



ICAO

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- Agenda Item 4:** ATM Automation System implementation by States
4.2 Systems operations management and maintenance practices

SOFTWARE MANAGEMENT AND TECHNICAL SUPPORT IN ATM AUTOMATION SYSTEM

(Presented by China)

SUMMARY

This paper introduces the ATM automation system software management specialized in organizational structure support in China, and provides relevant experience and suggestion in the process of it.

1. INTRODUCTION

1.1 The ATM automation system is a dedicated software system based on local area network. The software management and technical support system covers from scratch of project approval to running into operation with a variety of stages, including requirement analysis, software release, safety evaluation, test verification, problem correction and data statistics, etc.. As an essential prerequisite, it is crucial to aim to build a robust and practical ATM automation system and keep it in the good operational mode.

1.2 The ATMB of CAAC continues to promote ATM automation system software management systematically and standardizationally. In 2007, China established Software Support Center (SSF) to provide the Eurocat-X system for technical support in three large-scale Area Control Centers. In the past ten years, the system software version has gradually developed from the original V3 to the more feature-rich and complete version V8/V9. During the upgrading of the Eurocat-X system, the multi-site collaborative work mode ensured that the software version updated consistently and stably. It has played a leading and exemplary role for other regions to carry out software support.

1.3 In 2013, on the basis of experience summary, the standard procedure in support puts into trial implementation. In 2018, China released the regulation, established systematic procedures in software management among multi-sites, at the aspect of collecting, assessing, confirming and approving the software requirements.

2. OBJECTIVE AND ORGANAZATIONAL STRUCTURE

2.1 The ATM automation system software management work in China consists of software requirement management, fault correction management and software version/patch release management. The processes are linked and promoted to form a closed-loop control.

Agenda Item 4.2

28 – 30/10/20

- a) Requirement management ensures the quality and effectiveness of software requirement implementation, promoting new technologies to meet the development needs.
- b) Fault correction management, through the sharing of fault information and tracking, prevents the fault from occurring in related-site in order to enhance system safety.
- c) Software version/patch release management maintains baseline for software stability, so as to reduce potential operational risks caused by software changes and ensure the robust and quality of the system.

2.2 The software management and support system in China has three levels:

- a) The nation-level software management and support organization, responsible for coordinating software management in multiple regions and organizing third-party software test;
- b) The region-level software management organizations, responsible for coordinating the software management in multi-sites in the relevant areas;
- c) The operation-level software support units, responsible for software management and test on own site.

3. MANAGEMENT WORKFLOW

3.1 For software requirement management, the operation-level software support units collect and propose evolution correction plans based on operational needs or standard specifications; The regional software management organization receives the requirement, creates an initial requirement report and assesses technical solutions in the management area. The national software management and support organization analyzes demand schemes, solicits opinions among regionals, convenes a meeting for expert evaluations, and determines the final demand solution. All details of the demands and its states will be saved in the database to guide the implementation of the relevant projects. The supplier delivers software upgrades, and the management of related upgrades refers to 3.3.

3.2 For software fault correction management, the national software management organization organizes on-site software support units, related software support organizations and equipment suppliers to conduct fault investigation. The operation-level software supports unit records, preliminary analysis and fault report. The software supports organizations to focus on fault management, such as risk assessment and the priority of the fault. The suppliers focus on software problem correction and version/patch release. The management of these refers to 3.3.

3.3 For software version and patch management, the system supplier is supposed to deliver the software upgrades or fixes on time. The national software management organization review the information, such as the factory test report and relevant documents. What's more, it is able to organize third-party to carry out software test and release the software patch when the test passes. The regional software management organization manages the on-site software support units to carry out the re-test and upgrade the software of the operating system.

3.4 System software patches require factory test, third-party confirmation, and on-site adaptability test before installation and operation to discover potential failures as much as possible and to ensure the consistency of requirements. The suppliers conduct factory test to ensure that

complete tests have been carried out during the development phase and provide factory test reports. The national software management and support organizations organizes third-party software test to check whether the software functions are used generally as refer to the requirements specifications and whether the system can receive input data and generate correct output information, as well as to provide test report. The on-site operational software support units carry out on-site test to verify the adaptability of the system in the simulated environment, especially at the perspective of controllers, function inspection, and provide an on-site test report when necessary.

4. TYPICAL CASE

4.1 Case 1: In Feb 2017, a on-site software support unit found an issue of the system that when the QNH value was 1031hPa in the system, the transition altitude (TA) calculation of the system was 3000m (the expected value as 3300m). After reconfirming the problem through the test platform, it submitted the relevant information in the management system; The national software management organization received the issue, and then preliminarily determined it as a severe software defect. After confirming the fault information, it organized the supplier and all on-site software support units to investigate and finally found that 20 sites (23 systems) had this related software defect. In this way, management organization needed to develop risk control measures, such as risk announcement and troubleshooting plan. From March to June, the supplier delivered 15 patches under correction. After testing and verification, all patches had been released to the relevant sites in September.

4.2 Case 2: In Jun 2017, supplier delivered a software patch to repair ten defects, involving eight sites. After reviewing the relevant documents, the national software management organization organized on-site controllers and engineers to participate in third-party test. During the test, the test team found seven issues, one of would cause the memory of the system message processing to overflow under certain circumstances. This defect would lead to system degradation. Therefore, the patch was returned back to the vendor to avoid defective software on the operating system while installing it.

5. TEST ENVIRONMENT IN THE FUTURE

5.1 Currently, the software testing environment needs to be constructed separately for the different software versions of different system suppliers. This construction mode of the test environment is expected to be close to the site. However, the software and hardware on the test platform also needs to follow the operating system to be upgraded, which spends a great cost and lacks flexibility and compatibility. Besides, for suppliers and third-party software support organizations that undertake multi-version tasks, they cannot meet the needs of testing different versions on a single platform.

5.2 In the future, virtualization and cloud computing technologies will be the solution to comprehensive test platform. We look forward to envisioning to use IAAS to provide technical facilities services, to apply PaaS to provide cloud platform services, to push forward SaaS to give the ATM automation system operation services, and to migrate existing automation system software to the cloud-based platform for setting quickly, conveniently and flexibly up to build the software test environment. Based on the application of this technology, it can achieve scenarios of multi-site collaborative testing. China is keeping unceasingly to promotethe research and development of them.

Agenda Item 4.2

28 – 30/10/20

6. ACTION BY THE MEETING

6.1 This paper suggests that:

- a) In view of the advantages of software management in operation, to encourage states to consider the software management architecture and technical support mechanism of ATM automation system;
- b) To encourage states to establish the operational, regional and national software management and support system for the ATM automation system according to the quantity of the systems and suppliers.
