



International Civil Aviation Organization

METEOROLOGICAL/AIR TRAFFIC MANAGEMENT (MET/ATM) SEMINAR

Bangkok, Thailand, 26 – 28 November 2013

Discussion Topic 2: Requirements for MET support to ATM

METEOROLOGY IN THE JAPAN'S CARATS PROJECT

(Presented by Japan)

SUMMARY

This paper presents current status of efforts for improvement of meteorological information toward the Japan's future transportation system, called CARATS.

1. Introduction

1.1 In considering future air transportation system, Japanese Civil Aviation Bureau established a committee "Study group for future air transportation system" with a variety of members from government, industry, and academia, in April 2009, to deal with increasing air traffic, to meet the various needs from operators and users, with realizing efficient services and further improvement of aircraft safety and deal with global issues, such as global warming.

1.2 The committee developed the long-term vision for future air transportation system (CARATS) in September 2010, which describes targets and direction for the renovation of ATS system until 2025. Furthermore, in 2010, JCAB set up "steering committee for future air transportation system (CARATS steering committee)", and finally developed a roadmap for the CARATS (see figure 1).

1.3 Overview of the CARATS – CARATS has 7 domain goals relating improvement of safety and efficiency (refer table1). In order to establish it, CARATS has number of task for renovation of ATS systems, such as implementation of trajectory based operation, enhancement of performance based navigation. Members from government, industry, and academia deal with these tasks in close coordination. Before implementation of each task, other than cost-benefit analysis, level of achievement will be verified objectively by the numerical performance indicators. If necessary, they would be modified.

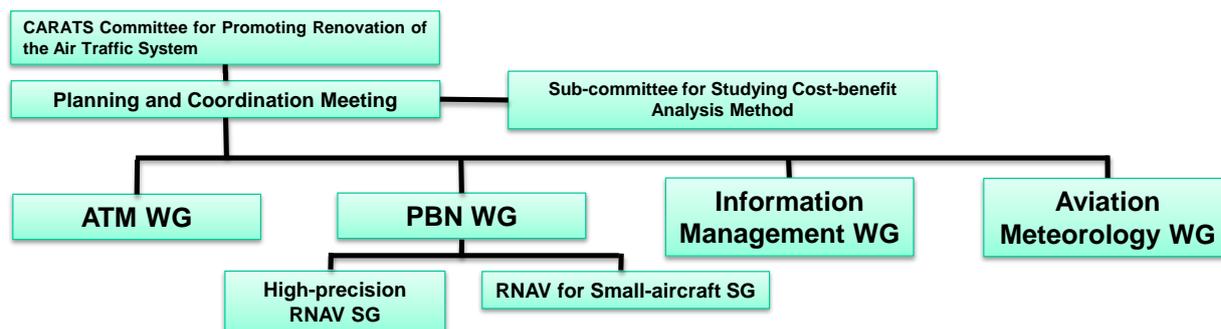


Figure 1. Working structure of the CARATS project

Target	Numerical target
Safety Improvement	Increase safety level by 5 times
Correspondence to traffic demand increase	Double the air traffic capacity
Improved convenience for users	Improve service level by 10% (Punctuality, Cancellation rate, Rapidness)
Improvement of operations efficiency	Reduce fuel consumption per flight by 10%
Improvement of the efficiency of ANSs	Improve efficiency of air traffic services by 50% or more
Environmental protection	Reduce CO ₂ emissions per flight by 10%
Enhancing the international presence of Japan in the aviation field	(Evaluated with the hosting of the international conferences, the contributions to the international cooperation issues and the others.)

Table 1. 7 Targets of the CARATS

2. Meteorological information in the CARATS

2.1 CARATS have identified those eight directions for renovation of ATS system, as below. For most of those directions, improved meteorological information will be essential.

- Realize Trajectory Based Operation
 Flight Information Regions (FIR) of Japan is considered as one airspace as a whole where all aircrafts from departure to arrival are controlled integrally. It is also transitioning to the ATM operations using trajectories with time-based management (4DT: 4 Dimensional Trajectory) applied in all flight phases. TBO is the core change in ATM and CNS in CARATS.
- Improvement forecasting
 The calculation of ATC air traffic capacity and traffic flow prediction will be upgraded. Also, the weather information quality and usefulness will be improved by preparing the weather prediction information specialized for aviation use and utilizing the weather data downlinked from aircrafts.
- Enhance Performance Based Operation
 More advanced control operations will be promoted to meet the performance requirements for aircrafts without relying on conventional avionics of a particular aircraft and/or radio navigation aids on the ground.

- **Satellite Navigation during all phase of aircraft operation**
It will achieve satellite based navigation with better accuracy, more reliability and flexibility in all flight phases, by which all aircrafts in the entire flight information regions of Japan will be able to grasp its precise position and time.
- **Improvement of situation awareness both on the ground and in the cockpit**
It is to create more situational awareness for recognizing aircraft positions and traffic situations through information sharing among controllers on the ground and pilots in the air. It will also help aircrafts maintain their mutual separation minima by using air-to-air surveillance.
- **Utilization of capability of human and instrument as much as possible**
It promotes an environment in such that human and machines can maximize their abilities, for example, by automating the routine communication, pilots and controllers can focus more on their value-added services.
- **Assurance of information sharing and Collaborative Decision Making**
It is to build a network that manages all information required in air traffic operation and provides an access to any users when needed. It also intends to achieve a collaborative operation and information sharing among international air traffic units and controllers.
- **High-Density operation around high-density aerodromes and congestive airspace**
The airspace will be utilized more effectively through Performance Based Operation, Satellite Based Navigation and the dynamic airspace management. It will further improve the ATC air traffic capacity by fully utilizing various support systems such as adjusting take-off and landing orders and shortening separation minima for aircrafts by an accurate and better time management.

2.2 In the CARATS meteorology WG, improvement of meteorological services is discussed. Main tasks are as below.

- **Sharing MET information via SWIM**
To ensure secure and timely access from all kind of users to the meteorological information with using global standard XML/GML based format (iWXXM) to help appropriate and collaborative decision making based on shared situation awareness.
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- **Meteorological Database**
Under the SWIM environment, in order to assure flexible access to meteorological information from users, develop integrated database with gridded meteorological information over whole air space. With standardized interface, all kinds of meteorological data, from observation to forecast, will be shared among users seamlessly. And also, aiming at improving accuracy of the trajectory based operation, those information will have high spatial and time resolution.

- Improved observations
 Integration of observation data around aerodrome, utilization of aircraft observation data, and implementation of new sensors will improve situation awareness around aerodromes and air spaces.
- Improved forecasts
 Develop high frequency and resolution of NWP model and new forecasting technics such as runway surface conditions, and new probability index, aiming at improving accuracy of aerodrome and air space forecast.
- MET Integration to ATM decision making support system
 With forecasting an impact on ATFM caused by weather, establishing framework to support immediate and appropriate decision making. Specifically, this will be completed via below two steps.
 - Translating adverse weather condition, such as Thunder Storm (TS), strong winds, to numerical operational constraint, such as variation of aircraft speed, cessation of operation (take-off, landing), setting no-fly zone, and shortening aircraft intervals), creating optimized trajectory with high accuracy.
 - Quantitative constraint for each aircraft will be translated to air space and aerodrome capacity based on ATF.
- Utilization of aircraft observation data via data link
 By down-linking aircraft observation data, get further dense observation data in upper air and use it to improve analysis and forecasting.

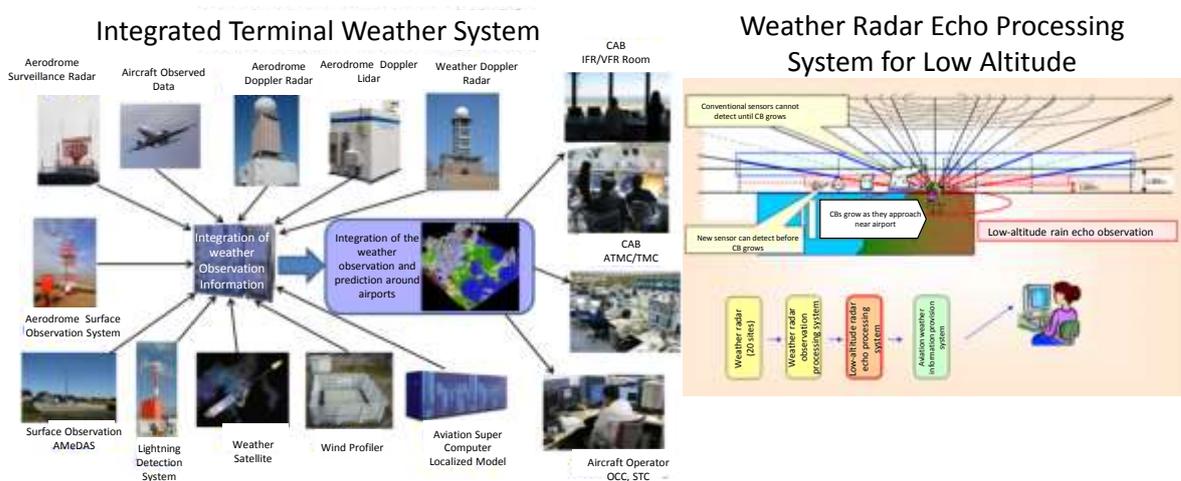


Figure 2. Example image of CARATS Meteorological Services – Integration of observation services

3. Summary

3.1 In the CARATS project, renovation of ATS systems has been discussed among various stakeholders, such as JCAB, JMA, JSDF, airline companies, pilot associations, aviation industries, and academic institutes.

3.2 CARATS Meteorology working group is responsible for develop roadmap for future improvement of meteorological services and information, e.g. data exchange via SWIM environment, development of meteorological database, and weather integration into ATM system, to fulfill global and domestic requirements, including ASBU.

3.3 Efforts for further collaboration with proceeding project like NextGen (U.S.) and SESAR (EU) will be necessary to achieve CARATS improvement of meteorological services with assuring global interoperability.
