10th USA/Europe ATM R&D Seminar

ATM Research in Japan

13 June 2013

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Japan Civil Aviation Bureau (JCAB)
CARATS R&D Sub-Committee

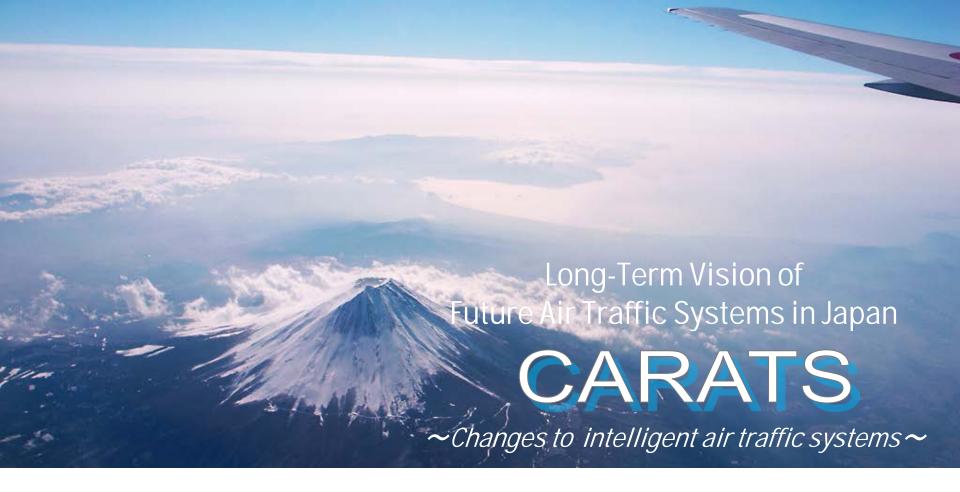
Air Traffic Management Department Electronic Navigation Research Institute

Contents

- CARATS: Long-term Vision
 - Outline and Roadmap
 - Implemented measures
 - Promoting R&D
- ◆ R&D at ENRI
 - ATM Research Topics
 - CNS Research Topics
- Conclusions







CARATS : Collaborative Actions for Renovation of Air Traffic Systems http://www.mlit.go.jp/common/000128185.pdf

"CARATS Progress Report 2011-2013" will be published soon.

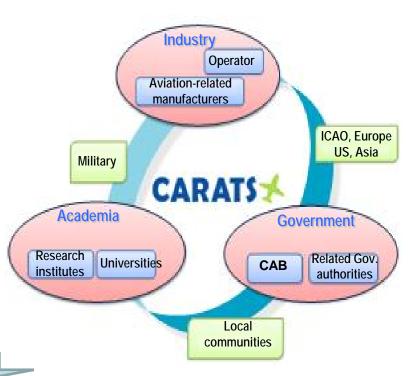
Renovation of Air Traffic Systems

Slides of CARATS are by courtesy of Japan Civil Aviation Bureau



For effective and efficient work on our future ATM systems, we need,

- Collaboration among industry, academia and government;
- Collaboration between operators and air navigation service providers;
- 3. International <u>collaboration</u> to realize seamless air traffic;
- 4. <u>Collaboration</u> among co-users of air space (Civil, Military); and
- 5. <u>Collaboration</u> with local communities





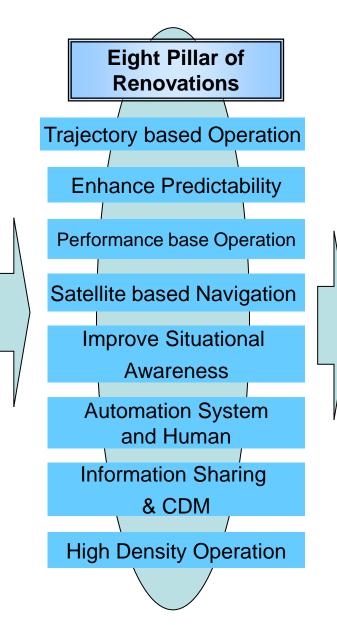
Collaborative Actions for Renovation of Air Traffic Systems





Goals setting toward 2025

- 1. Enhance safety5 times Safety
- 2. Increase ATC capacity
 Double Capacity
- 3. Improve user convenience +10% Service level
- 4. Efficient Operation-10% Fuel Consumption
- 5. Enhance ATM serviceefficiency+50% Productivity
- 6. Respond to Environmental issue
 - -10% CO2 emission
- 7. Strengthen International Cooperation



Realizing the renovation

Lay out a roadmap, representing step-by-step implementation of the measures required to build the future air traffic systems

<u>Clarify the roles</u> of the industry, academy and government partners.

Consider and set index for achievement analysis of numerical goals .





Establishment of Roadmap

To develop future ATS in organized manner based on the Long-term Vision, we established CARATS roadmap in March 2011 by working with related stakeholders.

- We clarified 55 measures to achieve the Longterm Vision.
- ➤ We grouped the 55 measures into Operational Improvements (OIs) and their Enablers (ENs).

Legend of CARATS roadmap



Preparation for Implementation (Measures can be implemented after this period)



Research and Development other related activities need to be done before implementation decision making.

Implementation Decision Making



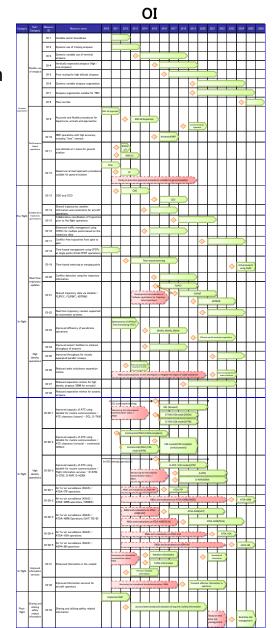
Implementation Decision Making (with two or more directions)

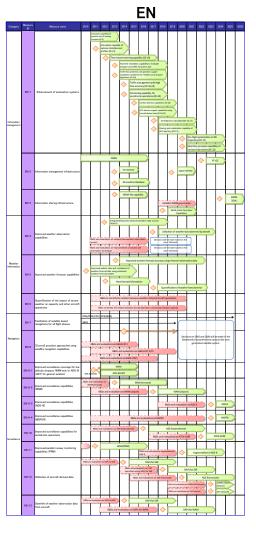


Already operated policy



Measures that is not clarified as OI/EN yet and will be studied further.

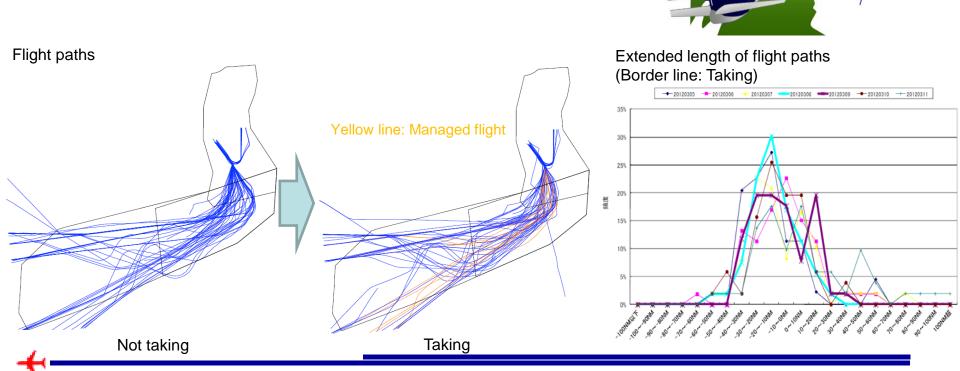






Sample of implemented measure 1: ARATS Transition of Air Traffic system in the contraction of Air Traffic system in th

- ACC controls time of passage over each fix, streamline air traffic flow, and avoid traffic concentration. At first, time-based management will be applied to domestic flight arriving to busy airports.
- Evaluating effects with ENRI now.



alter Actions for Renovative Confession and flexible procedures for departures, arrivals and approaches

Implemented RNAV/RNP procedures for departures, arrivals and approaches

SID/TR (Departures)

STAR (Arrivals)

RNAV1: 30 Basic-RNP1: 5 (# of Airports)

RNAV1: 26

(# of Airports)

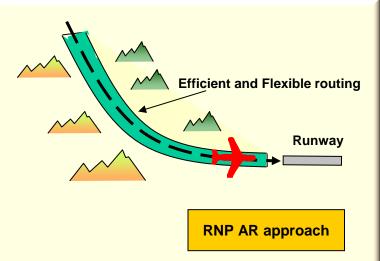
Approaches

RNP Approach: 15

RNP AR Approach: 10

RNAV(GNSS): 16 (# of RWY Ends)

2013/3/7





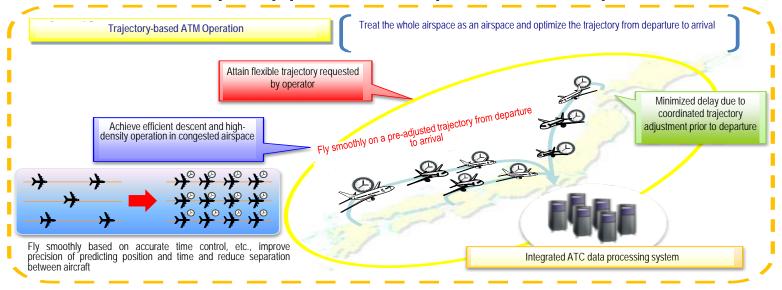
Sample of flight path (Odate-Noshiro Airport: RNP AR approach)

- By utilizing improved precision of aircraft navigation performance and precise airborne equipment, we introduce RNP AR approach procedures allows efficient and flexible routing.
- Assumed benefits are reduced route expansion, higher airspace capacity, and noise abatement.





- Trajectory-based ATM Operation
 - 4DT Concept applied to Japanese airspace

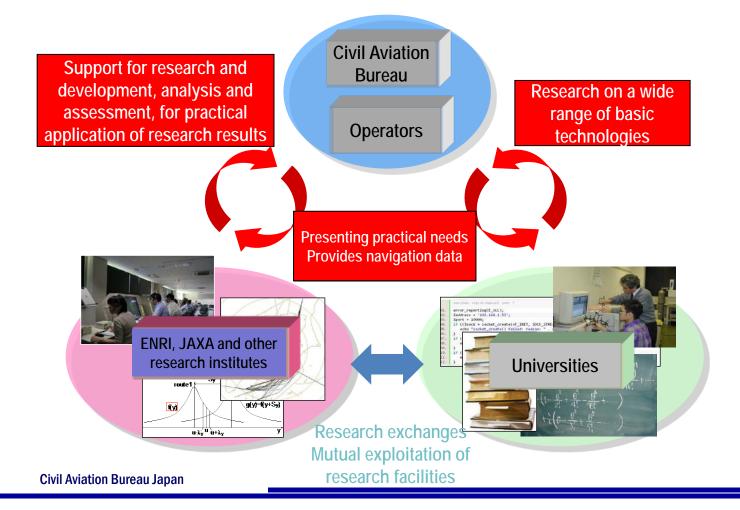


- SWIM: System Wide Information Management
 - Steps towards gradual implementation
- Data-link communication
 - Air-to-ground Data-Link in continental airspace





- → ENRI, JAXA and manufacturers have been main R&D stakeholders in Japan.
- → There are very few university researchers.







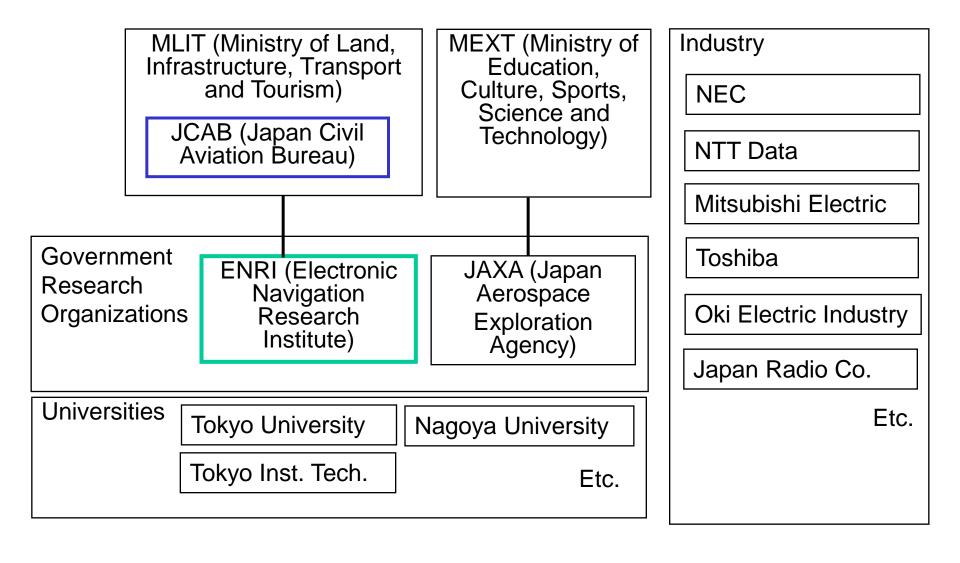
Sub-committee for Promoting Research and Development

Sample issues:

- → Limited human resources of research institutes
- > Research funding for universities
- → University education in ATM field
- Consolidation of aviation-related manufacturers' opinions
- → Providing air navigation system data or operational data for research purposes
- → Cooperation with other countries' research institutes



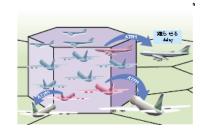
Japanese R&D Organizations

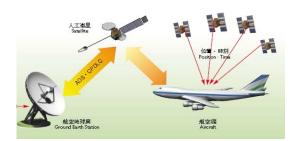




Introduction to ENRI

- ENRI is responsible for research and development in the field of ATM in Japan
 - Established in 1967 as a national laboratory
 - Budget: 1.6 billion yen (FY2013)
 - Personnel: 65 (47 researchers)
- Major Research Areas
 - Air Traffic Management
 - Navigation systems
 - Surveillance and Communication
 - http://www.enri.go.jp/eng/index_e.htm





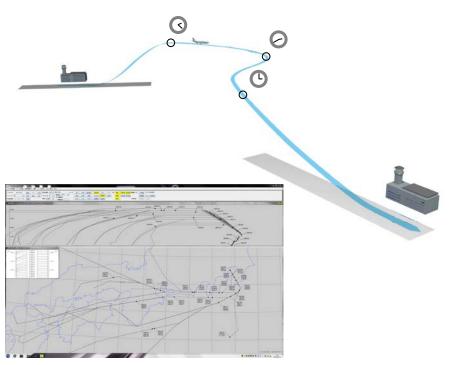




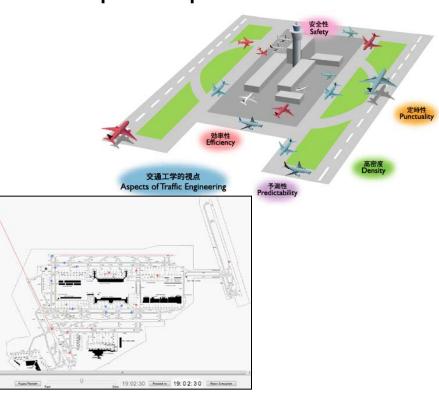
ATM Research Topics (1)

Trajectory Based Operations

- •Full 4D TBO concept creation
- Trajectory Predictor development



Airport Operations



- Airport Surface Movement Simulator
- Scheduling methods to alleviate airport surface congestion

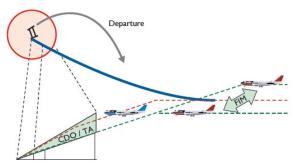


ATM Research Topics (2)

Oceanic Route Optimization

Optimization of Oceanic Track System including Arrival Route with CDO





Aircraft Surveillance Applications System (ASAS)



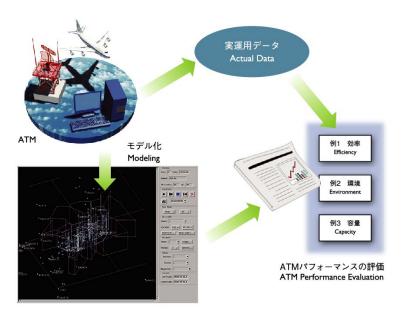
- Joint Airborne time-spacing Design Evaluation (JADE)
- Aircraft Surveillance
 Applications System (ASAS),
 Interval Management (IM)



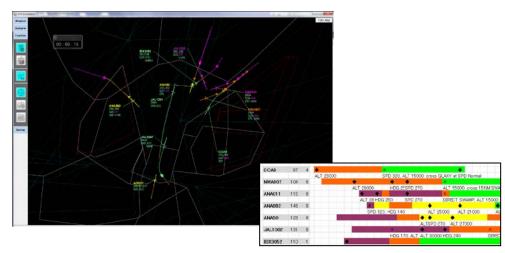
ATM Research Topics (3)

ATM Performance estimation

- Current Japanese ATM performance measurement
- Performance estimation of new measures



Development of Process Visualization Tool of ATC Tasks (COMPASi)



- Improvement of controller training
- Evaluation of new air traffic
 management system and procedures



Communication Research Topics

Aeronautical Mobile
Airport Communication
System (AeroMACS)



Development of experimental 5 GHz (C-band) prototype with MIMO antenna system

Future Aeronautical High Speed Data Links



Evaluation of emission quality and data transmission performance of new data links (e.g. L-DACS)

L-DACS: L band Data link Aeronautical Communication System

MIMO: Multiple-Input Multiple-Output



Navigation Research Topics

GBAS Ground Based Augmentation System

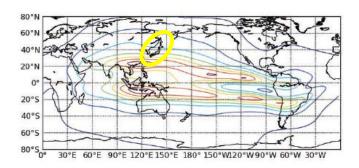
Japanese-developed CAT- I GBAS system with Ionosphere field monitor



GBAS facility and Boeing 787 at Kansai Airport



- •CAT-Ⅲ GBAS (GBAS Approach Service Type D (GAST-D))
- Landing Procedures of Precision Approach along Curved Path



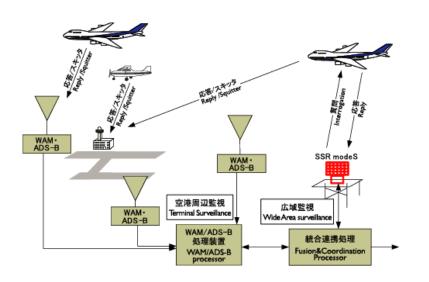
Ionosphere Density (12JST)



Surveillance Research Topics

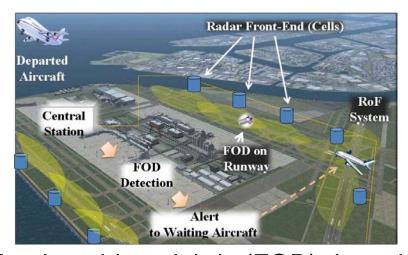
Hybrid Surveillance Technology

- Data Integration of conventional and new system
- Wide Area Multilateration (WAM) system
- Automatic Dependent Surveillance— Broadcast (ADS-B)





Advanced En-route Surveillance



Foreign object debris (FOD) detection Millimeter wave radar 90GHz linear cell



Main Facilities

Experimental Aircraft





Radio Anechoic Chamber



Experimental Mode-S Radar



International Collaboration

- Joint research between International ATM/CNS research institutes and Japan
 - NLR, NASA, ENAC, University of Nice-Sophia Antipolis, KARI, KOTI, KAU, etc.
- ENRI International workshop on ATM/CNS (EIWAC) 2013
 - ICAO, FAA, DSNA, DGAC, AAPA, IATA, NASA, etc.
 - 500 Participants (foreign 80)
 - 43 Presentations (foreign 28)

KARI: Korea Aerospace Research Institute

KOTI: Korea Transport Institute KAU: Korea Aerospace University

AAPA: Association of Asia Pacific Airlines





Conclusions

- CARATS, JCAB long-term vision
 - Eight Pillar of Renovations on ATM/CNS
 - CARATS road maps to realize the concepts
 - Sub-committee for Promoting Research and Development
- ENRI major research topics on ATM/CNS
 - TBO, Airport operation, Oceanic Route Optimization, ASAS, ATM performance, Visualization Tool of ATC Tasks
 - High Speed Data Links, GBAS, Hybrid Surveillance, FOD detection
- ENRI is contributing to CARATS in both near and long term basis.