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Computer-Assisted Military Wargaming Tool: SWIFT

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14. ABSTRACT

The Cybersecurity and Information Systems Information Analysis Center (CSIAC) was asked to provide information on the Standard War Game Integration Facilitation Tool (SWIFT) and other wargaming-related software and tools. While researching SWIFT, CSIAC personnel gathered information on wargaming and found realistic combat scenarios could be created to train military personnel on their strategic, operational, and tactical skills. A background on wargaming is included in this report, along with sources from U.S. Department of Defense (DoD) entities, academic scholars, and industrial/commercial products or research. Recent developments in artificial intelligence have also impacted the wargaming space, and they are discussed through recent academic publications and efforts from DoD organizations to develop wargaming technology.

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TI Research

A chief service of the DoDIAC is free technical inquiry (TI) research limited to four research hours per inquiry. This TI response report summarizes the research findings of one such inquiry. Given the limited duration of the research effort, this report is not intended to be a deep, comprehensive analysis but rather a curated compilation of relevant information to give the reader/inquirer a "head start" or direction for continued research.

Abstract

The Cybersecurity and Information Systems Information Analysis Center (CSIAC) was asked to provide information on the Standard War Game Integration Facilitation Tool (SWIFT) and other wargaming-related software and tools. While researching SWIFT, CSIAC personnel gathered information on wargaming and found realistic combat scenarios could be created to train military personnel on their strategic, operational, and tactical skills. A background on wargaming is included in this report, along with sources from U.S. Department of Defense (DoD) entities, academic scholars, and industrial/commercial products or research. Recent developments in artificial intelligence have also impacted the wargaming space, and they are discussed through recent academic publications and efforts from DoD organizations to develop wargaming technology.

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1.0 TI Request

1.1 Inquiry

What information is available on the Standard Wargame Integration Facilitation Toolkit (SWIFT)?

1.2 Description

The Cybersecurity and Information Systems Information Analysis Center (CSIA) was asked to provide information on SWIFT, a computer-assisted military wargaming tool.

2.0 TI Response

CSIA personnel gathered information on SWIFT, provided the inquirer with points of contact (POCs) for the wargaming tool's software, and set up a virtual meeting to discuss the topic. While performing research on the subject, however, different use cases for wargaming were found as well as prominent tools being used in the field.

2.1 Background

Wargaming allows participants to simulate conflicts and change the way they approach tactical challenges [1]. They can be configured to involve scenarios using many different levels of complexity (e.g., Figure 1), with the objective to study the decisions made during the exercise. The U.S. Department of Defense (DoD) has made strides to implement the practice to prepare for conflicts against adversaries, develop new tactics, and test new systems [2]. The advancement in computer technology has only further enhanced the practice, allowing developers to create scenarios with advanced levels of complexity and data analytics. By leveraging computer-assisted wargaming, player decisions can be tracked, and the outcomes can be modeled accordingly. In digital wargames where user input is limited, the scenario can be simulated at an agile rate for hundreds of times to display potential outcomes. To harness the potential of the technology, the Government Accountability Office (GAO) has encouraged the standardization of wargaming practices and data sharing between U.S. military branches.



Figure 1. Marine Corps Wargames, Quantico, VA (Source: GAO [3]).

A core element of a wargames is the uncertainty and surprise factor that can be presented in the simulation, which prompts users to adapt in a strategic manner while under pressure. The unpredictability reflects real-world scenarios, making it a valuable training method for developing combat readiness. There are three main levels of automation in wargaming—manual wargames, computer-assisted wargames (CAWGs), and fully automated wargames (FAWGs) [4]. They are described as follows:

1. Manual wargames have the human participants control all aspects of the simulation. Since there is no automation, users can manage the environment and decisions and focus on human behavior.
2. CAWGs utilize computer systems to automate certain aspects of the wargame while retaining human decision-making. The computer can help simulate certain factors.
3. FAWGs automate all the roles humans take in the wargaming process, including the functions of players and analysts. A simulation is run independently without human input by using algorithms and machine learning (ML) to make the decisions. This level of automation is closer to a simulation than a wargame due to the lack of human decision-making behind a scenario.

2.2 SWIFT-G

The SWIFT-G tool is a Cloud-based version of SWIFT [5]. The "G" in SWIFT-G highlights the tool's migration to a Cloud-based platform, as the original SWIFT was created to be a local desktop application. Originally designed as a Java desktop application in 2009, SWIFT-G leverages Cloud technology, enabling wargame developers to create conflict scenarios with realistic adjudication and data analytics for post-exercise analysis. It features clear adjudication, which facilitates wargame designers in customizing game rules, and represents a greater variety of flexible scenarios.

SWIFT-G enables users to work within a Cloud environment, which was developed for defense analysts to support online wargaming, and to participate in the exercises remotely. The tool aims to expand the depth of wargame exercises in many ways, such as using real-time data and implementing grid-based movement for forces.

One of SWIFT-G's strengths can be found in its ability to reflect real-world characteristics, as it includes features like unit visualization. The platform includes a detailed analysis toolkit that leverages modern browser capabilities to conduct remote exercises and supports flexible data export. The developers of SWIFT-G envision the tool as an adaptable platform for detailed military analysis that fulfills critical defense wargaming requirements. The tool's Cloud functionality allows engagement of many players concurrently, which is helpful for large-scale conflict scenarios.

2.3 Wargaming Related Software and Existing Tools

2.3.1 Space Wargaming Analysis Tool (SWAT)

SWAT is a specialized platform developed to plan military scenarios using space concepts [6]. It can visualize and simulate ground, air, and space activity within a wargaming environment and focuses on "ease of use." This tool can model various conflict situations, predicting potential outcomes of decisions made by participants. SWAT integrates asset tracking to provide detailed simulations and captures data for threat responses to support training for real battlefield operations.

2.3.2 Next-Generation Threat System (NGTS)

NGTS is a simulation platform designed to model multidomain threat environments [7]. Originally developed to improve training in air combat scenarios, NGTS has been updated to simulate interactions across land, air, sea, and space. It allows players to participate in threat situations that involve electronic warfare and variance in adversary tactics. Leveraging digital environments, NGTS can support mission rehearsal in high-pressure situations, helping analysts assess response strategies.

2.3.3 Bohemia Interactive Simulation’s Virtual Battlespace 4 (VBS4)

Developed by Bohemia Interactive Simulations, VBS4 is a simulation software desktop trainer used for scenario-based analysis [8]. It was developed specifically for military simulations and contains various tools to facilitate the creation of wargaming exercises. VBS4 provides an immersive space that simulates scenarios with its customizable terrains, enabling military personnel to practice complex procedures in a virtual setting. The tool allows users to “train anywhere on earth,” as it includes a high-fidelity, whole-world database [8].

2.3.4 Joint Conflict and Tactical Simulation (JCATS)

JCATS is a modeling tool to simulate complex scenarios for operational planning [9]. It enables highly realistic training environments, allowing users to conduct feature-rich wargames to simulate operations (e.g., Figure 2). It supports joint training exercises by representing various entities and sends exercise results to higher level commanders for evaluation. The tool features realistic algorithms and user-defined performance data, making it an adequate platform for the simulation of complex “what if” scenarios.

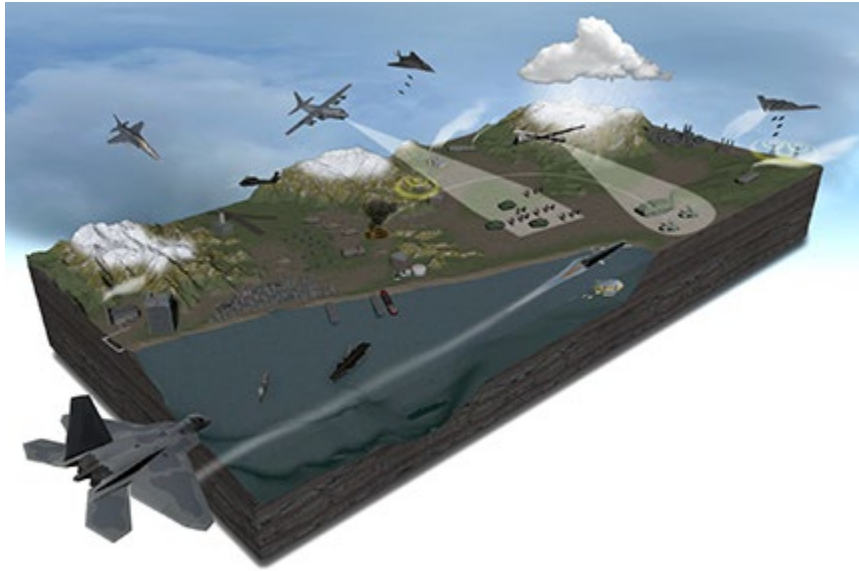


Figure 2. JCATS Rendering of Wargames (Source: LLNL [10]).

2.3.5 Advanced Framework for Simulation, Integration, and Modeling (AFSIM)

AFSIM is a simulation tool used for evaluating warfare environments and is mainly being utilized by the U.S. Air Force to simulate conflicts [11]. It can model key assets like sensors, weapons engagements, and communications systems; however, there is a strong emphasis on weapons systems testing, which is a strength of the tool. AFSIM is used in mission planning and operational testing to help users visualize strategic decisions in a digital form.

2.4 Artificial Intelligence (AI) in Wargaming

AI is being introduced into wargaming by providing analysis assistance for wargame practices, as the U.S. Army Corps of Engineers has explored AI in wargame scenarios to provide richer training experiences. AI opponents can learn from the actions players take and provide Warfighters with training exposures that represent behaviors found in real life [12]. Since it relies on fixed scenarios, traditional wargaming has been increasingly improved by efforts related to AI/ML to improve realism in the exercises. Efforts by the RAND Corporation highlight the necessity of using AI with scripted models to support simulations [13]. As adversaries around the globe advance technologically, the United States should continue to look for opportunities to implement AI in the defense sector. AI's presence in wargaming efforts is growing. The DoD is actively investing in frameworks to optimize AI systems' performance

across modeling and simulation, as they anticipate AI will transform military wargaming by facilitating predictive simulations.

2.5 Conclusions

The developments in wargaming technology are changing the way leaders prepare for conflict and how the military tests new weapon systems. As wargaming continues to progress, the quality of wargames will improve significantly and the design process will continue to be streamlined. SWIFT-G and the other tools mentioned in this report provide examples in the potential of computer-assisted wargaming. SWIFT-G enables the creation of conflict scenarios by harnessing modern Cloud technologies, supporting unique environments, and allowing rules to be easily modified for specific program requirements. Advancements in wargaming simulation are setting a new standard for military training and will continue to improve responses to conflict situations.

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Biography

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