Research on Architecture and Technology of Intelligent Operational Test System for LVC Interoperability

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Abstract. LVC combines the advantages of the actual training, the virtual simulation and the deduction simulation, and this training system. In this paper, the construction requirement of the smart equipment operation test and evaluation system of the distributed joint operation test is analyzed, on the based of which the application view of the public operational test system is established. The rapid construction program and the test scheme of the multi-dimensional war field environment combined is designed with the future smart equipment operation mode. Secondly, the design of public operational test framework based on LVC distributed joint operation is built. At last, the unified management and control method of digital joint operation simulation experiment based on LVC virtual reality training is proposed.

1. Introduction

At present, artificial intelligence technology is becoming more and more mature, and the development of intelligent equipment is flourishing. From the experience of the foreign equipment joint operation test, the American army took the lead in the idea of using the equipment operation test to test the combat effectiveness of the equipment from 1980s to 1990s[1,2].At present, the United States has formed a more integrated multi scale regional range and facility joint system. With the help of TENA technology and products, the distributed test range, training base, test room, and maneuver force are interconnected to form a practical situation, and the unified experiment, training and exercise are carried out. Precise results have been achieved and resources for trial training have been saved[2,3,4]. All of these provide a good reference for our country to carry out the comprehensive inspection of the operation of smart weapons and equipment.

Reference [5] aims at LVC of air defense forces support LVC (live, virtual, and constructive) for the problem of interoperability between heterogeneous training resources which is difficult to interoperate in interoperability simulation, and proves that this method can meet the interaction requirements of the simulated training system. Literature [6] takes the training of American LVC as a sample, and discusses the problems that need to be solved by the multi system union oriented to LVC training. It focuses on the analysis of the advantages and disadvantages of the three architectures of DIS, HLA and TENA, and provides a way of thinking for our army to carry out the multi simulation system interconnection technology. In view of the application requirements of the joint test training for weapon range, literature[7] has proposed the technical requirements and solutions for the distributed joint simulation support platform supporting LVC interoperability. All these technologies have laid the foundation for the future operation and big data processing of intelligent weapon in future battlefield.

In this paper, the simulation architecture and big data processing method of the operational test system is designed for the typical model of the integrated inspection of smart weapons, which is driven by multi range linkage and Real Equipment System and simulation. Its key technology of the support system is become an open architecture.

2. The process of digital joint operation test system

This paper, aiming at the operational test and evaluation technology of the operational applicability and effectiveness of the equipment. There are 7 aspects of the research about simulation of the operational test system of smart weapons and equipment on the public architecture design, the rapid construction of multi-dimensional battlefield, the digital joint combat test system and standard specification based on LVC simulation, the design of range for equipment battle test based LVC, the digital joint test of logical range and the demonstration and verification of the comprehensive inspection technology of the weapon system. Figure 1 shows hybrid driven digital joint combat test program based on LVC.

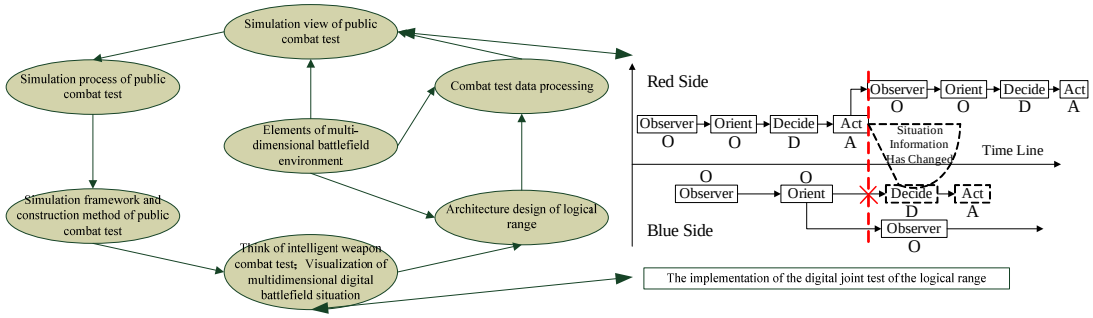

Figure 1. Hybrid driven digital joint combat test program based on LVC.

3. Equipment operational test design based on real virtual hybrid drive

Real equipment and simulation of hybrid technology refers to that under the drive of the joint battle situation, and high granularity, high real-time embedded simulation system of the target and battlefield environment mixed signals with the real enemy situation is mixed up. It will be contented operational test planning into weapons and equipment, with limited cost, and construct complex system fight environment［7,8］.

riven by the real virtual hybrid drive.

n ranges can be used to share the unified battle situation with the equipment in the n target range of the region required by the virtual arrival, and the battle situation can be realized by a small amount of mixed real equipment and simulation system.

The smart equipment operational test logic range based on the combination of real equipment and the simulation is a collection of experimental resources without geographic boundary, cross-regional range and facility.

The real equipment and virtual resources are consist of land, sea and aerospace electricity multi-dimensional real equipment, weapons and platform, as well as the virtual simulation resources, instruments and meters, data, plans, etc. these resource can be used to construct real equipment system, check the integrated test environment, and accomplish logic range test.

4. Unified control technology of digital joint operation test.

The unified control of joint operation test is shown in figure 2.

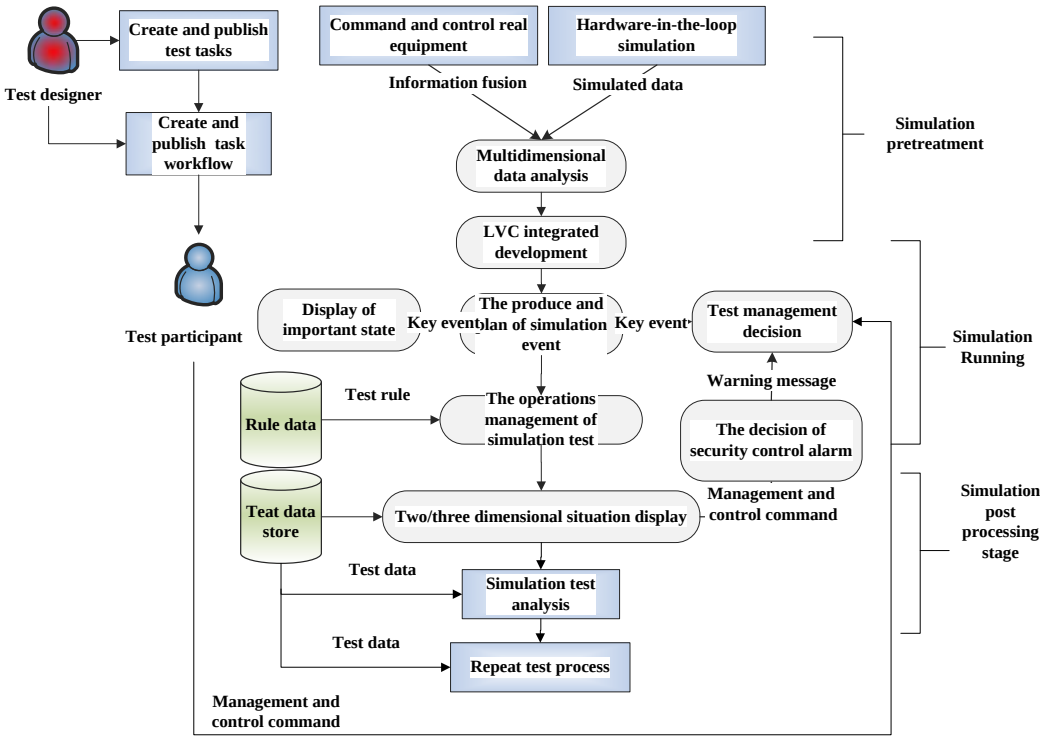

Figure 2. Unified control application mode of digital joint operation test.

The distributed joint operational test of smart weapon logic range is supported by various test resources, logical range and hardware and software facilities, which are distributed in physical domain, information domain and cognitive domain. To integrate these range resources and make unified control, we need a series of running process, rules and equipments, to build equipment system logic range.

The distributed joint test is established by the logic of a shooting range, run, and full life cycle assessment,and can provide full life circle support. To establish the logic range of task, firstly,the designing and experiment through the same entrance, need creates a test task and defines the task workflow, then develops role task, and integrates real equipment for typical test task and semi-physical simulation resources. Then operational test of typical tasks flow is designed, which mainly consists of three stages of multiple tasks, including preprocessing simulation, running simulation and post-processing step.

In this paper, one smart weapon of advanced fighters against the high value air targets in battlefield is researched to test the capability of weapon' operational effectiveness of missile attack. In the background, test the combat effectiveness of smart weapons is mounted in the fighter. operational test control application settings is set shown as figure 3.

The combat test system consists of test equipment, test equipment, test support environment and experimental public facilities. The test system, test support environment and test public infrastructure are used as the test auxiliary system to cooperate to design various types of evaluation test and integrated pilot project with the subject of system which is tested. It should be noted that both the actual and virtual equipment of the red and blue parties can be divided into the test range, training base and aviation unit of different cities. With real equipment or entities hardware-in-the-loop simulator objects, mainly to carry out the test needs to provide incentives for input, access devices, generation of test equipment and the shooting range test facilities, etc. and the composition of each subsystem mainly include situation generating system, interface adapter, target simulator and range test system. Experiment support environment is contented with system development, testing, operation management, monitoring and evaluation, and provide the basic database, including test analysis system, display system, the deduction system and basic database, etc. With combat scenario of the air combat background, we set up the digital joint operations based on LVC operation, and use "digital simulation-semi-physical simulation-field testing" and a variety of ways, which supports digital joint

operations test and system integrated flight test. Meanwhile, with the ability of weapons system designing analysis, integrated testing and effectiveness evaluation, it can support weapon system test identification and application research.

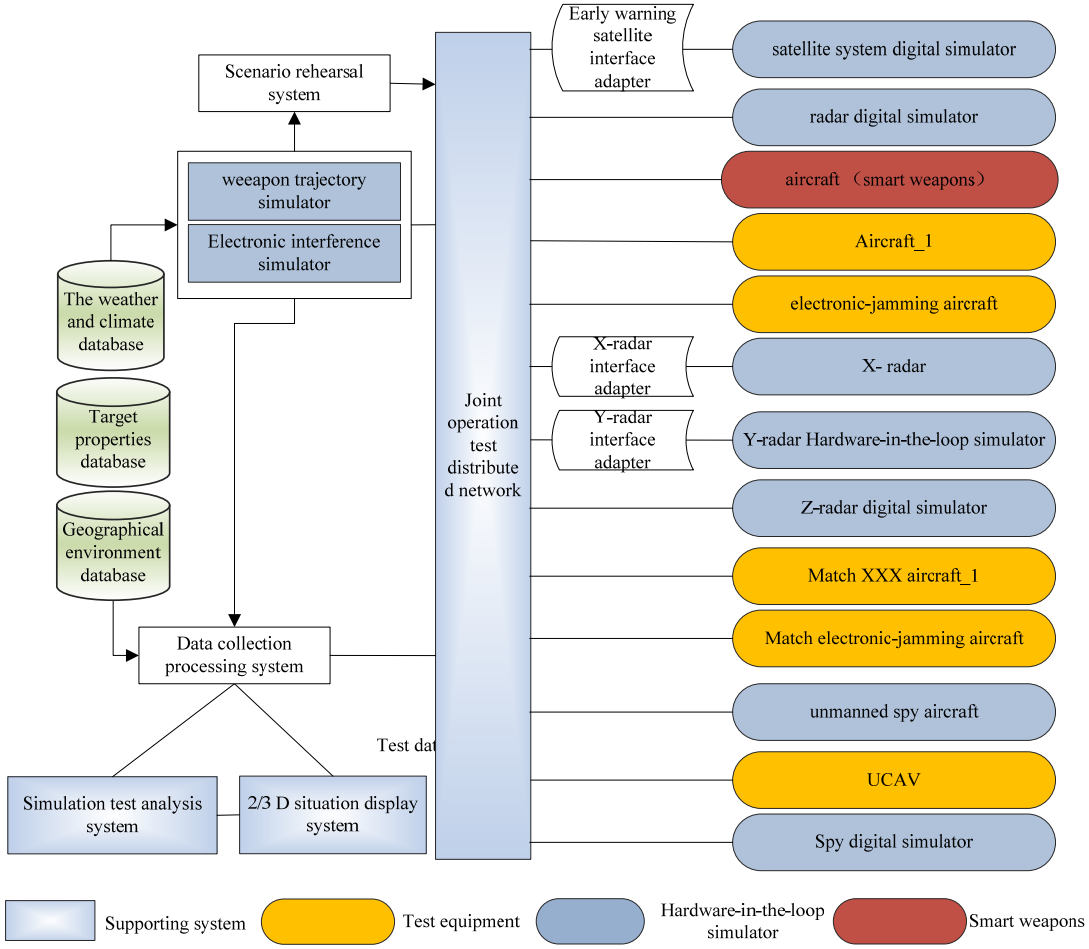

Figure 3. The combat test wants to set control application.

5. Conclusion

Based on the future information-based war, the system of public operational test process is designed under the condition of the need of smart weapons operational test. The distributed joint simulation operational test architecture of smart weapon supporting LVC operation is established, then the typical pattern of intelligent equipment operational test logic range based on real virtual hybrid is proposed. With the example of combat mission, the realization method and technology of digital joint operation test is illustrated at last. However, artificial intelligence theory and all kinds of military high technology are also in highly developed, and the corresponding equipment operational test system is developing continuously. It will need to be emerged into the latest new smart weapons. Key techniques of more diversified test and open architecture of self-evolution further explored.

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