

Wargames applied to Naval Decision-Making Process

Abstract. This research aims to establish the applicability of open source simulator Combat Global Blue, as a support tool for planning, at the stage of Confrontation Courses of Action of Naval Decision Making Process. The strategy proposed to carry out this research included in principle a thorough study of the relationship between planning, war gaming and simulation. After developed the analysis of the characteristics and limitations of the proposed simulator, was conducted a case study in which the tool was used, determining lessons learned and benefits extended by the system; especially related to the delivery of results in order to develop a solid base of information for the Commander take a reasoned and sufficient evidence decision. The results were satisfactory, since ultimately the capabilities of this simulator to represent virtually aspects of reality as operational factors force, time and space in a synthetic computing environment, make this a tool that despite its limitations, it's suitable for use in the confrontation in action courses.

Keywords: Simulators, Wargames, Battleship Intelligence Planning, Decision-Making Process.

1 Introduction

Since the adoption of Naval Decision Making Process (NDMP) in the Navy of Ecuador, has remained constant efforts to achieve improvements in this process; it has been important for the significant contribution of Advisors, Officers Plant, and Official Students of the Naval War Academy. This process is based on the use of some tools to support planning, which requires imagination and creativity to develop elements to improve results in the solution of a military problem.

This work aims to achieve an additional contribution, through the incorporation of a new tool to support the planning, the computer simulation. So, the purpose of this research is to demonstrate the applicability of the open source simulator Global Conflict Blue 2 for the development of Wargame in the third stage of NDMP: Confrontation of Courses of Action (CA). The results of this research will be useful as a guide and tools for Student Officers of the Naval War Academy, the Commanders, the Chief of Staff and Planning team, in the process of Wargames, in the third stage of NDMP in operational and tactical levels, especially considering that this stage is in the heart of the process.

In the 2nd section, the problem is posed, its causes and effects, and projected the results to be achieved. The 3th section, use an exploratory and descriptive study, presenting a retrospective of the stat of art of Wargames and simulation as planning tools, including some related concepts. In 4th section, a correlational study is developed by linking the capabilities of the proposed options required in a Wargame, and then through a case study will be establish the applicability of the proposed system as a support tool for planning, and their use in the confrontation. Finally, in 5th section, the conclusions and recommendations of the research will be presented.

2 Problem Statement

The Naval Decision Making Process was approved in its second edition as a doctrinal body in the Navy of Ecuador in the year 2013 with the coding AGUENA-PLANAV-01-2013. The military planning is structured as a broad process, allowing commanders and their staff or planning teams, at all levels, to make reasoned decisions and solve complex military problems. In this process commanders visualize a desired final state and then determine how that state will be reached [1]. Currently, NDMP is composed of seven stages: (1) Analysis of the Mission and Battleship Intelligent Preparation, at this stage the assigned mission and the essential and implicit tasks are reviewed. The BIP is developed and assumptions and limitations are reviewed; (2) Development of Courses of Action, the analysis of the relative powers of combat is made, the critical capacities and requirements are identified and related to the center of gravity, then producing the Action Courses (AC) that manage to balance capacities with vulnerabilities; (3) Confrontation of Courses of Action, the confrontation of the ACs against the Action Courses Enemies (CAE) is developed, guiding the process to establish the final feasibility and acceptability [2], the Wargame is the fundamental tool of this stage; (4) Comparison of Courses of Action and Decision, a comparison of the Conservation Action Courses (CAC) is carried out, based on the governing factors, after which the Commander takes "The Decision", selecting at his discretion and based on the information from the previous process the best CA that solves the military problem; (5) Development of Plans and Orders, communicates the commander's intent, guidance, and decisions in a clear and useful format that is readily understandable to those who will execute the order; (6) Transition, it is sought that the subordinates or those who must execute the planned achieve a detailed understanding of the plan developed in the previous stages; (7) Monitoring Planned Action, is the process of recognizing the differences between what is planned and what is being implemented, of appreciating the effects, and of considering adjustments in a timely manner [1]. This sequence of steps is intended to assist the commander and his staff to planning naval operations, based on the concepts of logic state decision-making. Decisions must be timely, reasoned, reliable and adequate solution to a military problem.

In this planning process much emphasis is given to the importance of the third stage, which is in the heart of the process, whether it is called to this stage as "Analysis of Courses of Action (Wargame)" in the publication NWP 01.05 [3]; its purpose is to create a solid basis for defining the feasibility and final acceptability of the courses of action and check their advantages and disadvantages. The third stage of NDPM assumes most importance, by adding value to the process, the Wargame, that defines in large part the product quality, which will be vital for justified the commander informed decision-making. The problem is that the resources planning support used in the Naval War Academy for the development of Wargame in the third stage of NDMP, difficult to develop a solid base of information, to further define the feasibility and final acceptability of Courses of Action and check their advantages and disadvantages.

This research will focus on the use of simulation tools in the confrontation of courses of action in third stage NDMP, in planning naval operations, exercises or

didactic Wargames, particularly in the Academy of Naval War oriented operational and tactical levels of conduction, in a pervasive environment context.

This paper will seek to answer the following question: What is the applicability of open source simulator Conflict Global Blue, in the development of Wargame in the third stage of NDMP: Confrontation of Courses of Action?

The results of this research will be useful as a guide for Officers students from Naval War Academy, and to the Commanders, Staff and Planning team to develop the Naval Planning Process to solve a military problem at the level operational and tactical.

3 Background

For Craig Orme, “simulation is not about technology – it’s about culture. Simulation is about being willing to be confronted directly by your strengths but, more importantly, also your weaknesses. It is about learning how to deal with complexity, risk, uncertainty, chaos and ambiguity” [4].

A Wargame is not an analysis in the classic sense of the word, since it does not quantitatively decompose the military problem. It is in essence the interaction between human decisions and the game of events. Mathematical models are essential in the simulation of such events; the results of the application of such models should serve as inputs to the game process, and should not be taken as a result of the Wargame itself [5] [6] [7]. The Wargame is a tool to better understand the dynamics of war. It constitutes a source where a series of questions must be originated, whose answers must be found during the course of the exercise. Therefore, a Wargame must be used in the investigation of processes, of designs, not to calculate results, but to achieve improvement or establish their validity for solving a problem. This is where the importance of playing several alternatives for solving a military problem - the, courses of action - lies in the fact that its maximum exploitation will be aimed at establishing if the conception and design of a military operation satisfies the operational functions, or operational requirements of the needs of the sequence of tasks considered and whether their synchronization is adequate to achieve the desired final state at the end of operations. The questions that arise in the Wargame should be oriented to improve the design or to take considerations to solve the problems that appear [5] [6]. Therefore, when technical, statistical or physical parameters are of greater interest than the study of human decisions, then this tool is relegated and it is preferable to use other research methods such as operational analysis [7]. Francis J. McHugh, a Naval War College Advisor, NWC, in one of the naval classic books, "Fundamentals of Wargaming", incorporates aspects related to computer-assisted Wargames and computer Wargames, main advantages and disadvantages. Highlighting, the computer Wargames as a powerful tool for analysis and investigation in the future of naval operations. Although at that time, computer science and computers had not achieved the current levels of progress. His work already emphasizes the importance of technique and the main advantages, without neglecting the true classic purpose of the Wargame. This work has a relevant importance, based on the fact that nowadays a personal computer is able to execute a

number of operations as complex as the large and complex computers of the late sixties [8]. Gerald, G., Carlyle, M., Kelton, D. and Salmerón, in the research paper "Operational Planning Tools for US Navy Maritime Commanders", developed at the Naval Postgraduate School (NP), present an assessment of various decision support tools to support the maritime operational planning process. In this context it is highlighted that the NPS has been developing for more than fifty years, scientific tools to support the planning process of military operations. Was performed a analysis of three computational tools to support operational planning, which normally had specific objectives for certain areas of planning, nevertheless it is proposed that integrating them allows to achieve a very significant improvement of the planning [9].

In the Thesis titled "Operational Level-Naval Planning Using Agent-Based Simulation", from Naval Postgraduate School, is presenting an interesting research report on the use of the agent-based simulation technique to be used as an operational support tool in the Naval planning process at the operational level. Through the model developed during this research, it was sought to deliver to the commanders a tool that being employed in the planning process allows them to make decisions with a larger information base. In this case, the agents represented in the model the opponent of the naval commanders of the operational level, since they had the capacity to carry out the deployment and to develop the maneuver based on the perceptions of the virtual operational environment, attributes and movements of the adversary, with demonstrated that agent-based simulation has as characteristic its ability to capture many of the dynamic aspects of the planning process, establishing an initial planning tool [10]. Arthur Bettega, emphasizes the level of realism that the modeling and simulation tools have achieved, which has allowed the Brazilian Navy to use computer simulators for its tactical and operational Wargames, which provide the right tools for the representation of Scenarios, entities and interactions between players. However, he details that at the strategic level the seminar method is still used without using a robust virtual environment available for Wargames at this level of conduction; So his research aimed to examine the feasibility of using a synthetic computational environment in Wargames of the strategic level in the Brazilian Navy, taking into account the greater complexity of the required models, and formulate the perspectives of scientific growth and Technological and potential opportunities that arise from their use by the Brazilian Navy [11].

The emphasis of pervasive Wargames on decision-making entails that it must be structured to help players make decisions and enable them to learn about the effects that they produce [12]. The pervasive game concept was inspired by pervasive computing [13], with a multitude of intelligent objects embedded in a computer network [14]. Pervasive games expand the spatial, temporal, and social limits of traditional games, and are usually played by certain people at a given time in a specific place [15]. Even though many games follow different structural approaches, such as the study of a campaign by a group of amateurs, or those professional Wargames that a planning team with a large number of advisors develops to investigate potential for future war, a good Wargame will always need some essentials elements [10]: purpose or aim; scenario; database; models; rules and procedures; participants (players, controllers and observers); analysis; culture and environment; and auditorium.

4 Case Study

In this section, through a correlational study, the concepts of planning, Wargames and simulation will be associated to identify and evaluate the main characteristics of the open source simulator Global Conflict Blue to establish the limitations, and through a case study: Amber-Pearl Planning, developed by the Command Course, based on its results, develop the lessons learned and establish the applicability of this simulator as a tool to support planning in the Wargame that takes place in the third stage of the NDMP.

The GBC simulator of the naval war was developed by Dewitt Colclough employing the languages of programming C++ and Python. The official portal of this application is the site www.gcblue.com, where you can find support information, progress reports of development projects to optimize the simulator and reports of failures. The main features that this simulator has are the following: global cartography, including bathymetry of the oceans; realistic models regarding the dynamics of aircraft flight, maneuvers of naval units, sensors, fuel consumption and ammunition; realistic dynamics of time and space incorporates a basic model of sea conditions, sound velocity profile and ray tracing; Man-Machine Interface (HMI) with contextual menus and easy-to-use commands; 3D graphics with the possibility of being visualized in real time, although with very basic functionalities; Incorporates a basic radar cross-section model; Incorporates a basic model of damage to the platforms that integrates physical effects like fragmentation and blast wave; An editable database for scenarios, which can be recorded for later playback; an editable database for platforms, which includes a large number of platforms with their weapons, sensors and associated equipment (this is one of the main features that differentiate it from other simulators); time control, which allows the acceleration of time up to 30 times; all menus, platforms, 3D models and symbology have an open format, and can be customized through their own developments; designed for large-scale games, with the possibility of managing more than 1000 units and installations of all types (ships, submarines, merchants, fishermen, aircraft, bases, ground-based radars, refineries, pipelines, airports, etc.); designed to be executed in multi-player mode through the use of a PC that acts as a server; launches a report of interactions through an information window, and the GBC simulator it's compatible with personal computers, being undemanding at the level of necessary requirements.

In the Command Course at AGUENA, a planning exercise "Amber-Pearl" and two Wargames were executed. GBC simulator was used as a tool to support planning, in conjunction with other software to support decision making, during two of these events. Initially, the Amber and Pearl cells were organized, led by operational and intelligence officers. The Chief of Staff acted as an organizer and arbiter. The first step was to integrate into the geographical area of the Indian Ocean, the Mascarene Islands, Amber Island and the coasts of East Africa, the naval media, aircraft, own airports and adversaries. For this it was necessary to be guided by the information produced by the development of the mission analysis, development of the BIP and the development of the Courses of Action. According to the Guide of the Games of War developed, the two CAs were played against the two CAE, using the sequence method of essential tasks (critical events).

In the first confrontation CA 1 was played against CAE 1, the first critical event, which was: "Interrupt the LL.CC.MM. Military of the occupation forces that AMBAR maintains in the Mascarene Islands, within the Area of Maritime Exclusion established from January 23, 201X. ". Initially, the options menu will configure the aspects of visualization and environmental impact that will be considered, among them, fog, water reflection, aircraft enrollment times and embedded helicopters. In the scenario editing environment, the sea state information and sound velocity profile were entered. After which positioning the units in the area of operations, in this process it is necessary to restrict the information to each of the cells (closed Wargame). To position the units in the synthetic computing environment, the scenario editing tool was used. Once the own and enemy units have been positioned in synthetic, each of them is configured in the logistic aspects, this implies the configuration of ammunition and ammunition load available, which should be consistent with the information of the logistical files or order of battle. The next step in the process is to set up the Emission Control Plan, for each of the units based on what is detailed in each course of action, in this case in CA 1. Then the simulation is started in RAID 1, generating the movements and actions of the units considered in the courses of action that each cell is playing. These actions with the decisions are recorded in the worksheets, whose formats are available in the BIP. It will always be important that the records relate to the level of driving that is played, while observing the implications of each action and decision for subordinate commanders.

The units Amber and Pearl are observed during the interactions visualized from the editing environment, where it is possible to also play the actions, although it is not advisable, since it loses the sense of uncertainty that will always generate decision making in a more realistic environment and therefore better results. During the process, Staff members provided tables, logistical calculations, casualties calculations, analyzes, log files and other tools that contributed to validate the actions and results in order to better adjust the simulation to reality. Through the contribution of the members of the staff, the effects achieved with each of the decisions and actions adopted were identified and additional requirements were established for the own forces. The records were the basis of information, which based on the visualization of the events, actions, reactions, counter-reactions and effects generated by these, allowed: visualize your own strengths and weaknesses and the enemy; determine the advantages and disadvantages of CAs; provide useful and consistent information to develop the final test of CA acceptability, in terms of: prospects of success, feasibility of execution of each CA and exploitation of critical factors; and provide useful and coherent information to develop the final CA feasibility test, in terms of: cost of success, cost of failure, available forces to face a later effort. The use of GBC simulator in the confrontation of the CA, collects the results of other Wargames in addition to the "Amber-Pearl" planning exercise, the use of a synthetic computational environment, makes it possible to appreciate the relationships of the operational factors force, time and space, which is not usually achieved with less dynamic manual simulations.

The first confrontation will always be more complex, due to lack of practice or little experience in the development of analytical Wargames, and the use of the simulator. This effect is appeased by continuing to confront the CA and CAE, depending on each of the critical events established.

It has been demonstrated that the functionalities and capabilities of GBC, allow its use to be applicable in the Wargame of the confrontation of the CA, constituting an important tool in the process of Planning, recommended to be used initially in AGUENA, in planning exercises and didactic Wargame, allowing a substantial improvement in the results of this process. Due to the possibilities of representing the dynamics of naval operations, this simulator can be used in other stages of planning, specifically in the development of CA. Since it could incorporate the means, establish the relations of command, identify the needs of grouping or separate means and manage to conceive in a virtual environment the design and the operational maneuver, this would allow to achieve a detailed concept of the operations for each course of Action, managing to integrate operational requirements and functions long before they are confronted with CAE.

5 Conclusion

The Wargame constitutes a source which must originate a series of questions, whose answers are set in their development, it constitutes a tool for exploratory research, useful in addressing complexities and uncertainties of naval operations planning phase; used in the confrontation of courses of action creates a solid base of information, useful for the commander and take a reasoned decision evidence.

A simulation is a simplified representation of reality, when applied in Wargames with the support of computers, manages to represent in the virtual domain the most important aspects of the physical domain, integrating into a single computational synthetic pervasive environment force factors, time and space, which allows us to appreciate the dynamics of naval operations and the relationships between these factors, thereby achieving a better understanding of the effects that would produce decisions on future operations. GCB simulator have the capacity to generate a synthetic computing environment, where is possible incorporate and recreate the media and own actions of naval operations, representing adequately the dynamics that characterizes them, facilitates their use, as a tool to support the planning, at the stage of confrontation of courses of action, in order to optimize the results of this process to establish a useful basis for the decision information.

It's recommended promote the research, regarding Wargames and their potential uses with the support of simulation tools. Promote the use of the simulator GCB during the development of future planning exercises and didactic Wargames from Naval War Academy, with a view to achieving greater experiences, lessons and skills for use, so as to achieve a substantial improvement in the development stage of confrontation CA Naval Planning Process in the operational and tactical levels, so that they can project future this knowledge to the rest of the Navy through official who graduate from this institute.

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