Research on Red Force and Blue Force Confront Simulation System of Navy Surface Warship

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Abstract. All the world's military powers attach great importance to the training of Imaginary Enemy Force, and the high level of simulation of fighting between red force and blue force has become an important mode of military exercise. On the basis of introducing the function of red force and blue force fighting simulation system of naval surface warship, this paper analyzes the structure of the system and the logical relationship between its parts, puts forward 10 key steps of the system operation flow, and finally looks forward to the impact of the new technology. The structural design and process steps proposed in this paper can be applied to the development of other analog countermeasure systems.

1. Introduction
The best army is produced on the battlefield, and this sentence is no exception and abroad. However, a good army must have done a lot of systematic training before going to the battlefield. The level of training at ordinary times has a direct impact on the level of combat. Therefore, all the world's military powers attach great importance to the usual force training. The establishment of the blue force, in the way of imaginary enemies, in accordance with the equipment and methods of potential enemies to carry out military training, has become a common practice. For example, the U.S. military's Fort Irvine National Training Centre[1], as well as China's ZhuRiHe Training Base[2], have played a huge role.

Compared with the red force and blue force fighting in real field between real soldiers, the simulation fighting on the network is carried out by computer simulation systems, which has the advantages of rapidity, economy, repeatability, large sample size and timely data processing, and has gradually become an important mode of military exercise.

As the main force of the maritime power, the combat capability of the naval surface warship often represents the naval combat capability. Unlike the Army Force and the Air Force, the naval operations have characters as follows: 1) combat space is vast, involving the air, surface, underwater; 2) high-tech equipment is more highly dense, operations is more complex; 3) Navy forces’ movement speed is relatively slower, combat time is longer; 3) surface formation is usual fighting unit, and there will be almost no fighting between single ship with single ship. The design of simulation system must take these characteristics into account in order to reflect the naval warfare process more truthfully.

This paper will first introduce the functions of naval surface warship confront simulation system between red force and blue force, then analyze the structure of the simulation system and the logical relationship between the various components, and finally put forward the system operation flow, as well as some matters needing attention to simulate the fighting.

2. The function design of the confront simulation system
In recent years, the weapons and equipment of the world's naval powers have entered a stage of rapid development, the main battle equipment presents a multi-model, serialized, standardized, modular,
networked and multi-platform carrying trend, which can meet different operational needs. There are many high-tech characteristics in mobile, operation, fire strike, communications command, intelligence reconnaissance, maintenance support and other combat links.

The confront simulation system should be able to accomplish the following tasks: First, to provide theoretical basis for naval surface warship training and operational effectiveness evaluation, the second is to provide some virtual battlefield environment and confrontation conditions for naval training and evaluation, air and sea joint training and evaluation, and third, as an imaginary enemy to participate in the higher organization of the larger simulation counter exercise task.

Based on above ability, the confront simulation system should have basic functions as follows:
- to display all weapon technical and tactical parameters and its operational effectiveness of both red force and blue force, and their campaign group typical configuration and grouping form introduction, as well as common tactical action methods summarized;
- to generate the confront simulation fighting scenario, including the combat plan data, the auxiliary technology and the tool that generates the fighting scenario, display of operation process and the war situation;
- to display multi-scale confront process, including the single weapon system operation --unilateral combat -- single ship combat -- formation combat and so on according to the task demand;
- to process large data, which can collect from the program development to the result analysis of the whole process of the key information, such as the force real-time position and movement elements, and use mature data processing methods for analysis;
- to realize two operating simulation modes of “automatic” confront simulation and “human in the circuit” confront simulation, which can not only set specific parameters to allow the countermeasure system to run itself and get the data of interest, but also can artificially control the process to modify the countermeasure parameters in real time;
- to re-disk and evaluation, which can carry on the complex demonstration to the confrontation whole process, carries on the data analysis to the key node of the simulation countermeasure, evaluates the fight gain and loss against both sides, provides the data support for the final training summary.

3. Structural analysis of the confront simulation system
The red force and blue force confront simulation system of surface warship is a complete network simulation system based on comprehensive simulation combat space, simulation model of various equipment of surface warship, typical combat countermeasure simulation model, etc. The researchers can use it to take the combat countermeasure simulation of surface warship equipment as a means to realize the research on the use of surface warship force, the analysis of equipment combat effectiveness, and the ability exercise of the decision maker to commander.

The system can be logically divided into the following parts according to the task: simulation management part, simulation model library and environment database, warship equipment simulation part, evaluation and demonstration part, computer force generation system, network management part, whose network structure is shown as in figure 1:

(1) Simulation management part: to produce the virtual simulation environment, the management system simulation confront process, and complete the confront simulation main model calculation and so on. Whose main equipment is PC, workstation.

(2) Simulation model library and environment database: to provide various supporting data and models for system simulation countermeasure and research. Whose main equipment includes data servers and database maintenance machines.

(3) The simulation part of warship equipment: to simulate the combat use platform of warship equipment by means of soft simulation, and construct a virtual warship which can be arbitrarily configured to participate in the countermeasure simulation. Whose main equipment are PC, notebook, projector and part of the semi-physical or physical.

(4) Evaluation and demonstration part: to record and synthetically evaluate all the data in the simulation process, analyze and demonstrate the simulation conclusion and playback wonderful process, etc. Whose main equipment includes PC, workstation, and projector.
(5) Computer Force Generation System: to generate a number of simulated underwater intelligent targets, surface warship intelligent targets and aeronautical intelligence targets, the number of which depends on the requirements of the simulation system and the development of the system. Which can not only simulate the red square strength but also simulate the blue square strength. Whose device is a multi-PC computer.

(6) Network Management part: to achieve the management of the system network and user rights management, large-scale input management and power management. Whose main equipment includes domain manager, communication server, switch, printer, digitizer, power distribution system.

The system generate the red force or the blue force according to the human requires, the simulation management part is the white, then the confront simulation test is carried on.

4. Running flow of confront simulation system
The running flow of the system is closely related to military requirements and experimental methods, and varies with the size of the experiment. The main steps are as follows:

The 1st step, military personnel, together with technical personnel, based on the military requirements of the simulation experiment, under the support of the experimental database and the military knowledge base in the library system, discuss and analyze collectively through the discussion support system.

The 2nd step, on the basis of clear research problems, military personnel use the operational thinking management tools in the experimental operation management system to determine the operational background, the situation of red force and blue force weapons, the sea battlefield environment, the combat process and so on.

The 3rd step, laboratory technicians determine the experimental method according to the laboratory’s research ability and experimental resources using experimental program, form a preliminary experimental scheme, develop or obtain the corresponding simulation model from the model library;

The 4th step, according to the experimental scheme, the simulation operation platform will be established;

The 5th step, according to the experimental scheme, experimental force and battlefield environment will be generated by using computer generation force system, surface warship equipment semi-physical simulation system, and sea battlefield environment generation system;

The 6th step, the combat simulation scenario will be generated according to the operational thinking and simulation operation platform composition, then the simulation experiment scheme will be run and debug;

The 7th step, the simulation experiment will be carried on according to the simulation experiment scheme which has been debugged in the 6th step, and will be displayed in 2D and 3D form by the demonstration support system which is receiving simulation data and simulation experiment operation process;

The 8th step, the simulation data will be collected, analyzed and formed the preliminary processing results of this experiment processing by simulation data processing support system;

The 9th step, the combat effectiveness or ability analysis and evaluation will be developed by the combat effectiveness evaluation support system;

The 10th step, military personnel and technical personnel together use the research support system to carry out in-depth analysis of the experimental results, and draw technical and tactical conclusions in view of the purpose of this application experiment.

5. Conclusion
The red force and blue force simulation confront system of surface warship will mainly provide simulation experiment environment for naval surface warship force practice, method evaluation and commander decision-making ability training. According to the degree of personnel participation, system running can take two kinds of ways: first, the tectonic simulation countermeasure method, also known as "person is not in the loop" simulation. The second is the virtual simulation countermeasure method, that is, "people in the Loop" simulation. Each of the two approaches has its own
characteristics, which are worthy of our in-depth study of the organization red force and blue force simulation of the confront way. The structural logic analysis proposed in this paper, as well as the operation process steps, has a certain universality, which can be applied to other confront simulation system design.

In the future, the big data technology, cloud technology, unmanned system technology, such as a large group of advanced concepts and technical methods, will certainly give the navy red force and blue force simulation confront great impetus and promotion, we are full of optimistic expectations with that.

6. References

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