

# Flight Test Data Management System Research and Design

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**Abstract.** The flight test data is of great value and is the primary basis for researching and developing civil aircraft. This article gives an exploration on the emergency and necessity of establishing the flight-test data management system, presents the construction principles and design conception of flight-test data management system combined with multiple sites based on distributed access and computation system by analyzing the current situation of related techniques and the requirement of flight-test data management system, and then describes the structure, function components and application perspective of the flight-test data management system.

## Introduction

The test data of civil aircraft is the most direct basis for aircraft stereotypes, identification and certification and demonstration verification. It is an important support for aircraft improvement, modification, pre-research and scientific research. Development and establishment of civil aircraft flight test data management system, can effectively store and manage flight test data, improve the quality of data processing, improve data query and application and data processing of the lag state, to provide the basis for test results, shorten the flight test period, , Which can save a lot of important historical data for the pre-research and flight test of various models in the future. It has a wide range of value in aircraft test method research, flight test software development, flight test engineer and training engineer training.

With the continuous development of civil aircraft, especially the development of large passenger aircraft, modern flight test technology continues to develop, all kinds of bus, electronic equipment and aircraft, flight test data show a large amount of data, unstructured, network, multi-user development trend. Test flight test parameters increased significantly, the amount of data surge, large aircraft single test data information can be up to 80GB, and contains a variety of data formats, such as sensors, bus data and audio and video data. So the need to establish a high availability, high scalability, high security and manageability of the data management system to achieve flight test data online and never stop, to ensure that online users can access the system at any time data; to achieve massive data Online storage, for the mass flight test data to provide a secure storage system; to achieve efficient data transmission, can simultaneously allow multiple users to access data and data processing, data transmission will not affect the smooth flow of the network.

## Development status at home and abroad

In foreign countries, through the Boeing, Airbus, Bombardier and Brazil and other civilian aircraft host manufacturers, are equipped with independent development and delivery test flight capabilities, with a complete set of test data management as the core of civil aircraft flight test system. US Boeing company in the early 80s on the aircraft test data has formed a database management, the professional platform can easily call the library of test data. Today, including the test process, procedures and other audio and video, together with the test data into the database management. Russian computer equipment is not advanced, but the flight test database has long been established, and the application of the database for a high degree of speed alarm system design, the economic benefits are considerable. The German Institute of Flight Mechanics has processed a large number of flight test data to form a powerful database, which has played a huge role in the development and application of parameter identification software and the debugging of simulators.

Domestic flight test data management in the early use of the form of file management, the use of disk array for file storage, access to documents and retrieval is very inconvenient. With the increase in the amount of flight test data and the development of civil aircraft flight test work, also began on how to effectively carry out flight test data exploration and try. China has established a flight test database management system for flight test data management. The data is stored in the form of files. The path management of the files is realized by the database, and the data are classified and managed to improve the query efficiency of the data. However, due to a single function, simple architecture, can not meet the different needs of users, multi-user parallel access to the response efficiency is too low, resulting in the system usage is not high.

### **Analysis of Data Management System Object**

Flight test data management system needs to fully manage the test data related to flight, through comprehensive analysis, data management objects can be divided into the following categories.

a) Basic data

The basic data includes basic information such as flight planning and flight test information, which is managed by the data classification and the cataloging of the data as the basic data dictionary. There are: flight outline outline data dictionary, airworthiness regulations basic data dictionary, aircraft configuration and modification of basic data dictionary, flight test environment based on data dictionary, flight test data types and data items based dictionary.

b) test flight test data

The test flight test data refer to the test task information and the obtained test data in the whole flight test process, including the test flight information, the test parameters and the test data, the test parameters and the test data, the relevant data information The

c) Engineering application data

Engineering application data, including professional processing of the project data and statistical analysis report, is the data management system user query and download the main object. Including engineering data, statistical analysis reports, algorithm library management.

d) System information

System information, including user information, rights management, operation and maintenance of log information and other system-related information, but also need to be unified management in the system.

### **Design of Flight Test Management System**

China's large-scale civil aircraft will use multiple prototype aircraft off-site joint test mode, the need to plan the construction of a master data center and a number of flight test data center composed of multi-joint flight test data management system, one of the flight test points in the storage capacity And the main data center is equivalent to the main data center of the remote data backup center. The main data center and the various test points through the lease between the dedicated cable connection, the system has a data synchronization and disaster recovery mechanism.

Multi-flight test data management system architecture shown in Figure 1

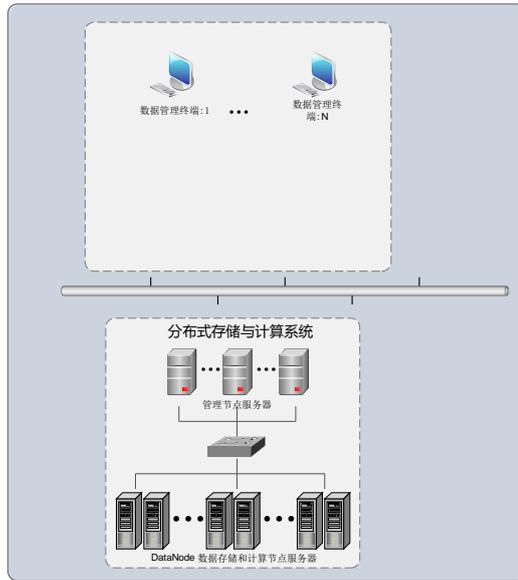


Figure 1 multi-flight test data management system architecture

The data in the test airborne data logger is unloaded by the flight test data unloading system and then stored in the distributed storage and computing system directly after being received by the data preprocessing system. At the same time, the received data from the data preprocessing system for unpacking, data sorting and other pretreatment. The preprocessed result data is stored in a distributed storage system. Distributed storage and computing systems can carry hundreds of T or even the number of P data storage, is all the test data storage center. The data management application system mainly manages the data.

Software system from the functional logic point of view can be divided into four levels, from bottom to top:

Operating system layer: Linux and CentOS for distributed storage and computing system servers, Windows Server for application servers, and Windows for workstations.

Application Server Layer: The Server section of the software system, which includes the IBM websphere web and C / S architectures for B / S application deployment.

Hadoop Technology Framework Platform layer includes HDFS technology framework for distributed file storage, HBASE for relational data storage, MapReduce technology framework for distributed computing, and an HIVE technology framework for SQL statement parsing and data warehousing. As well as the corresponding interface with the application layer and the cluster management software system.

Basic platform layer: This part is connected to the underlying software platform and application system middleware platform. Including tools integration middleware, business process middleware, data management middleware and integrated portal four parts.

Application system layer: the top layer for the application layer, mainly by the data preprocessing and data management of the two major application systems, as well as system integration interface and data synchronization backup software system and other components.

The data management system is divided into test flight information entry, flight data query and download, flight data browsing and playback, flight test data statistics, test flight data management system to achieve the unified management of flight test data and test flight engineers, designers and suppliers and other users of the rapid distribution of data management system is divided into flight information entry, Report, test flight data archiving, flight test management portal six modules.

According to the above-mentioned modules of the main users, the application software system to achieve the model, the load requirements of the server and other different factors, for the different modules configured corresponding to the terminal and server. There are two ways to provide Blu-ray tower and tape drive for data archiving.

The system uses the B / S structure, the user through the browser to achieve data processing service request preparation, the server receives the service request, start the database system distributed intermediate interface data processing software, use in the distributed storage and computing system in the test flight Data file, completes the user's service calculation request, and then returns the result to the user. The data administrator uses the flight data management portal to define the use of the data, and the user browses the data management portal for data query and downloads.

a) Flight information entry

Information on flight test data, such as flight time, location, sorties, data type, sensor line, etc., are entered, classified, stored, and interconnected with flight test data.

b) data query and download

Through the scientific settings query conditions can quickly and accurately query to the user needs the test data, and then the query data for effective selection. The data query method is divided into two types: extension query and combination query.

Data packet download is to allow users with permission to export data to the specified format, and provide extended interface, customized to the user needs a specific file format, the user to download the packet.

c) flight test data playback

System design Based on a variety of perspective classification of navigation tree, easy to quickly view the flight test data and statistical data, is conducive to different levels of engineering staff to understand the work of the test flight (flight test mission, flight test aircraft, flight space and the environment, Subjects and flight test outline regression check and its corresponding test flight test data, etc.) situation.

The system provides the task of the flyback task playback, which can use the preprocessing result to carry on the whole process review to the single test task, drive the monitoring parameter, the virtual instrument and the audio and video information playback display.

d) flight test statistics report

The system can not only summarize the completion status, flight time and other factors of the flight test task, but also can monitor the progress of the task of the overall test flight, the task of the single task, and so on, so that the user can easily and intuitively To monitor the completion of the flight test mission.

The system provides a powerful multi-dimensional test fly card function, the user can pass the test flight in addition to the test flight aircraft, test subjects, flight space and other dimensions for data viewing.

e) Flight data archiving

The system provides data archiving function, the purpose is to complete the task of the task in time to the archives department registration, archiving to tape drive or CD-ROM, including the task of the task of all the data, such as raw data, process data and analysis After the data and so on.

f) Flight data management portal

The Flight Data Management Portal is a platform for administrators and users to interact with data. Features include open permissions, user management, data addition, editing, delete, classification, download, backup and other functions.

## Conclusion

In this paper, the test flight data management system is based on the data storage and access mode of distributed storage and computing system, the flight management portal based on B / S structure can realize the rapid introduction of flight test data, Flight data rapid conversion, flight test data display, flight test data quickly search and browse, flight test data simple calculation, flight test data

statistics and data analysis algorithm expansion and other functions, and can use the enterprise network resources to achieve data sharing.

### **References**

- [1] Dai Huaiyi. Study on Data Mining of Massive Flight Experiment [J]. Measurement and Control Technology, 2011, (30).
- [2] Wang Hongwei. Flight test data management [J]. Measurement and Control Technology, 2001, (07).
- [3] Wang Jianjun, Duan Huaiyi. Structure Design of Distributed Flight Test Data Processing System Based on WEB [J]. Computer Measurement and Control, 2010, 18 (6).
- [4] Li Jie, Lin Caixing, Xie Gadi. Design and Implementation of Flight Test Data Management System Based on .NET Platform [J]. Electrical and Mechanical Integration, 2006, (03).