updated dynamically?	Yes	Highly positive
Scenario Mapping	Can unit positions and incidents be updated dynamically?	Yes	Highly positive

CONCLUSION

Warpaths.io demonstrated an important increase in capability to rapidly assemble and train government and military leaders. The availability and application of online synchronous matrix wargaming capabilities to support multi-domain government and military decision training are now significant and available. Platforms such as Warpaths.io present an excellent addition to a coalition or national capability to train senior leaders in military, diplomatic, information, and economic arguments. The emerging multi-domain arena of modern technologies requires nations and alliances to rapidly train and prepare for not only possible regional crises but long-term comprehensive and coherent national and alliance strategies.

.

REFERENCES

1. Engle, Charles. (1988) "Wargame Developments", Retrieved 25 January 2022 from www. Wargamed evelopments.org /matrix.htm
2. Engle (1988)
3. Nagle, Tom (2021) "Warpaths.io". Retrieved 25 January 2022 from www.warpaths.io
4. Hodges, Jeffrey, United States Army Modeling and Simulation Office, Personal Interview, 22 January 2022
5. Stilwell, Wayne (2021) Black Sea 2022: A Matrix Wargame. US Army Modeling and Simulation Office, Fort Belvoir, VA
6. Engle (1988)