



ICAO

*International Civil Aviation Organization***SEVENTH MEETING OF THE ASIA/PACIFIC AIR  
TRAFFIC MANAGEMENT AUTOMATION  
SYSTEM TASK FORCE (ATMAS TF/7)***Bangkok, Thailand 2-4 June 2026*

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Agenda Item 4: ATM Automation System Implementation Experience by States

4.5. Integration with External Systems

**DESIGN AND APPLICATION OF OUTPUT STANDARDS FOR INTEGRATED  
MONITORING INFORMATION IN ATMAS**

(Presented by China)

**SUMMARY**

To mitigate increasing workload and enhance onsite situational awareness, this paper proposes a standardized specification for integrated monitoring information output. By leveraging the universal and lightweight properties of the JSON format, the specification defines periodic and event-driven mechanisms to unify disparate system data, thereby optimizing monitoring and response capabilities.

**1. INTRODUCTION**

1.1 In large-scale Area Control Centers (ACCs), the increasing complexity of ATM operational scenarios and heightened requirements for safety margins have led to the proliferation of disparate systems, including Air Traffic Management Automation System (ATMAS), Voice Communication Systems (VCS), and voice recorders. The fragmentation of monitoring data across these platforms—each with its own display format and interface—significantly complicates maintenance efforts and increases the operational workload.

1.2 To address these challenges, this paper proposes a standardized monitoring information output specification for ATMAS. By leveraging the universal and lightweight advantages of the JSON format, the specification implements both periodic and event-driven output modes to unify disparate system health data into a centralized monitoring platform. The application of this standardized framework in operational environments enables rapid situational assessment and precise fault localization, ultimately bolstering the integrated monitoring and maintenance capabilities for CNS facilities.

**2. DISCUSSION**

**Integrated Monitoring**

Overview of the Integrated Monitoring

2.1 The objective of integrated monitoring is to standardize and export operational status and diagnostic data from various ATC facilities to an external centralized platform. These facilities encompass ATMAS, VCS, recorders, and VHF ground-to-air communications. By aggregating diverse monitoring streams, the platform provides modular and customizable Human-Machine Interfaces (HMI). This enables operational personnel to achieve holistic situational awareness across all systems while facilitating rapid anomaly localization and collaborative incident response.

Technical Specifications for Output Interfaces

2.2 To ensure flexible connectivity and robust data transmission, the system architecture supports diverse output methodologies and rigorous security controls as follows:

a) Interface Versatility:

Supporting both network-based and serial communication interfaces to maintain compatibility with various generations of monitoring infrastructure.

b) Communication Protocols:

Supporting multiple network protocols, including TCP, UDP unicast, and multicast, to accommodate different data dissemination requirements.

c) Output Methodologies:

Providing the flexibility to export monitoring data either directly from local modules or via a consolidated output gateway.

d) Distributed and Local Management:

For remotely deployed partitions, the system supports both centralized data acquisition and independent local output. This dual-mode design fulfills the requirements for centralized oversight while granting operational sites the autonomy for local management.

2.3 All external communications are strictly managed through controlled network boundaries. By deploying security measures such as firewalls or security gateways, the system implements policy-based access control to ensure full compliance with cybersecurity standards.

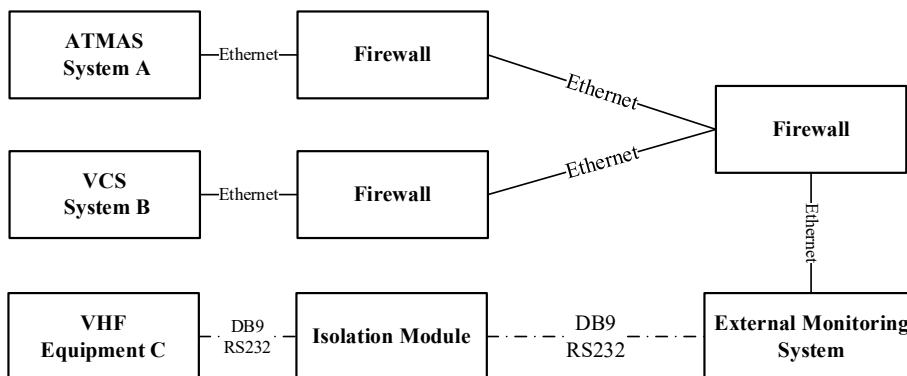


Figure 1 Interface Framework

### Monitoring Data Specification

2.4 To ensure comprehensive and accurate representation of the system status, the integrated monitoring data is categorized into two primary types: static system structure configuration files and dynamic monitoring data reports.

- a) **Static System Structure Configuration Files:** These utilize XML format to describe the hierarchical relationships between automation system modules and sub-modules. They provide a definitive mapping of nodes, statuses, and parameters, forming a tree-like structural baseline. Any architectural modification necessitates a synchronized update to these files.
- b) **Dynamic Monitoring Data Reports:** These provide real-time updates on the operational status and parameter values defined in the static files. They are further divided into Routine Reports for continuous health monitoring (e.g., CPU, memory, and process status) and Event-Driven Reports triggered by system anomalies for rapid fault localization.

2.5 Event-driven reports characterize the impact on system operations through four distinct severity levels. These levels provide a standardized framework for prioritizing maintenance responses and can be customized by operational departments to meet specific onsite requirements:

- a) **Normal:** The system is operating optimally with all monitored indicators within expected parameters. No anomalies or performance degradations are detected.
- b) **Advisory:** An irregular state or performance deviation is detected that does not currently impact functional availability or service quality. No immediate intervention is required (e.g., a node's CPU utilization slightly exceeding normal thresholds while system operations remain stable).
- c) **Warning:** An anomaly is detected that limits non-critical functions or degrades performance, although core services remain operational. Manual intervention is necessary to prevent further escalation (e.g., loss of a single radar data feed).
- d) **Critical Alert:** A system failure or the loss of critical nodes/modules results in the partial or total unavailability of core functions. Immediate corrective action is required (e.g., a Flight Data Processing (FDP) server going offline)

2.6 Dynamic monitoring reports consist of two primary sections: the Message Header and the Message Body. The header contains metadata regarding the report itself, while the body carries the specific monitoring data.

- a) **Message Header:** Every report must include a mandatory header containing the event timestamp, system identifier, report type, and a Cyclic Redundancy Check (CRC) code. These elements ensure data integrity and support the unique identification, categorization, and archiving of each report.
- b) **Message Body:** The body carries the substantive monitoring content, including specific equipment types, module identifiers, severity levels, and detailed report findings. This structure ensures an accurate representation of the operational status or anomaly details of the monitored entities.

### Data Transmission Mechanisms

2.7 To balance data timeliness with network efficiency, the system implements distinct transmission logics for static configuration files and dynamic monitoring reports:

- a) **Static System Structure Configuration Files:** Upon completion of system initialization, the ATC automation system generates and exports the static configuration file based on the currently loaded modules, sub-modules, and parameters. This is a one-time transmission.

- Unless an external system explicitly requests a re-acquisition, the static file is not re-exported after the initial startup phase.
- b) Dynamic Monitoring Data Reports (Periodic): Routine reports are assembled and transmitted according to pre-defined intervals agreed upon with the external monitoring platform. To accommodate specific operational requirements, intervals can be customized for individual nodes, modules, or parameters. The configurable range for these intervals is typically between 5 and 120 seconds.
  - c) Dynamic Monitoring Data Reports (Event-Driven): Event reports are assembled and transmitted immediately upon the detection of changes in module status, system parameters, or external link connectivity. This asynchronous transmission ensures that critical operational events are captured and reported without delay.

## 2.8 Achievements

The application of standardized JSON and XML monitoring specifications at the Guangzhou Area Control Center (ACC) has enabled the seamless integration of various CNS facilities, including ATMAS, into a centralized monitoring platform. This implementation provides maintenance personnel with comprehensive situational awareness and facilitates the rapid localization of system anomalies, demonstrating a feasible approach for promoting standardized monitoring data output across multiple aviation information systems.

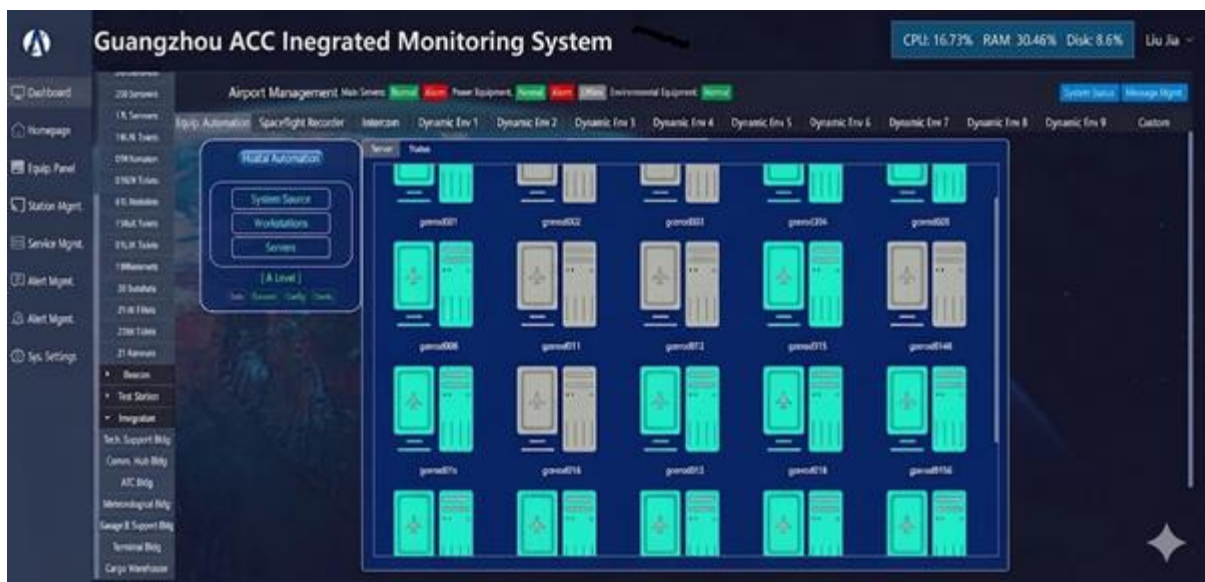


Figure 2 Integrated Monitoring System HMI at Guangzhou ACC

## Challenges

2.9 The primary challenge lies in retrofitting legacy CNS infrastructure that relies on outdated hardware architectures with limited processing power. Adapting these systems to support modern JSON and XML output specifications requires extensive engineering effort to ensure seamless compatibility without compromising the stability of core functions.

2.10 Furthermore, the transmission of high-frequency monitoring data from geographically dispersed assets, such as remote VHF stations or radar sites, can impose a substantial overhead on limited network bandwidth. It is essential to optimize data payloads and transmission intervals to achieve an effective balance between monitoring precision and network efficiency.

2.11 Successfully addressing these integration challenges provides a strategic foundation for extending the standardized framework to the broader CNS domain. Establishing cross-system data models for VHF, ILS, and ADS-B ground stations will eventually facilitate a unified network-wide view of equipment health, serving as a key driver for the evolution of industry-wide standards and regulatory frameworks.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matter as appropriate

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