



Research on Quality Evaluate of Shipborne Application Software

Mei Yang^(✉)

Dalian Naval Academy, Dalian 116018, China
570336266@qq.com

Abstract. The next generation of simulation analysis and evaluation system combines the simulation system with the actual command and control system to provide more accurate analysis, prediction and control methods for military complex systems. Combat assessment analysis is the basis for command decision making. With the transformation of warfare from mechanization to information, the explosive growth of combat information, the war system presents unprecedented complex features, which poses challenges for combat assessment. In-depth discussion of the basic mechanism of the military simulation analysis and evaluation system, the key elements of the system output and the system analysis category. Finally, suggestions for the development direction of the evaluation and analysis of the military simulation analysis and evaluation system are put forward.

Keywords: Shipborne Application Software · Quality Management · System Construction · Engineering

1 Introduction

With the development of high-tech and the improvement of ship automation, the proportion of ship-borne application software in modern ship equipment is increasing, and the position in ship-borne control system is gradually rising from the supporting products of hardware to the independent products. The development quality of shipborne application software is directly related to the function of equipment system, and directly affects or even determines the quality of equipment [1, 2]. Factors affecting the quality of software products include the technologies used in software development, the capabilities of software developers, quality control of software development processes, and the time and cost of software development constraints, as shown in Fig. 1.

The object of software development quality management includes not only the technical content, development process, but also the management of developer, time schedule, etc. The software quality management refers to a series of command and control activities carried out to ensure software quality [3]. These activities include: setting quality policy and quality objectives, implementing quality planning, quality control, quality assurance and quality improvement.

Ship-borne application software is an important part of modern ship control and information system. It has the characteristics of general software engineering, production

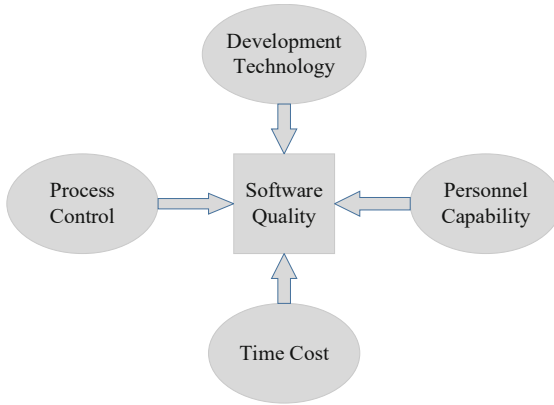


Fig. 1. Factors affecting the quality of software products

mode, integration process, distribution, long-term maintenance and centralized upgrade. The development of software should not only be organized strictly according to the engineering process, but also strengthen the quality management in the development process. It is necessary to construct a whole process, all-round and multi-level quality management system to ensure the quality of software product development. Therefore, it is of great significance to strengthen the research on quality management in the process of software development to guarantee and improve the quality of software.

2 The Engineering of the Development Process

The engineering of the development process is the precondition to ensure the quality of the software products, and the engineering organization and control of the development process is the primary quality management of the shipborne application software.

The engineering of software development process usually needs to make and implement the development plan in stages according to the software life cycle, and verify it step by step to realize the whole process control of software development in the life cycle [4]. In software life cycle, in order to describe the process, activity and task of software development, operation and maintenance, many life cycle models are put forward. In software development, appropriate software life cycle models should be chosen according to the difference of software scale estimation, schedule requirement, technical basis and experience level of software developers. Among them, waterfall model, V-type waterfall model and incremental development model are commonly used in software development.

In order to guarantee the quality of software products, as well as its host hardware products, we must first ensure the scientific, reasonable and controllable development process, the quality control of software products and, above all, the quality control of software development process. Therefore, once a software life cycle model has been scientifically selected, the software development process should be defined strictly according to the selected model, and it should be taken as the basic basis of the software development and management.

In order to strengthen the control and management of software engineering, it is necessary to set the process target for each stage of software development strictly according to the requirement of process control, measure its execution in time, check the process target, find the deviation and correct it constantly, which requires that the process should have certain stability, the process product should be visualized, and the process measurement data should be representative. That is to say, to plan (P), implement (D), check (C) and dispose (A) four tasks, that is, to follow the general principle of process-controlled PDCA rolling cycle rise.

3 Practice of Quality Management

The quality management in the development of shipborne application software is not a general abstract concept, but a series of project management, process management, engineering management and supporting practice activities around ensuring and improving software quality. The practice of quality management includes two categories: quality control and quality assurance. Quality control is the technical and management activities of software developers and managers to ensure the quality of software. Quality assurance is a supervised activity, which must be independent, objective and impartial. Software quality assurance and quality control supervise each other and complement each other. Quality control and quality assurance work run through the whole process of shipboard application software development.

3.1 Quality Control

Generally speaking, quality control activities should be carried out as required during the development of shipboard applications, the main contents of which include [3, 5]:

- (1) Software configuration management. Unlike hardware changes, software is easier to change, technical status control is difficult, software changes out of control will have a disastrous impact on software quality. Software configuration management is the control of software technology status, control software changes of the important means. Software configuration management work requirements: must establish software configuration management institutions and implementation of management personnel, must make software configuration management plans, must be software changes and updates to identify and explain, should be set up including “development library”, “controlled library”, “product library” including the configuration library, and strict implementation of the software products, upgrade management procedures. For distribution, cycle and maintenance characteristics, need to establish.
- (2) Software document management. Software document is the result of software development work at A certain stage, it provides the management with the progress of software development process, which enhances the visibility of software development process, and it is convenient for the management to supervise and manage the whole software development process. The preparation of software document must

be completed in time at each stage of software development, and the corresponding documents must be provided for different stages and levels of software, and can not be written afterwards; the compilation of software document must follow the relevant specifications, such as GJB438A-1997 “weapon software development document” and so on. Software development documents shall generally be subject to controlled management after review at all levels, and may not be changed at will.

- (3) Software review management. Software review is an important means of quality control at all stages of the software life. The software development process is controlled through review to verify that the software development work at each stage meets the requirements. The software review is divided into two categories: one is peer review: a technical review of the work product by peer experts, the other is milestone review, which is generally led by administrative line, technical line, user representatives, and a management review of the development process of the work product. The review activities should generally include review plan, product preparation for the review work, meeting or correspondence review, issue evaluation opinions, and modify the work product according to expert opinions. In the case of temporary safeguards, confidentiality restrictions and insufficient on-the-spot determination of benefits, the priority of the reviewers shall be determined without affecting other components, and the adoption shall be determined by appropriate assessment methods.
- (4) Software defect management. In the development of shipborne application software, all kinds of errors or defects are inevitable, and the purpose of software defect management is to improve the quality of software by testing and testing to discover and eliminate the errors or defects in the software. In contrast to the software development process, different software tests are required for non-stage software. As with the software development process, software testing needs to be carried out according to the process of planning, design, execution and analysis, and there can be no lack of any link in the process. The software defect management should pay attention to the closed-loop feedback, one is to monitor the modification and closure of the tracking defect problem, the other is to identify the defects found in a certain type of software, to track whether there are the same defects in the relevant software products. For ship software with strong inheritance, it is necessary to distinguish the commonness and individuality, global and local, equipment and technology in time to manage and forecast. Based on the idea of data analysis, defect management is carried out, and historical data is used as resource for defect prediction.
- (5) Software standardization management. The standardization management in the software development work, one is the standardization of the product, the other is the standardization of the development process. The standardization of products is to follow the standard of the industry standard or the product family of the research unit, especially the same functional components, the same basic computing tools and standard functions. Standardization of the development process is to establish a quality management system in strict accordance with national or military standards.

3.2 Quality Assurance

The quality assurance of shipborne application software development is mainly carried out by the development unit and the project team's special quality management personnel to supervise and inspect the software process and products.

- (1) The quality assurance of shipborne application software development is mainly carried out by the development unit and the project team's special quality management personnel to supervise and inspect the software process and products.
- (2) The article reviews and reviews the products and processes. During the whole process of software development, the project quality manager shall inspect the stage work product and the engineering process, record the non-conformance items, and notify the R&D personnel.
- (3) Track and verify the correction of non-conformance items. After discovering the non-conformance in the software development process and the product, the quality manager is responsible for tracking the correction and verifying the effectiveness of the corrective action after the deviation of the documented identification record.
- (4) Report the quality assurance activities on a regular basis. Project quality managers need to regularly prepare quality weekly, bi-weekly and monthly reports in order to inform the leaders, project leaders and stakeholders of quality defects and corrective actions.
- (5) Communicate with users regularly to find quality problems. In addition to the whole process of monitoring and checking software development and products, quality assurance activities include regular communication with end users or customer representatives, understanding the problem feedback of products in the service of the army, and acting as a bridge between the communication force and the development unit.

The characteristics of shipborne application software decision-making quality assurance in accordance with the plan at the same time, the event-driven, active and passive combination of quality assurance work, especially in the case of on-site support, off-site research and development, field testing, before, after the task to adopt special groups, special people, timing, fixed-point and other forms to ensure the implementation of quality assurance work and benefits.

4 Localization of Quality Management System

The production process of software needs the coordination of resources, technology, management and so on. The quality standard stipulates the basic requirements and principles, and the specific implementation and practice also need to be closely combined with the unit's resource guarantee, technical reserve and capability level.

For a long time, the construction of software engineering standard system in our country has always taken American standard as the main reference object, and has transformed many American standards into Chinese standards, which has played a great role in the development of various kinds of software in our country, which can be understood as a systematization of software development management system.

However, in the practical development of shipborne application software engineering, the required software quality management system needs to be combined with the specific application field and the practice of the development unit to realize the secondary localization of the quality management system. Many times this is due to the fact that the software engineering-related requirements are not well localized. Although the relevant standards have defined the related activities in various software processes from different levels and angles, they are of high guiding significance to very professional software engineering theory researchers [6, 7]. In the actual software development process, the front-line researchers, more hope that the top-level standards combined with the unit's actual localization, from the point of view of engineering practice to establish a landing, with local characteristics of the process requirements, and supporting the development of the corresponding project template to guide the process management, document preparation and other work.

In order to eliminate the hidden trouble caused by traditional hand-made software development, the software development unit should combine the practice of research and development, improve the system and strengthen the training. All the members of the research unit should establish the consciousness of "quality first", regard the quality of the project as the life, from design to development to use and maintenance, formulate and follow the perfect quality management rules and technical standards, and study how to strengthen the construction of the organization system by perfecting the software quality management system, on the basis of accurately grasping the requirements of the software quality, Establish a scientific and reasonable quality management system, define the quality management responsibilities of all levels and departments, and improve the quality management ability and level of shipboard application software.

5 The Scientization of Quality Management Methods

- (1) On-board application software quality management is basically software development project-centered, software engineering to promote and promote software quality management, quality management methods should be scientific, in the quality management methods should adhere to:
- (2) Improve quality by applying the idea of life-span management. During the whole life cycle of software from requirement analysis to new system substitution, the activities of each stage and each link are carried out, and the management tasks and objectives of each stage and department are defined.
- (3) Developing, developing and maintaining software with the principles and methods of software engineering. Shipborne application software system is complex, software measurement, workload estimation, demand change and risk management are difficult, development progress and quality are difficult to guarantee. Using the idea of software engineering to strengthen software development is helpful to improve the quality and efficiency of software products and reduce the difficulty of maintenance.
- (4) Establish corresponding rules and regulations, clarify duties and powers, and standardize the management of software quality. The quality of software runs through the whole process of software development and application, and the quality work

runs through the whole process of project, requirement, scheme, delivery, verification, operation and maintenance. In addition, in order to ensure the scientific and effective improvement of software quality, software testing has been gradually transformed from error-correcting mode to prevention and error-correcting mode, which runs through all levels of code unit, sub-system, system and so on. The establishment of a mechanism for evaluating, controlling and implementing software quality management is conducive to the scientific, institutionalized and regular implementation of software quality management [8, 9].

6 Summary and Prospect

At present, the more complex the structure of ship control software, the more functions and the higher quality requirements, the more workload of management control in the process of software development. There must be no strict management control over the software development process and the technical state of the software. The consequences are unthinkable [10].

The development of shipborne application software should constantly strengthen the optimization research of quality work, find out the main problems in the life cycle of software products such as demand analysis, design realization, test, operation and maintenance, and actively adopt reasonable and appropriate methods to solve and alleviate the contradictions; strengthen the research of countermeasures in each link of quality management, and strengthen the close cooperation among all departments within the unit, Proactively explore new means and methods of software quality supervision, and strengthen in-depth communication and communication with external stakeholders. According to the characteristics of industrial software, grasping the characteristics and rules of software design, strengthening the quality supervision and management in the process of development, and according to the principles of system supervision, highlighting key points, prevention and inspection, making the process of software development in accordance with the requirements of engineering management, effectively grasping the key links of software demand analysis and design review, document verification, configuration management, etc. Grasp the milestone node control, the standard management, strictly follows the detail, can prevent the situation, greatly improves the software quality and the reliability.

References

1. Xu Yani, Hu Yanguang, Zha Guoqing. Research on RMS Process Audit Procedures and Methods for Military Products [J]. Science and Technology Management Research, 2008, (12):320-32.
2. Li Zhiwei. Research on Engineering Quality Management of Military Software Development [J]. Manufacturing Automation, 2011, 33 (3):17-20.
3. Ruan Lian, Liu Min Yan, Han Feng Yan. Equipment Software Quality and Reliability Management [M]. Beijing: National Defense Industry Press, 2006.
4. Chang Hao-li, Yang Hai-cheng, He Miao, etc. Research on Quality Management of Aerospace Product Development Process for Multi-level Suppliers [J]. Manufacturing Automation, 2009, 31 (1):1-4.

5. Ma Chih-ping. Preliminary study on military software engineering management [J]. *Mine War and Ship Protection*, 2009, 17 (3):63-65.
6. Gao Xueqing. A Brief Analysis of Software Engineering of Weapon and Equipment [J]. *Electronic World*, 2013 (11).
7. Pressman. *Software engineering: a practitioner's approach to research* [M]. Zheng Renjie, Ma Suxia, Translation. Beijing: Mechanical Industry Press, 2007.
8. Tasso C: *Software Quality Engineering*. Computational Publications, 1997.
9. Gu Bingbing, Guo Yadong. The embodiment and application of software thinking in the construction of weapon and equipment system [J]. *fire and command Control*, 2010, 35 (10):106–109.
10. Chen Zhicai Process-Software development specification based on quality control [J]. *Aerospace Standardization*, 2001, 6:19–23.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

