Conceptual design of combat software operation test

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Abstract: In modern wars, software systems are the same important as hardware systems. At present, the test and appraisal institutions gradually pay more attention to software performance and operational use inspection[1]. At this stage, the test design and evaluation can’t answer whether the software can meet the actual combat and training requirements of the army, whether it can adapt to the specific task requirements under the realistic environment, whether it can adapt to the working requirements of multi arms and multi system equipment system under the condition of joint operations. Some software systems become furnishings cumbersome and many other strange appearances, because of the lack of real and objective evaluation, which urgently need to be implemented in the field under the real or mimetic real combat environment, the design of combat test and assessment of software system should be strengthened. Aiming at the current urgent need, this paper designs the software system combat test system.

1. Introduction
In recent years, with the rapid development of weapon system in the direction of informatization, digitization and intelligence, software system plays an important role during the generation of operation effectiveness[2].

Software is a series of computer data and instructions organized in a specific order[3]. Software is usually divided into system software, application software and middleware between them. The software enables the hardware. After the software runs, it can make the hardware run according to the function required by the design.

In the cycle of equipment life, the software system mainly experiences a series of test activities in the initial sample to normal sample test[4], such as unit test, configuration item test, integration test, system test. Software state solidification is usually organized and implemented by a third organization, accompanied by real installation to carry out state identification. Finally, the operational test is carried out by the users or units in full real equipment and under real combat environment. There are obvious differences among the three types of tests, showing as Table 1.

| Assessment sample | Preliminary sample/normal sample test | performance test | operation test |
|-------------------|--------------------------------------|-----------------|---------------|
| Software unit / configuration item / system | software system | software systems |

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| Equipment conditions | Non real condition | Quasi real / real conditions | real conditions |
|----------------------|-------------------|-----------------------------|-----------------|
| environment condition| Simulation environment | Simulated environment / real environment | real environment as combat |
| Assessor             | The development unit arranges test personnel | Third party test appraiser | Military personnel |
| mode of operation     | Refer to operational mission and implement according to user manual | Refer to the operational mission and operate as close to the operational mode as possible | Operate and use according to the tactics of war, discipline and logistic service |
| Evaluation index     | Function and performance index in development contract and requirement specification | Function and performance index in development contract and requirement specification, as well as service performance index | Operational use oriented indicators |
| level of Attention   | Focus on internal quality with software development phase | Pay attention to external quality during the test run phase | With the use stage, pay attention to the quality of use |
| test method          | Item by item assessment | Comprehensive test of software and hardware | test with combat mission |
| test purpose         | Solve problems and solidify equipment status | Find out the equipment base | Master comprehensive efficiency |

The assessment samples are integrated from software units, configuration items, systems to several interconnected software systems in a combat unit. The granularity of the tested samples is increasing, the scale is getting larger, and the complexity is getting higher. Early development test is mainly to verify whether the function and performance index of the tested software can meet the requirements, while the system combat test focuses on evaluating whether the software system or some software systems can meet the user's operational requirements under certain combat methods, training methods and protection methods, evaluating the actual combat effectiveness, the degree of system integration and contribution rate, and tapping the potentiality of the system.

From the perspective of software quality, the quality focus changes with different stages of software life cycle. During the software development stage, we should pay attention to the internal quality. During the operational test stage, we should pay attention to the external quality. During the operational use stage, we should pay attention to the quality of use. The apply quality of software that is, the quality of software should meet the perspective of end users. Therefore, the operational test of software system should focus on assessing the quality of application in the actual combat environment used by users, and assessing the level of software system adapting to different combat tasks.

2. Overall strategy of software system operational test.

Referring to the software test and evaluation process, the software system combat test process is divided into five stages: planning, design, preparation, implementation and summary.

Because of huge cost of a combat test, we should fully carry out the software system combat test, fully tap the potential of the system, the combat evaluation should be objective and real. The following principles are recommended:
3. Design of software system operational test scheme

The software system combat test process can be divided into five stages: plan, design, implementation, evaluation and summary, as shown in Figure 1.

3.1. Test planning
According to the mission of the tested equipment, carried out operation test planning, analyze the operational requirements, establish the test evaluation index, formulate the test strategy.

3.2. Test design
According to the mission and task of the tested equipment, analyzes the formation of forces, combat attempts, combat action process of both sides, as well as the formation, use principle, use process of the tested sample, etc. Carry out the design of combat test, such as determining combat test subjects, designing test cases and refining test data.

4. Test implementation
According to the test implementation plan, the test environment was built step by step, the data were recorded from the beginning to the end. Collect date at the end of the test.
4.1 Construction of test environment

4.1.1 Deployment and maintenance of software system
Install the tested software system, carry out installation and configuration maintenance, information security maintenance, operation environment maintenance, etc.

Installation, configuration and maintenance: make the software system run normally under the actual working environment of the equipment, and adjust the software and operating environment according to the functional characteristics, quantity, main characteristics and interactive connection of the software.

Information security maintenance: protect the system from threats from the external environment and internal risks, ensure the continuity of system operation, adopt technical and management means for data security, and deploy corresponding security measures.

Operation environment maintenance: ensure the normal state of software environment and hardware environment required by software operation, and carry out environment configuration, virus killing and other activities.

4.1.2 Test deployment preparation
Install and deploy test software such as screen recording software, monitoring software, portable recorder and handheld terminal for operational test fault recording.

4.1.3 Data acquisition
When the test starts, the tester shall carry out the test according to the test implementation plan. Record software system and user behavior in various ways:

1. Screen recording software recording
   The screen recording software will record the operation and use of the software
2. Monitoring software records
   Monitoring software can record sample's behavior and reaction.
3. Portable recorder recording
   The portable recorder can easily track the operation and use of the software when the personnel change the location during the test.
4. Operational test fault record handheld terminal record
   In case of software hitch, the hitch information is very important for software effectiveness evaluation. The handheld terminal of operational test hitch record is used to record the software hitch information, and the real data can be recorded in the first time through voice input, photo taking, video recording and other ways.
5. Recording of photographic / video equipment
   In case of software hitch, if the hand-held terminal of operational test failure record is not available or not available, the camera / video equipment can be found to record software hitch information.
6. Manual recording
   In case of software failure, if the hand-held terminal and camera / video equipment are not available, the paper and pen can be used to record the failure information quickly and briefly.
7. Attention
   For the assessment of some indicators, it may be necessary to fill in the investigation and analysis form after the test. For example, human-computer friendliness needs to collect the experience results of military personnel on the software system in the form of investigation and analysis table. For example, for satisfaction indicators, military personnel are also required to fill in the satisfaction questionnaire.
4.1.4. Test data collection and summary
The key data during the test can be saved or uploaded online, and the data can be collected after the test. The structured and unstructured data such as text, picture, audio, video and pen and paper records can be sorted and saved to prepare for the subsequent analysis and evaluation.

4.1.5. Test evaluation
According to the evaluation methods of all levels and all kinds of indexes determined by the operational test evaluation index system, the test data are analyzed, processed and evaluated.

From the test data, find out the data needed for the evaluation of the test evaluation index, and do a good job of sorting and analysis. For example, according to the screen recording video, we can analyze the software start time, task execution time, software failure time, normal working time after failure, data sending time, data sending type and size, data receiving type and size, software closing time, etc. The test data are processed to get the data needed for test evaluation.

Compared with the operational test evaluation index system, the calculation results of each index are calculated one by one[5].

According to the test evaluation method, the evaluation results of software system combat test are given, and the "software system combat test evaluation report" is generated and summarized.

5. Conclusion
This paper analyzes the current situation of software test, designs the combat test in view of the current urgent need, elaborates the test planning, test design, test implementation, test evaluation, test summary, and describes the specific operation process in detail, which is of great significance to guide the follow-up software system combat test.

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