The 2nd ENRI International Workshop on ATM/CNS

Akihabara, Tokyo, Japan
10 November, 2010

国土交通省
Ministry of Land, Infrastructure, Transport and Tourism

Contents

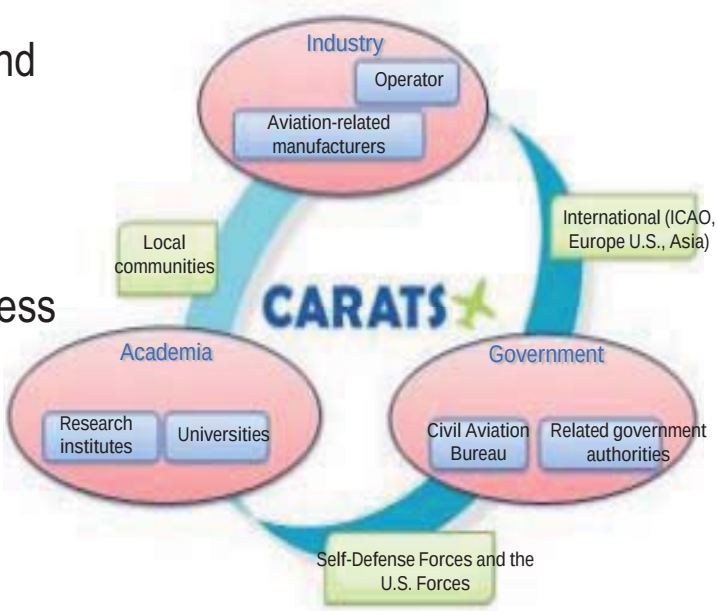
Theme topic for EIWACS 2010

FORSEE: FOR (e) Safety, Efficiency and Environment

1. What's "CARATS" ?

In order to effectively and efficiently work on future ATM systems, we need;

1. Collaboration among industry, academia and government;
2. Collaboration between operators and air navigation service providers;
3. International collaboration to realize seamless air traffic environment;
4. Collaboration among co-users of air space (civil, Self-Defense Force, US Force); and
5. Collaboration with local communities



CARATS :
Collaborative Actions for Renovation of Air Traffic Systems

2. Background (1)

Social and Economic Challenges in Japan

- **Decreasing population**
- **Declining birth rate**
- **Aging society**
- **Global warming issues**
- **Rapid growth of economy in Asia**

A "Growth Strategy" needed to sustain Japan's economy and enhance its international position

"Aviation" is one of essential foundations for social and economic development and upgrading of life standards

Improvement of aviation services level needed in both quality and quantity

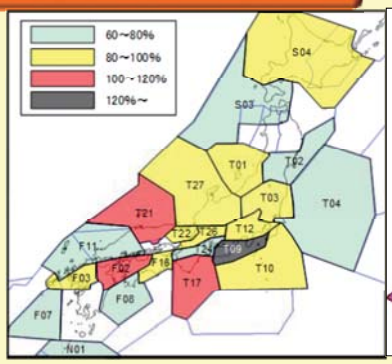
For example, ATC capacity enlargement in congested air spaces and streamlining air traffic systems, while meeting users and social needs

Air Traffic Systems, through its renovation, will continue to be a cornerstone for future growth of Japan

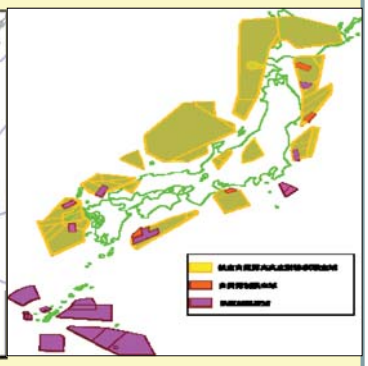
2. Background (2)

Constraints in present ATM systems

- Shortage of ATC capacity unable to meet high demand of air traffic
- Chronic delay of traffic due to the ATC overload
- Inefficient operation due to inflexible use of airspaces and routes
- Accidents/incidents attributable to human errors and HMI under the current systems



Load factors of ATC sectors when traffic increases by 1.5 times

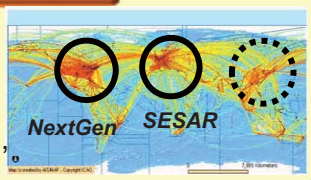


Civil airspaces surrounded by military training zones

"Dynamic" and "Strategic" renovation of Air Traffic Systems

Global Trend in "*Global ATM Concept*" Crystallization

- **ICAO**: Adopted "*Global ATM Operational Concept(Doc.9854)*" targeting at 2025, has been promoting the Concept with its stress on global harmonization.
- **US/EU**: Completed an ATM master plan and are now in development phase
- **Asia/Pacific**: Some States maybe are studying its own master plan or having one, but neither the regional nor sub-regional programme does exist.

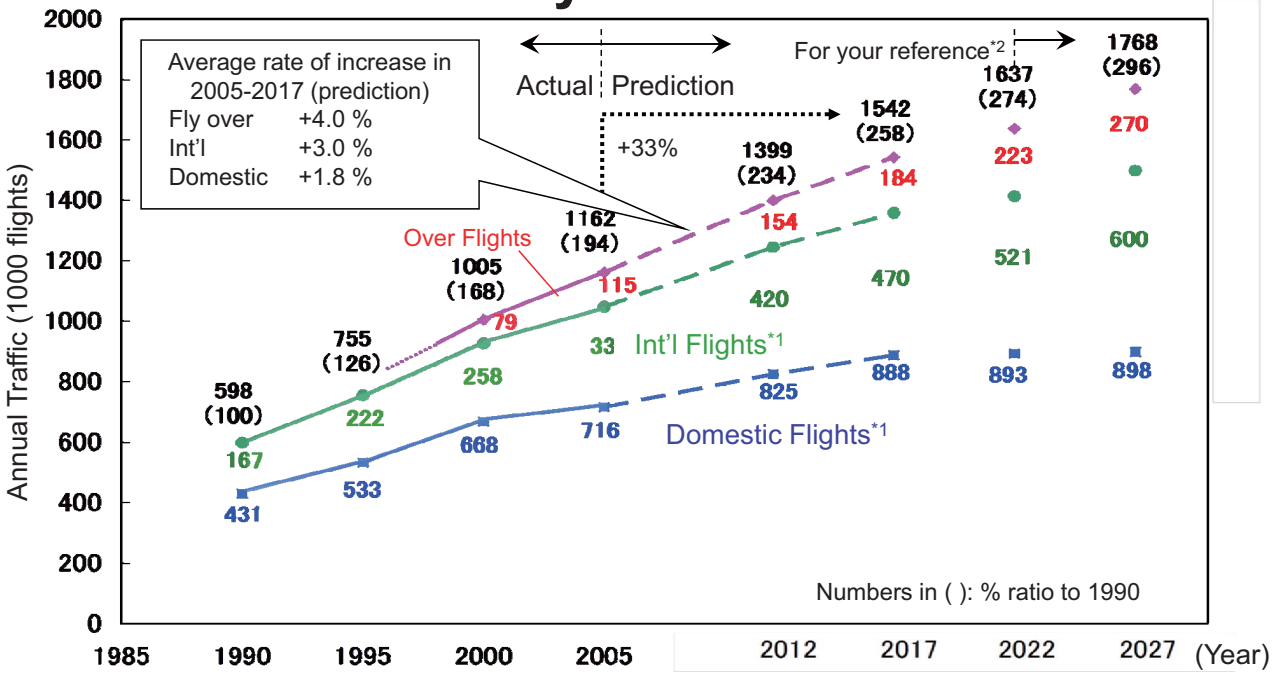


Intra-regional and inter-regional cooperation for realizing "Global ATM"

3. Trend/Characteristics of air traffic (1)

Looking at domestic and int'l traffic to/from Japan, ・・・

The number of flight, including overflight, is forecast to increase by 50% around 2027.

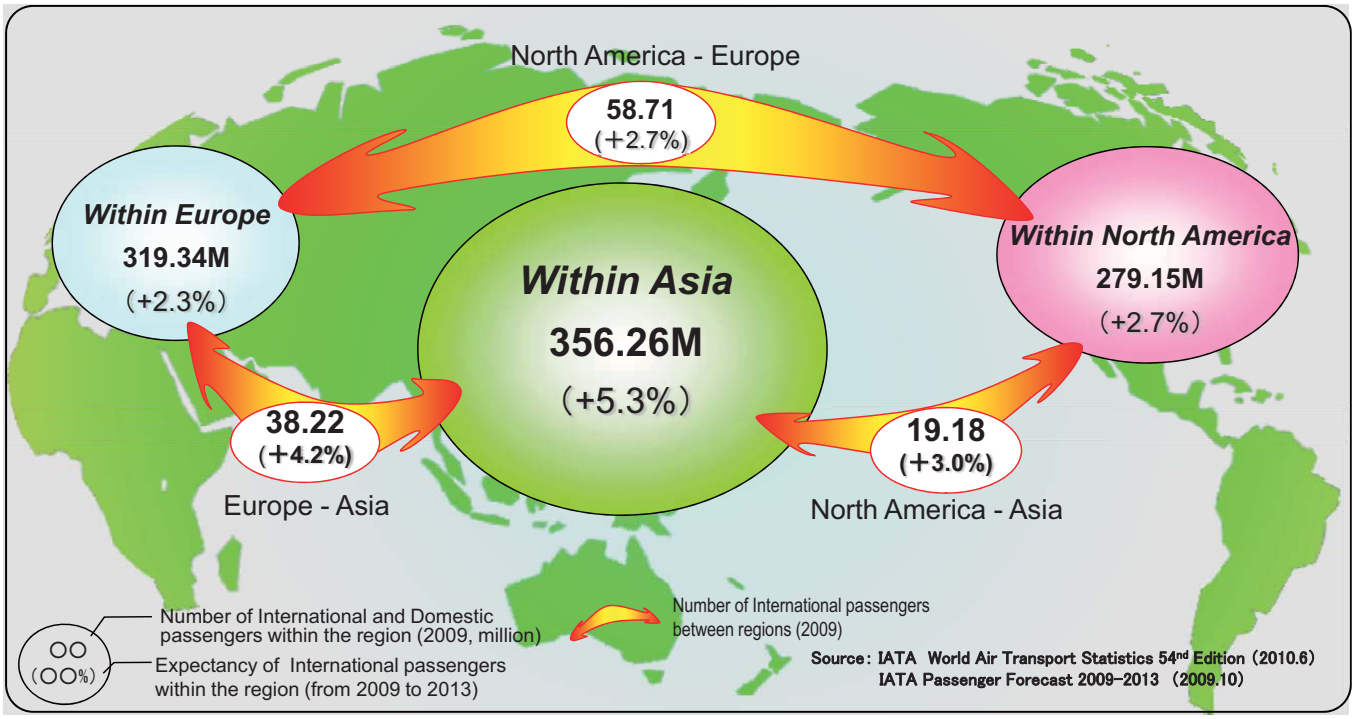


*1: Prediction of demand is premised on the capacity limitation of metropolitan airports.
*2: The figures beyond 2022 is tentative prediction and will be re-forecast at the next reviewing process.

3. Trend/Characteristics of air traffic (2)

Looking at intra/inter regional traffic of Asia, ・・・

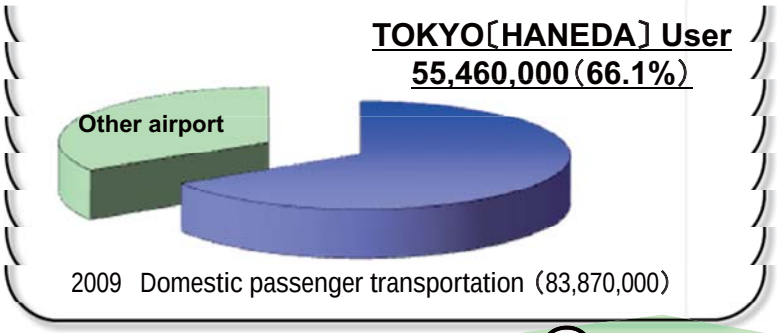
A steady increase of air traffic in the Asia/Pacific region, along with its robust economy. Still, further growth is expected.



3. Trend/Characteristics of air traffic (3)

Looking at a domestic air transport network, ・・・

Convergence of air traffic into the metropolitan area.



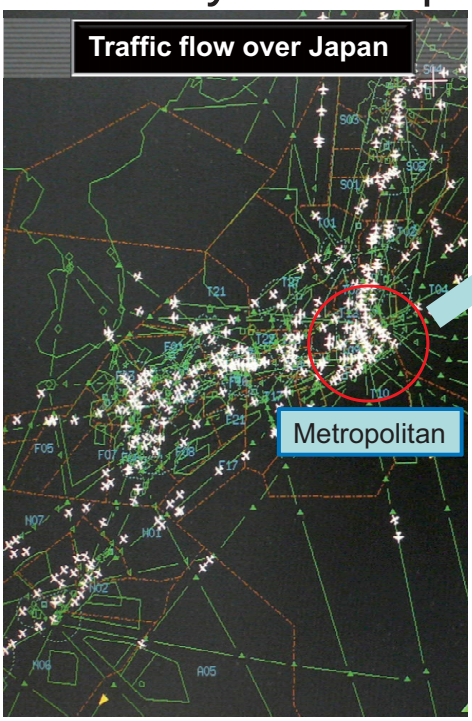
Haneda-based domestic air transport network

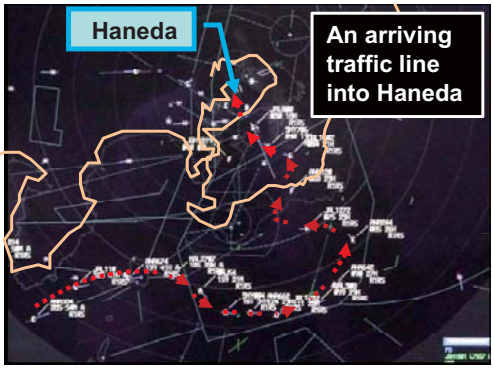
※ 25 routes (one million or more passengers a year of 2008)

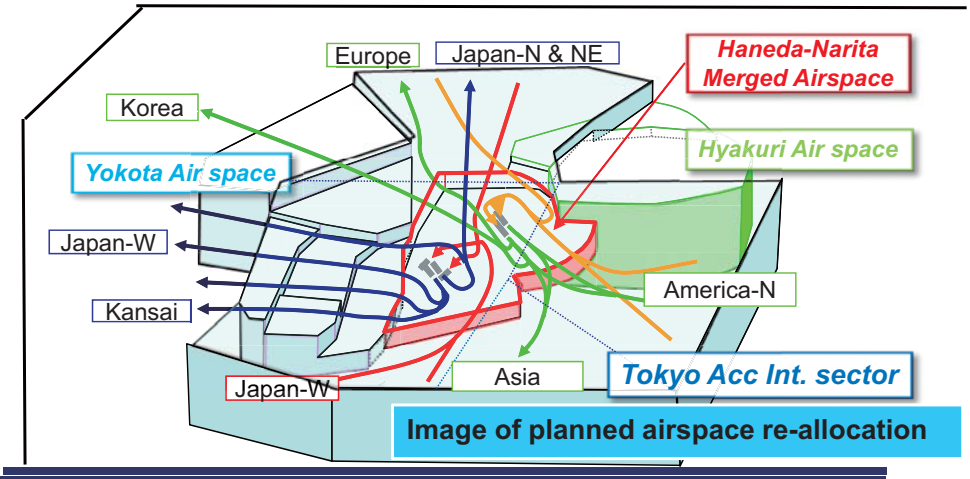
3. Trend/Characteristics of air traffic (4)

Looking at a traffic flux over metroplex, ・・・

Congested flows of air traffic, radar-vectored through segmented and layered airspaces.





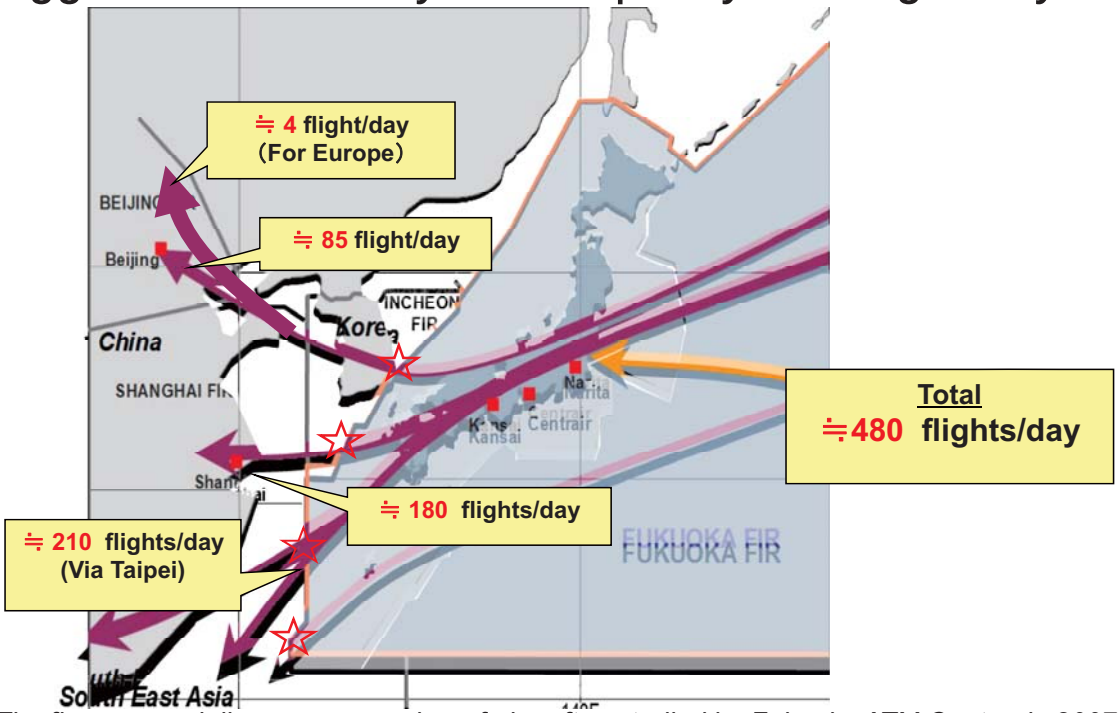


Civil Aviation Bureau Japan

3. Trend/Characteristics of air traffic (5)

Looking up at the air corridor above us, ・・・

A hike of over flight and cross-boundary traffic in Fukuoka FIR can aggravate efficiency, ATC capacity and regularity.



Note: The figures are daily average number of aircraft controlled by Fukuoka ATM Center in 2007.

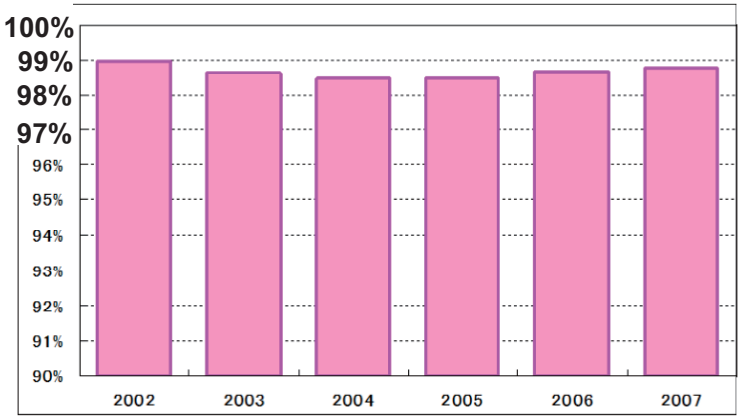
Civil Aviation Bureau Japan

3. Trend/Characteristics of air traffic (6)

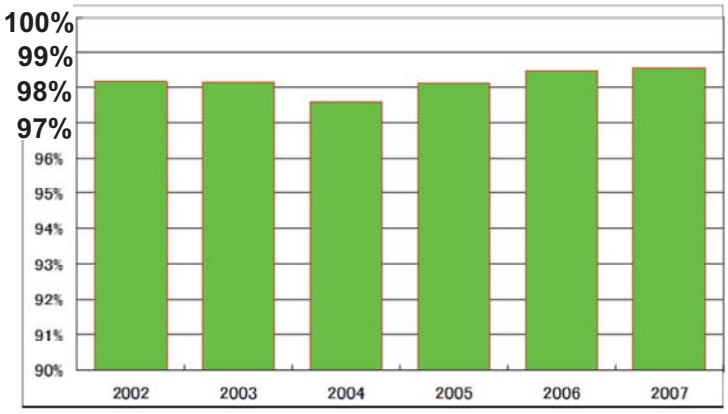
Looking at air navigation service clients, ・・・

High expectation of “rapidness” in transportation

High expectation in “regularity” of transportation



On-Time Arrival Rate

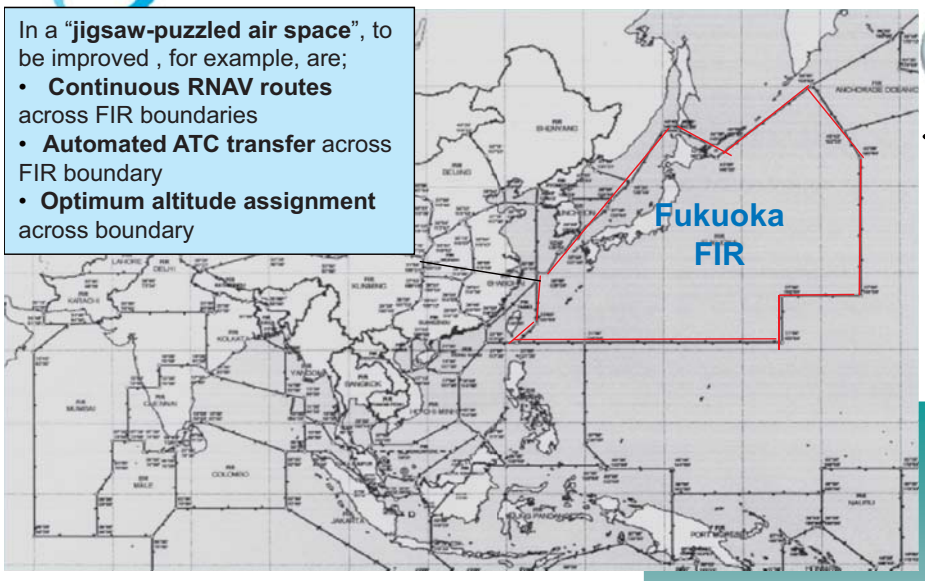


Serviceability of Flight

3. Trend/Characteristics of air traffic (7)

In a “**jigsaw-puzzled air space**”, to be improved , for example, are;

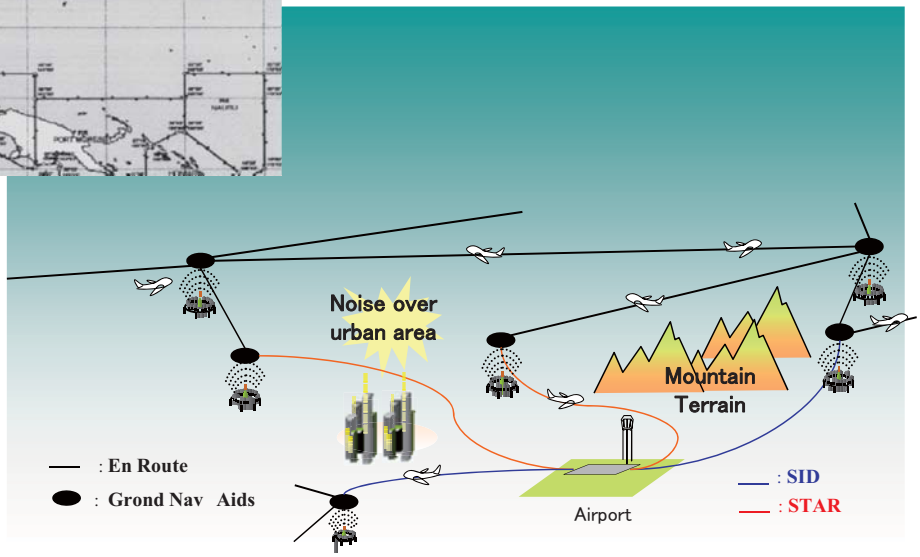
- **Continuous RNAV routes** across FIR boundaries
- **Automated ATC transfer** across FIR boundary
- **Optimum altitude assignment** across boundary



Looking at other aspects, ・・・

Inefficient cross-boundary operation due to the ops/tech gaps

Restricted routes and procedures due to the tech/topographical constraints



4. Outline of CARATS (1)

Features: What's "CARATS" in short?

- A long-term vision, foreseeing at 2025 and beyond
- A product thru collaborative work among ATM stakeholders
- Aiming at performance-based ATM system with clear targets
- Encompassing wide actors and systems, including airborne
- Stepped approach based on roadmaps
- Performance review and goal achievement analysis

4. Outline of CARATS (2)

Structure: What does "CARATS" comprise?

7 Goals

1. Enhance safety
   5 times Safety
2. Increase ATC capacity
   Double Capacity
3. Improve user convenience
   +10% Service level
4. Improve operation efficiency
   -10% Fuel Consumption
5. Enhance ATM service efficiency
   +50% Productivity
6. Reduce environment effects
   -10% CO2 emission
7. Strengthen International Cooperation and Contribution

8 Direction of ATM Renovation

1. Trajectory-based Operation
2. Enhancing predictability
3. Performance-based Operation
4. Satellite-based Navigation
5. Improving Situational Awareness
6. System automation and HMI
7. CDM on Information Sharing Platform
8. High Density Operation

Roadmap(*)

Short Term

- TBO at Decent phase
- RNP-AR
- Data Link
- Improved ATFM
- Airport surface ATM

Mid Term

- Precision Approach using SAT NAV
- SWIM
- Dynamic ASM incl. non-civil Airspace

tentative

Long Term

- ASAS
- Full 4D Trajectory

(*) Roadmaps are under consideration.

5. Goals of CARATS (1)

Example:
Goal 1: Safety Enhancement

numerical target

Enhanced Level of Safety (5 times safety)

While air traffic volume is forecast to increase by 1.5 times in 2025, the air traffic systems should reduce the number of aircraft accidents at least by half.

➡ (1.5 x 1.5) X 2 = 4.5 Round-up ➡ 5.0

descriptive goal

- "Safety" continues to be a major prerequisite in designing and establishing the future air traffic systems.
- Focus on the countermeasures against accidents attributable to human errors, meteorological factor, inadequacy of information sharing among stakeholders and lack of situational awareness.
- In terms of crisis management, security measures and contingency measures must be secured to provide continuous and stable AN services.
- For continuity of operation, the systems should be designed with high reliability and invulnerability against external factors.

6. Directions of ATM Renovation (1)

ATM renovation supported by CNS innovation to achieve "seven goals" by overcoming the existing constraints .

8-pillared renovation

1. Realization of trajectory-based operation (TBO)
2. Improving predictability in ATM
3. Promoting performance-based operation (PBO)
4. Development of satelite-based navigation during all flight phases
5. Adequate situational awareness in the air and on the ground
6. Maximum application of human and machine capability, on the platform of automated ATM systems
7. Information sharing and collaborative decision making(CDM on SWIM Platform)
8. Attainment of high-density operation in congested airspaces and at airports

6. Directions of ATM Renovation (2)

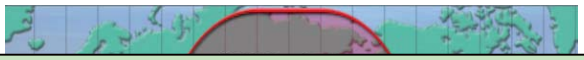
With "TBO" as a core element, 8 lines of renovation will pave the way to ATM paradigm shift.

Line 1. Trajectory-based Operati

Benefits by GNSS operation

- Provision of navigation service to cover the entire Fukuoka FIR
- Continuous Navigation service from departure to arrival using GNSS
- Higher precision and flexibility in design and use of airspaces, routes and procedures
- Less operational restriction resulting from ground obstacles
- Safety enhancement
- High fuel-efficiency and less CO2 emission
- Tool for noise abatement
- etc

Line 4. Satellite-based Navigation



Benefits by TBO

- Optimized, user-preferred route setting
- Efficient operation both on board and on the ground
- Optimized use of the entire air space by allowing for numerous factors
- Fuel-efficiency and less CO2 emission
- Integration of ground systems
- Less human intervention

etc

6. Directions of ATM Renovation (3)

Toward "Safety" goal, the following items, not limited to these, are operational improvement under each line.

Example: Safety Enhancement (Goal 1) and relevant renovation

Line 2: Improving predictability

- Maximum use of WXR forecast information
- Improvement of WXR forecast, using down-linked airborne data
- Provision of optimum 4DT, capitalized on high predictability

Line 4: SatNav in all flight phases

- Provision of navigation service at lower altitude
- GNSS-based precision approach
- Flexible route setting to avoid the ground constraints

Line 5: Enhancing situational awareness

- Improvement of visibility for surface movement, esp. for blind areas
- Improvement of ground-air surveillance capability
- Improvement of air-air surveillance capability

Line 7: CDM and Information sharing

- Adequate coordination among ATM stakeholders
- Timely accessibility to needed information
- Well-informed decision with more transparency

7. Work plan of 2010 (1)

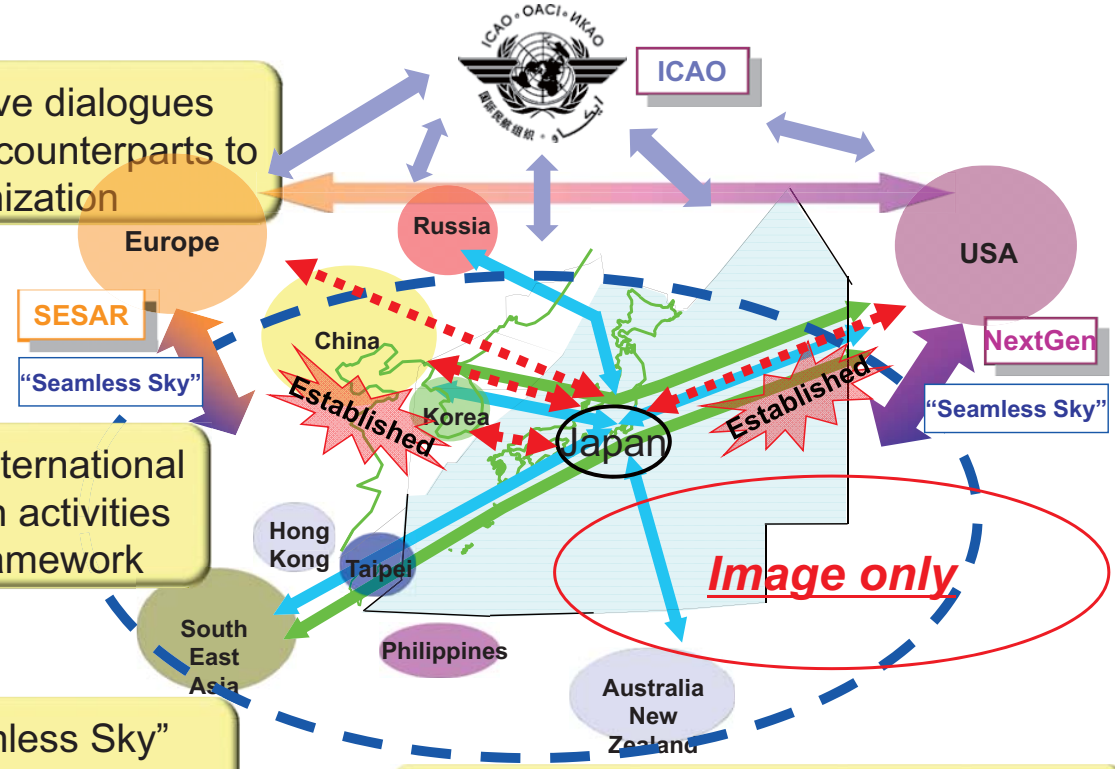
So far, a vision on future ATM has been blueprinted.
In FY2010, "CARATS Promotion Committee" will ...

- Lay out a roadmap, representing step-by-step implementation of the measures required to build the future air traffic systems.
- Clarify the roles of the industry, academy and government partners.
- Study and set indices for achievement analysis of numerical targets .
- Consider a framework, as necessary, to ensure the steady implementation of the mapped measures.

7. Work plan of 2010 (2)

To ensure our future system be interoperable with others, we will... ,

- Continue to have dialogues with overseas counterparts to secure harmonization
- Contribute to international standardization activities under ICAO framework
- Work on "Seamless Sky" initiative with Asia/Pacific States



- Assist States in need for smooth transition to future ATM systems

8. R&D aspect in CARATS (1)

R&D will also be undertaken in a phased approach with external factors taken into account.

Vision (Concept, Targets, Lines of renovation, etc)

Roadmaps

- Government Policies
- Aviation Policies/Directives
- Social / Economic trends
- Operational needs

Selection & focus-on

- ICAO's global ATM policy
- ATM modernization in other Regions/States
- Technology innovation
- Global issues affecting Aviation

ENRI *Mainly CNS/ATM*

- R&D long-term vision incl. roadmap
- Five-year work program
- Annual work plan etc

JAXA *Mainly Aircraft Operation*

- "DREAMS" project
- Five-year work program
- Annual work plan etc

Technical solutions, validation, verification, evaluation, safety assessment etc

8. R&D aspect in CARATS (2)

Under CARATS vision, expectations to research institutes are:

To conduct R & D, taking well into account operational needs and international trends.

To analyze and evaluate brand-new tech and ATM ops in a timely manner, in cooperation with CAB, operators and others.

To collaborate with academia and industries, leading to wider spectrum of ATM research and R&D calibre in Japan.

Effective and efficient role playing to be laid out over a long span.

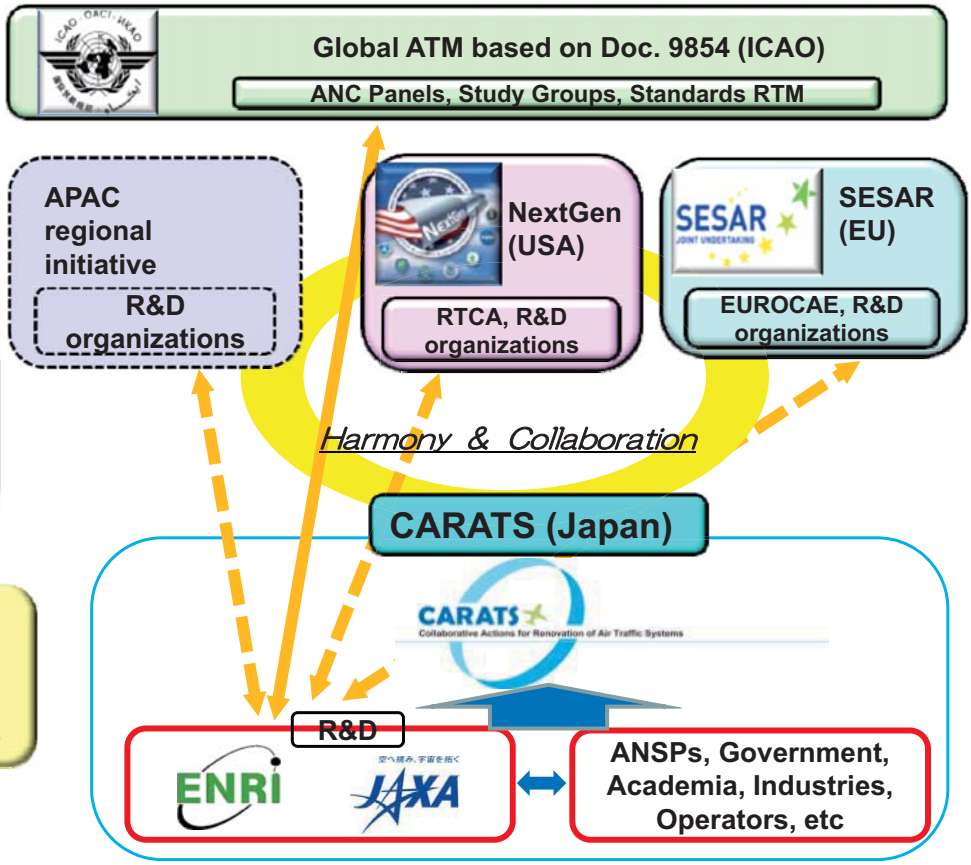
	Planning	R & D	Standardization	Development	Implementation	Operation
ANSP	・Leading ・Policy making	・Request ・Support	・Leading ・Legislation	・Regulation ・Procedures ・Manuals	・Implementation	・Operational evaluation
Research Institutes	・Proposal ・Needs finding	・R & D	・Participation	・Safety Assessment ・Validation	・Support to implementaion	・Support to evaluation
Operators	・Needs presentation	・Request ・Support	・Participation	・Procedures ・Manuals	・Equipage	・Operational evaluation

Note: The above table is an example only, does not constitutes CARATS vision. Involvement of academia and industries are subject to individual cases.

8. R&D aspect in CARATS (3)

R&D institutes are expected to play significant roles in forging a global ATM by :

- Involvement and contribution to int'l standards making.
- Cooperative work with R&D entities of other projects
- Keeping abreast with the tech evolution and proactive involvement



The End

Thank you for your attention.

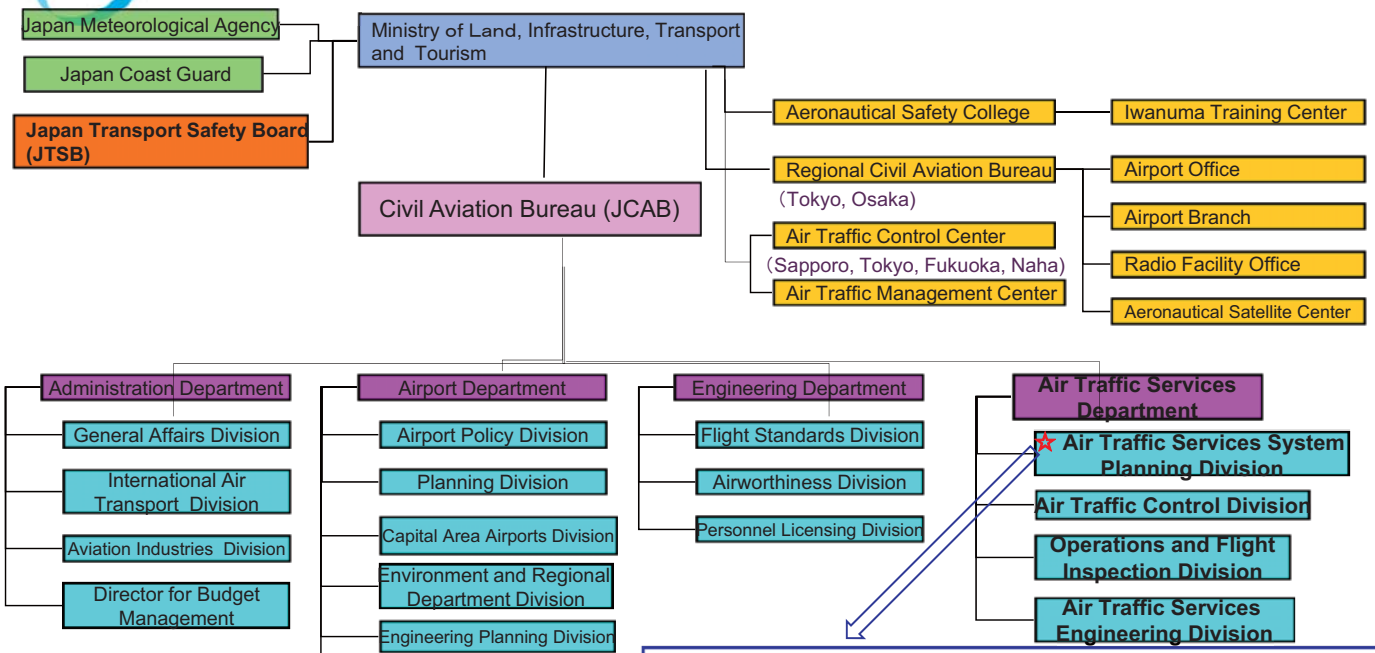
Merci pour votre attention.

Gracias por su atención.

清听谢谢

청취 감사합니다

ご清聴、ありがとうございました。



For further information, please access to
http://www.mlit.go.jp/koku/koku_CARATS.html,
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