CARATS

(Collaborative Actions for Renovation of Air Traffic Systems)

Background

Demand forecast of air traffic in Japan

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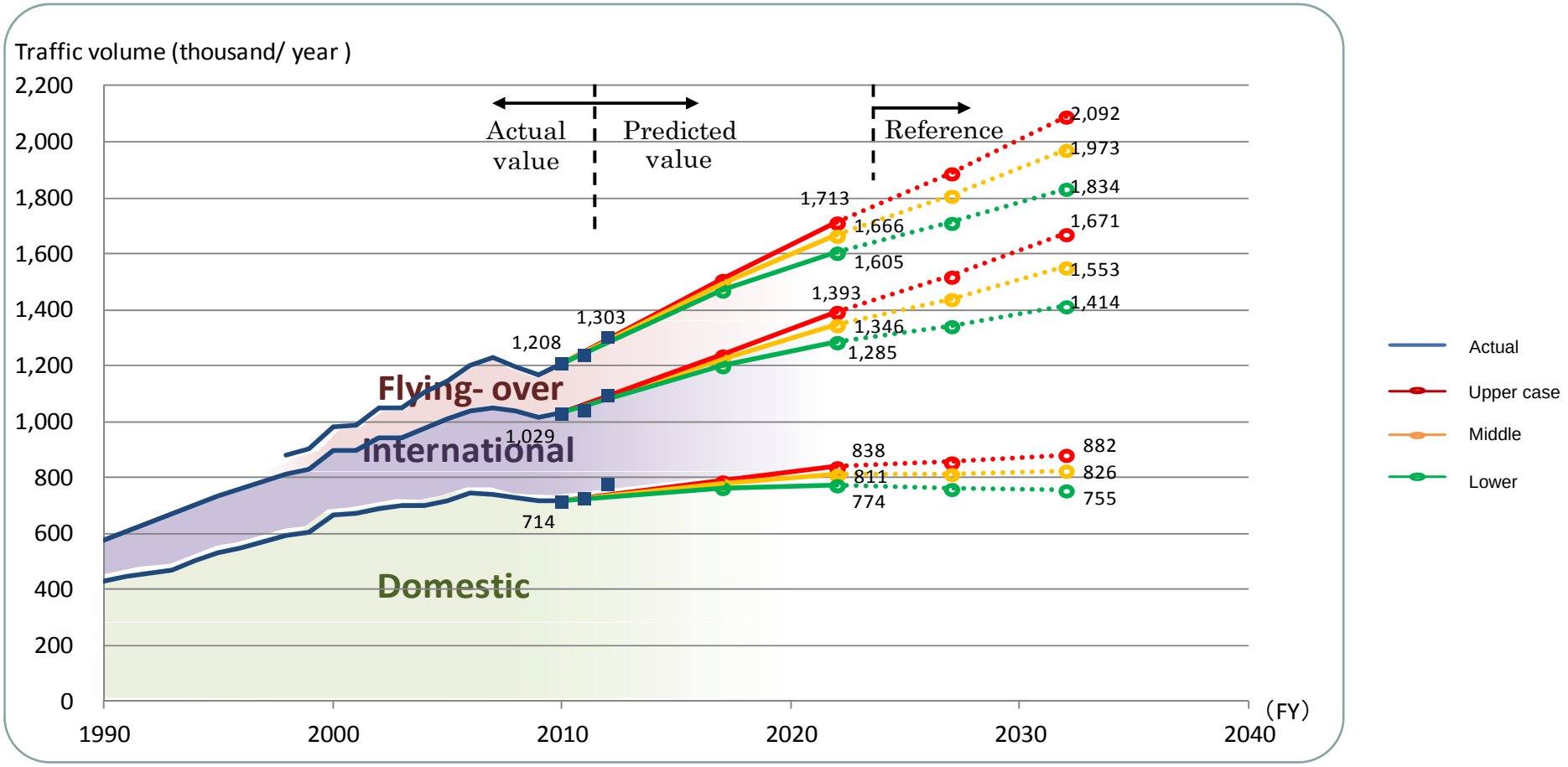
- International flight and flying-over are increased. Domestic flight is dependent on the case of GDP.
- Even if GDP is estimated low, the number of aircrafts will exceed the limit of air traffic control capacity around 2025.
- The demand may go up rather than this forecast by further promotion of inbound tourism and the growth of LCC.



* Basic case of GDP is set up based on the economic growth rate which is a target of the Japanese future strategy.
(economic growth rate is set up to 1.7% from 2010 to 2017 and 2.0% from 2017 to 2032)

* In upper case, economic growth rate is set up 1% higher than basic case.

•In lower case, economic growth rate is set up 1% lower than basic case.

•The number of IFR flights is that to add military, non-scheduled and cargo flights to those above.

Transition of the number of flights and the number of staff

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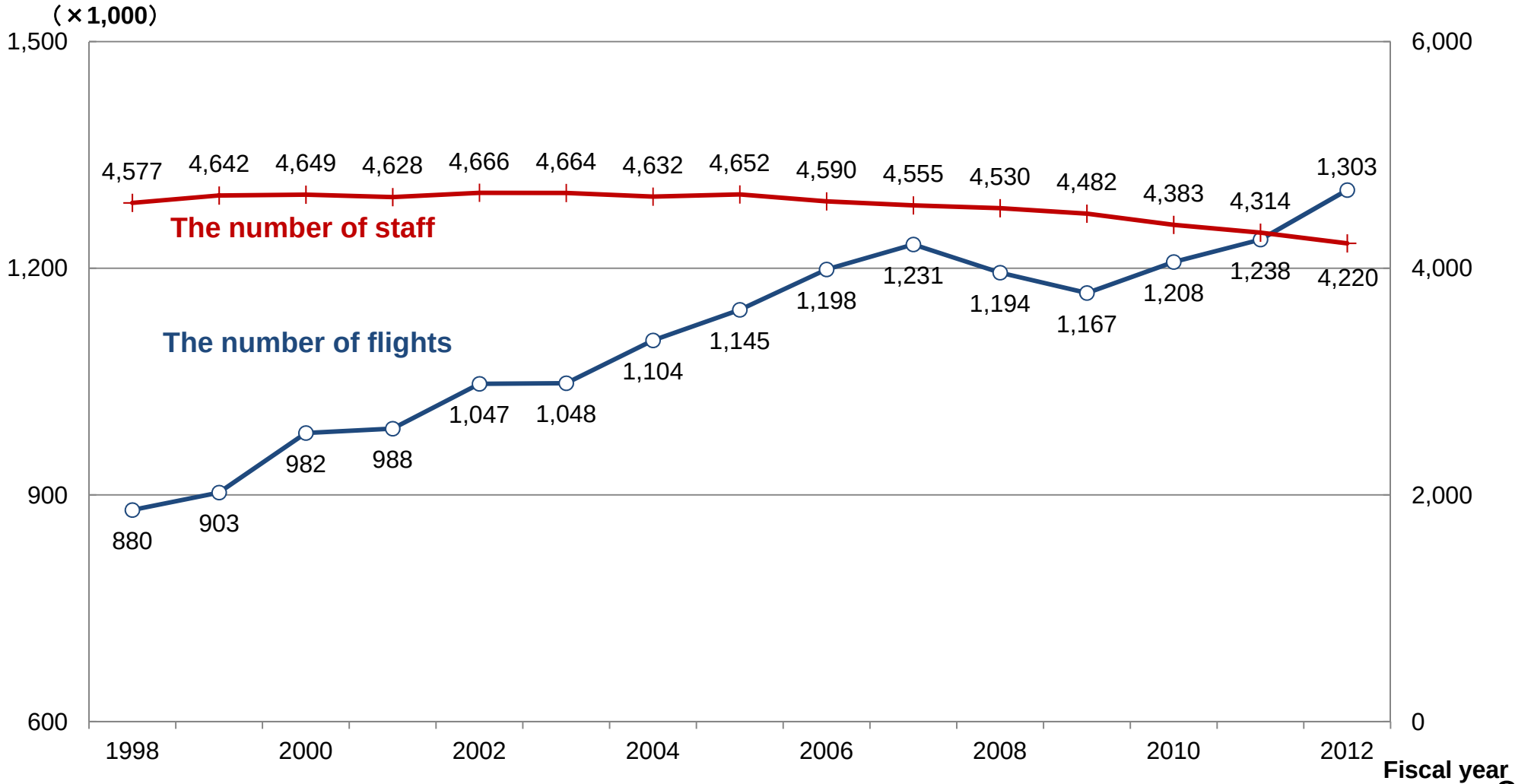
- The number of flights increased 1.5 times in the past 15 years.
- The number of staffs decreased slightly every year.
  - ⇒ We have conducted air traffic services corresponding to the increase of air traffic demand by the enhancement of systems and the improvement of productivity.



*The staffs include air traffic controller, air traffic communication specialist, air navigation service engineer, aeronautical lighting and electricity specialist and aeronautical satellite operations specialist.

CARATS Overview

Consideration of long-term vision

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- 2009～2010 Development of long-term vision
  - Establishment of “Study group for Promoting Renovation of the Air Traffic System”
  - Development and promulgation of “Collaborative Actions for Renovation of Air Traffic Systems”（CARATS）

CARATS
Collaborative Actions for Renovation of Air Traffic Systems

- 2010～2011 Development of roadmap for each measures
  - Establishment of “Committee for Promoting Renovation of the Air Traffic System”
  - Consideration of concrete measures and development of roadmap

- 2011 ～ Implementation of the measures

Working Framework

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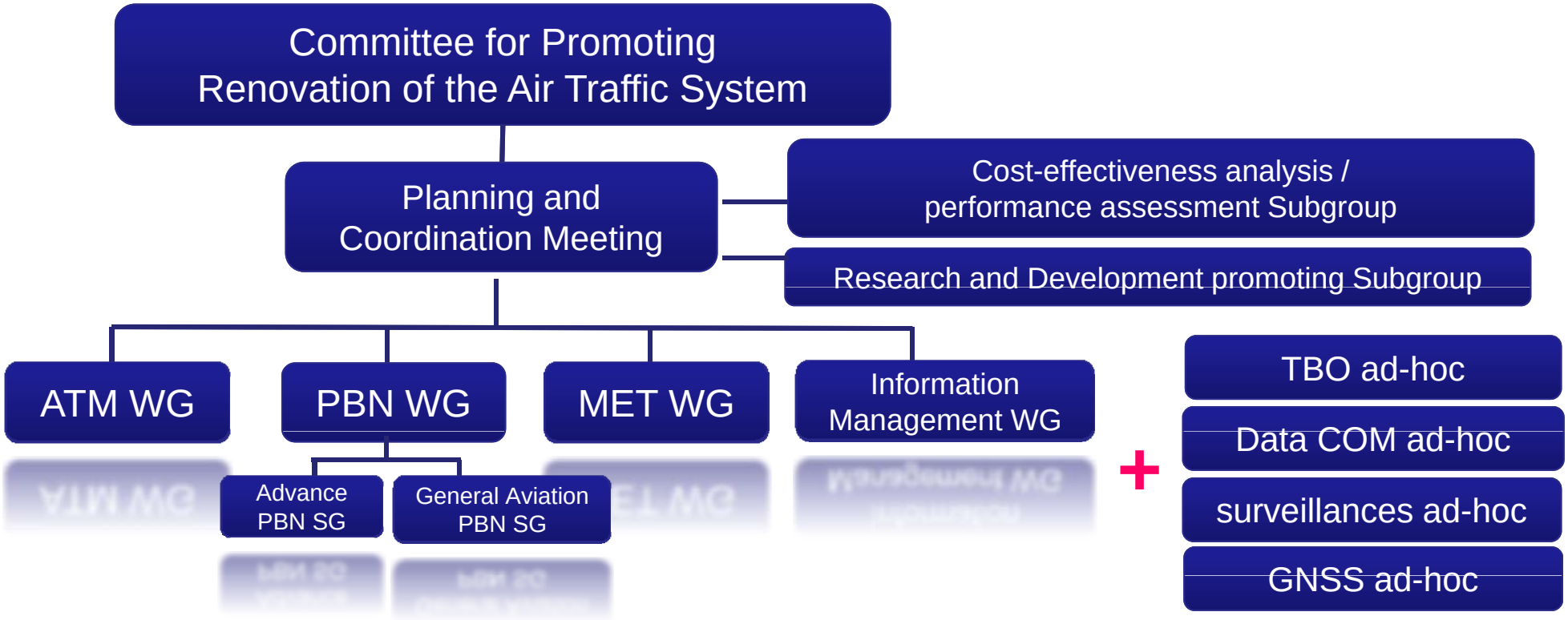

***ATM: Air Traffic Management, PBN: Performance Based Navigation, RNAV: aRea NAVigation**

- The committee manages whole CARATS activity.
- Each concrete discussion of the measure is carried out in each WGs, ad-hoc and SG under the PBN WG.
- All of these meetings are collaborative activity in which JCAB, research institute, manufacturer and airline have participated.

Objectives of CARATS

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Objectives to be achieved by 2025
(clarifying numerical targets)

Objective	Numerical target
Enhancing safety	Increase safety level by 5 times
Responding to the increase in air traffic volume	Double the air traffic control capacity in congested airspace
Improving user conveniences	Improve services level (punctuality and reduction of flight time) by 10%
Improving operational efficiency	Reduce fuel consumption per flight by 10%
Improving productivity of air traffics services	Improve productivity of air traffic services by 50% or more
Responding to environmental issues	Reduce CO2 emissions per flight by 10%
Enhancing the international presence of Japan in the aviation field	(Qualitative objective)

Development of performance indicators

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Development of indicators for checking the status of implementation of the CARATS measures
Progressing CARATS measures steadily and monitoring and analyzing hem continuously

Objective and Numerical target	Outline of indicator
1 Enhancing safety (Increase safety level by 5 times)	The number of aircraft accident and important incident resulting from ATC (the average number for the past five years)
2 Responding to the increase in air traffic volume (Double the air traffic control capacity in congested airspace)	(Under consideration)
3 Improving user conveniences (Improve services level by 10%)	Punctuality : The rate of the arrival delay flights exceeding 15 minutes
	Actual operation rate : The flight cancellation rate by the influence of the whether (the average rate for the past three years)
	Rapidness: Flight time of Gate-to-Gate of main routes.
4 Improving operational efficiency (Reduce fuel consumption per flight by 10%)	The amount of the fuel consumption per flight in main routes
5 Improving productivity of air traffics services (Improve productivity of air traffic services by 50% or more)	The flight plan operation number of each air traffic controller
	The flight plan operation number to the maintenance expense (the average number for the past three years)
6 Responding to environmental issues (Reduce CO2 emissions per flight by 10%)	The amount of the CO2 emissions per flight in main routes

Direction of renovation of CARATS

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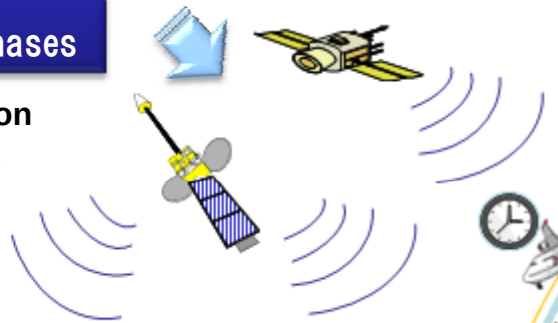
4. Realizing Satellite-based Navigation for All Flight Phases

Aircraft can determine position and time accurately in all FIR of Japan by Satellite-based navigation



3. Promoting Performance-based Operation (PBO)

1. Realizing Trajectory-based Operation (TBO)

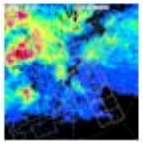
5. Enhancing Situational Awareness on the Ground and in the Air

Cooperation between ground and air, Information sharing

Integrated ATC processing system

8. Realizing High-density Operation in Congested Airports and Airspace

6 Making Maximum Use of the Capability of Human Beings and Machines



2. Improving Predictability

The calculation of air traffic control capacity, Estimation of traffic flow, Improving of predictability of meteorological phenomena

7. Complete information-sharing and Collaborative Decision-Making

CARATS Roadmap

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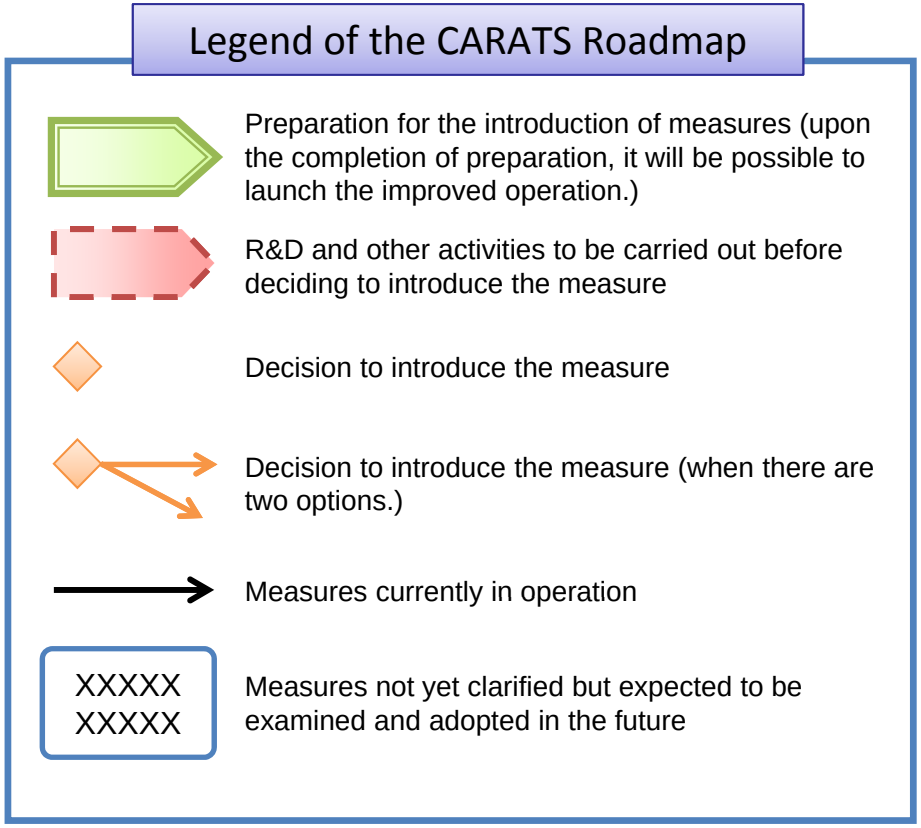
In order to establish future air traffic systems in a planned manner based on the CARATS, it is necessary to prepare a roadmap specifying measures to be taken through collaboration among the parties concerned and put short-term measures into action first, while carrying out R&D in a planned manner regarding long-term measures.

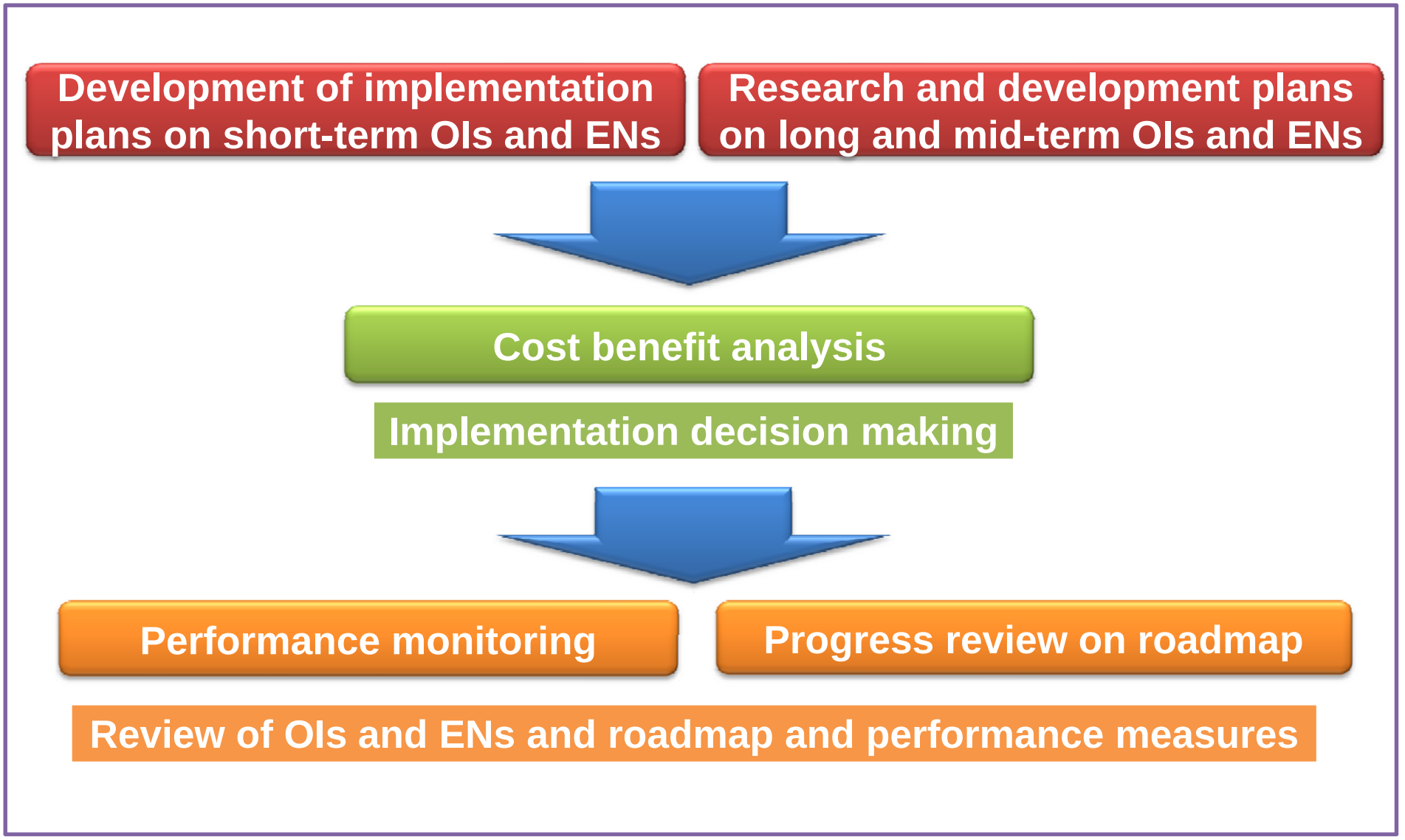
From this viewpoint, the MLIT prepared the CARATS Roadmap in March 2011.

The roadmap specifies 64 measure that needs to be taken in order to achieve the CARATS, and categorizes them into measures intended to improve operation (operational improvements (OI)) and measures relating to technology necessary for enabling such improvement (enablers (EN)).



Appendix (Excel file)

Activities in implementation phase



Recent Topics

Decision for Introduction of CARATS measures in FY 2013

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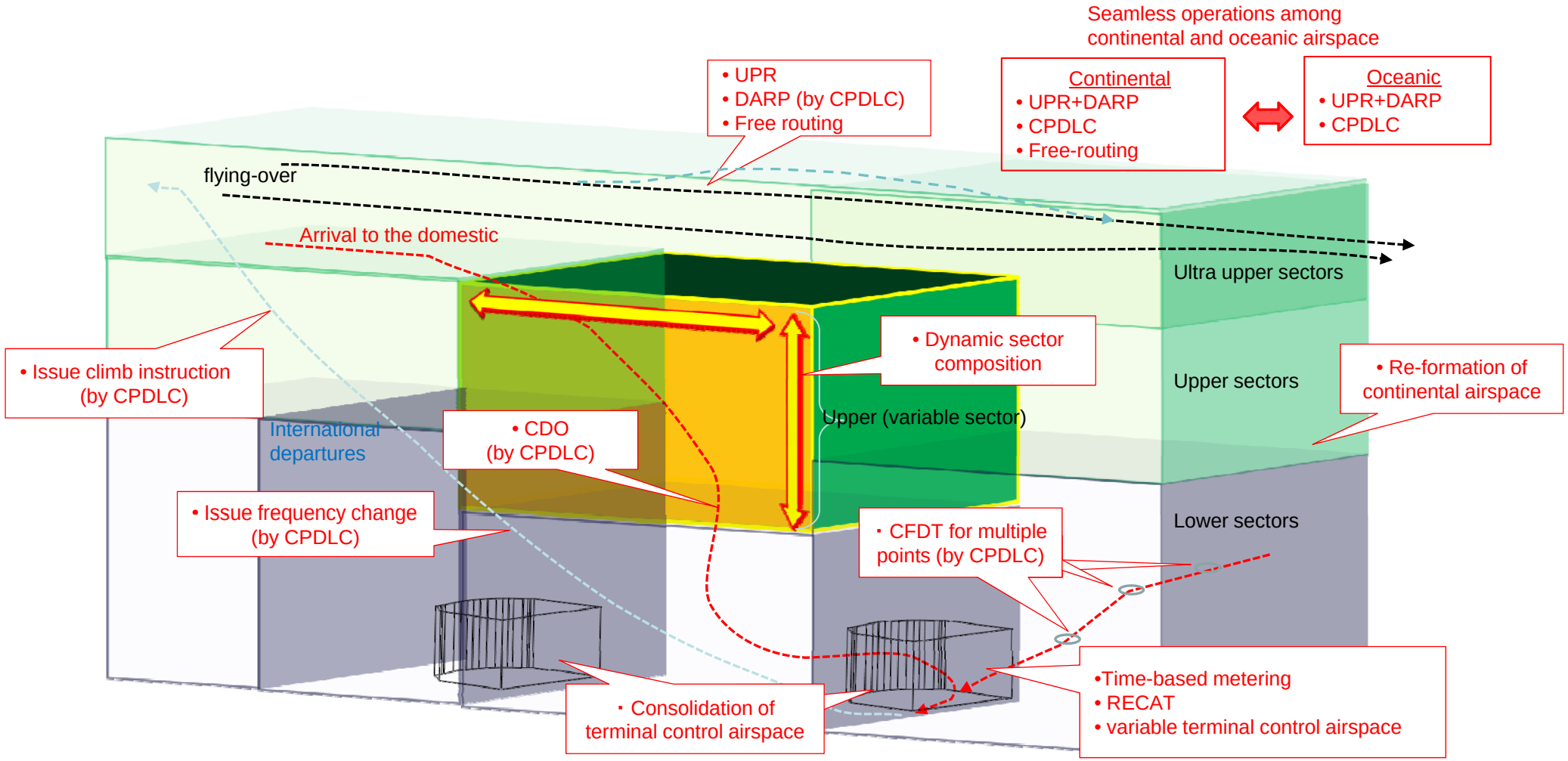

Fundamental System
- Integrated air traffic control data processing system (EN-1)
- Integrated display for weather observation data (EN-4-1)
- WAM for en-route (EN-9-2)

Implementation year (current plan)

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- Airspace re-formation
  - West Japan 2020
  - East Japan 2024
- Dynamic sector composition
  - change of vertical boundary 2020
  - change of vertical and horizontal boundary 2026~
- Continental CPDLC 2021
- UPR and DARP in the continental airspace
  - UPR 2025
  - DARP 2026~
- Time-based metering
  - fixed metering fix 2018
  - dynamic metering fix 2021
- RECAT (phase 1, 2) 2018
- Variable terminal control airspace
  - operation using multiple fix point 2019
  - operation by instruction of L/L 2021

Future airspace structure

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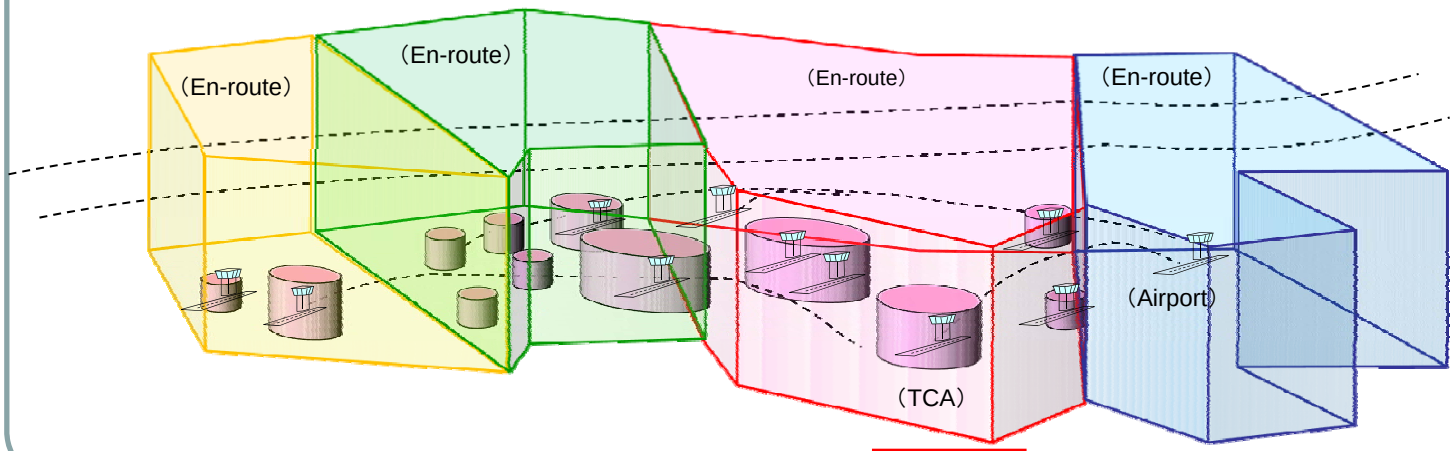
【Current - divided by geographical bases】

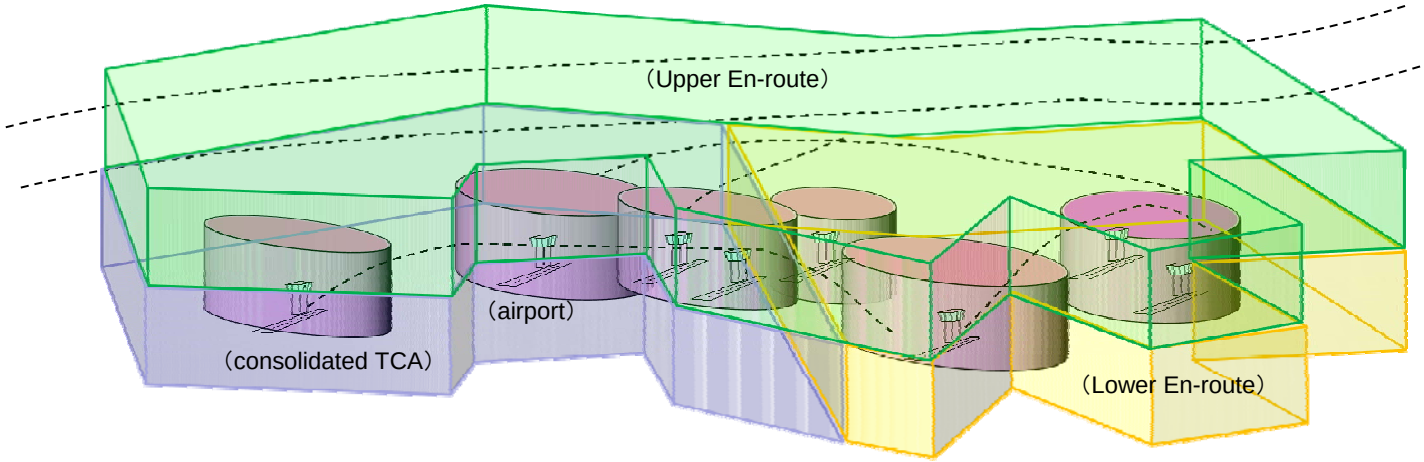


【The current airspace】
・Each ACCs <u>divided by vertically</u>

・ACC controls from the surface to upper

・TCAs are set depending on the location of airport

【Future - divided by aircraft movement i,e, climb, cruise and descend phase】



【Future airspace】
・ACCs divided into upper and lower.

・TCAs consolidated or expanded

Continental CPDLC (service image)

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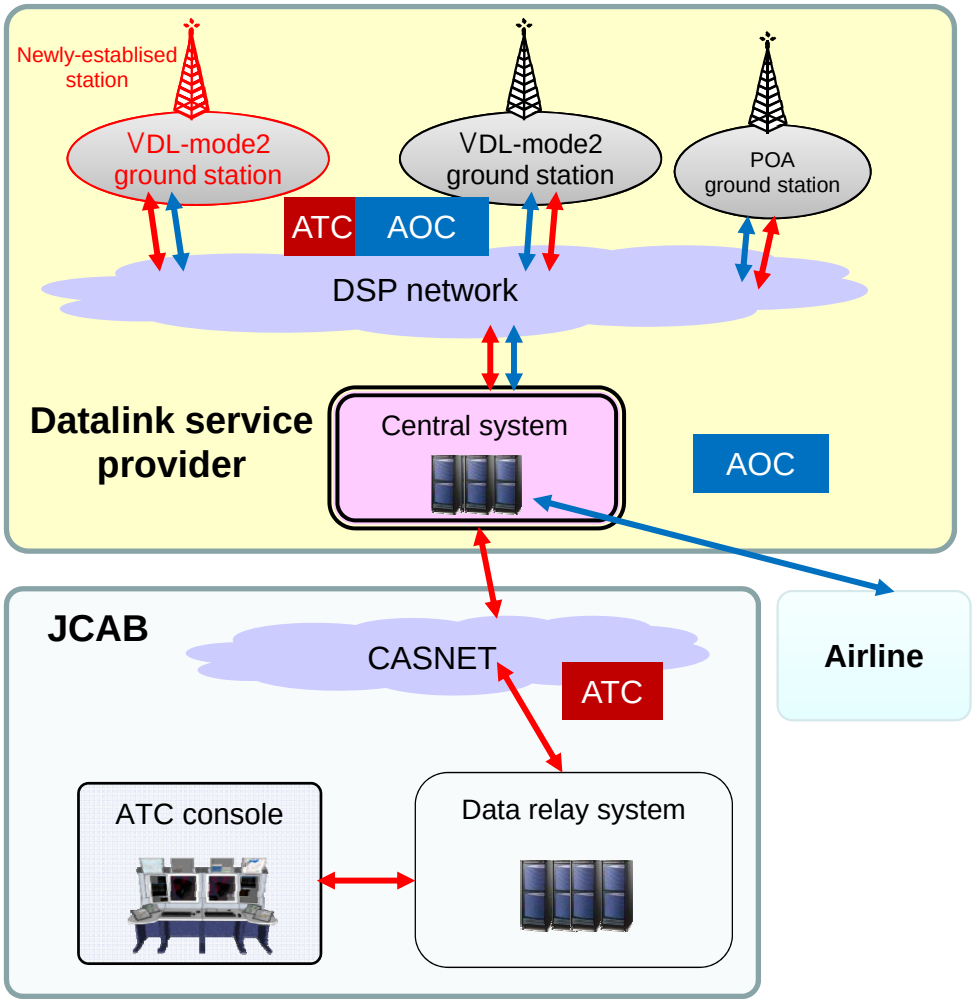
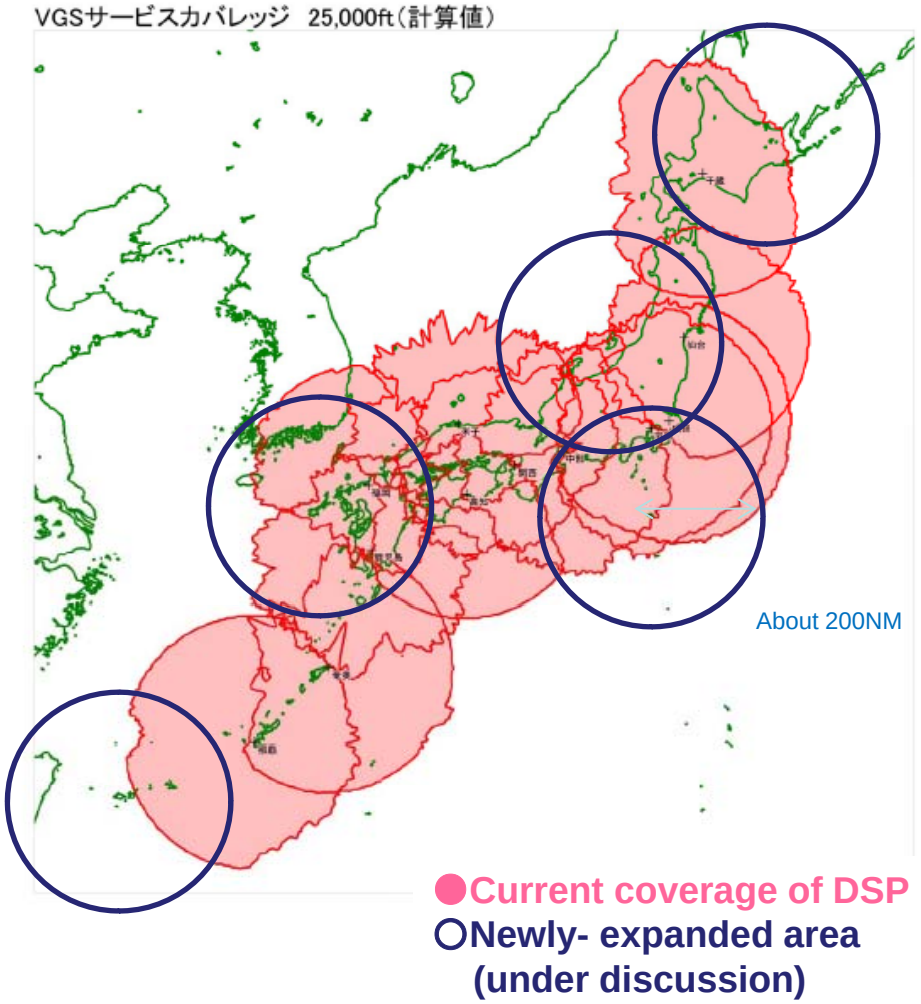
Utilization of private company



Consideration of service coverage



Example of other activities

Example of Activities : Performance based navigation

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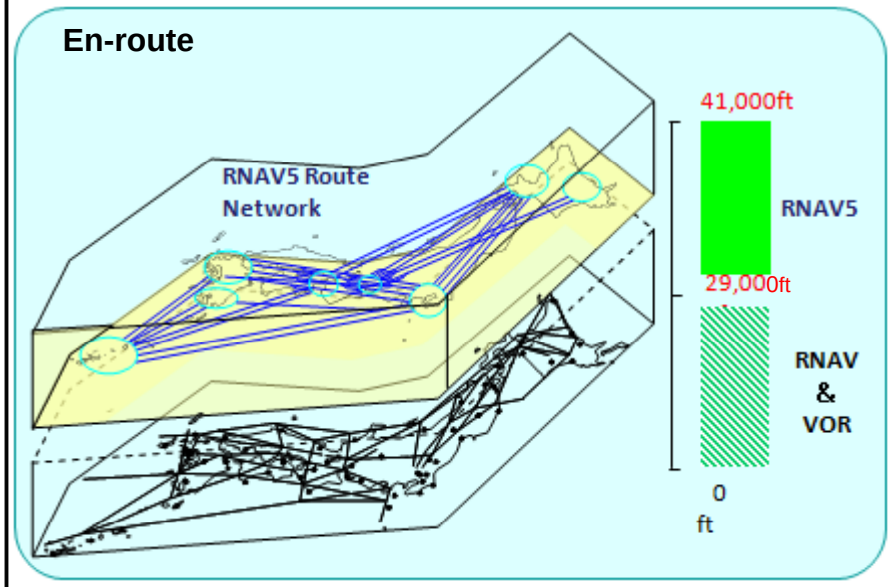
Expansion of RNAV by using an aircraft equipping the advanced flight management system for navigation, and having high navigation capability. As a result, flight efficiency and safety are improved.

⇨ Nationwide implementation of PBN is promoted by shift to higher precision RNAV.

Status of implementation of RNAV



SID/TR（Departure）

RNAV1: 27
Basic-RNP1: 12
(# of Airports)

STAR（Arrival）

RNAV1: 24
Basic-RNP1: 6
(# of Airports)

Approach

RNAV(GNSS): 31 (RNAV:16　RNP:15)
RNP AR Approach: 12
(# of Airports)

As of JUNE1, 2014

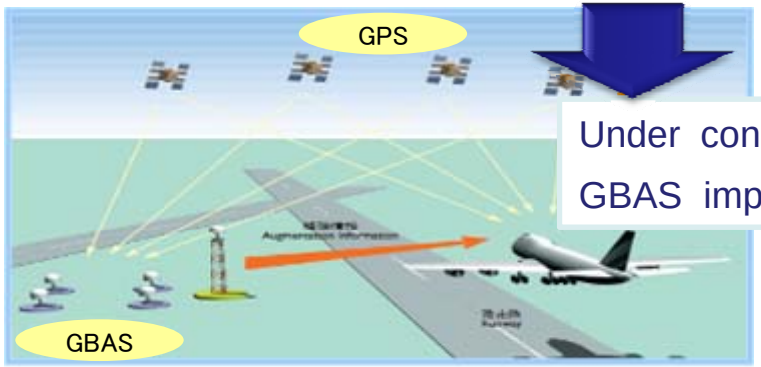
A precise and flexible approach procedure

2012-
RNP AR approach (Authorization Required)

○ Apply RF leg

☆ Reduce flight distance
☆ Provide vertical guidance
☆ Improve MINIMA
☆ Noise abatement

2021-
Curved precision approach
RNP to xLS with RF leg



Under consideration

GBAS implementation

Example of Activities：Trajectory-based operation

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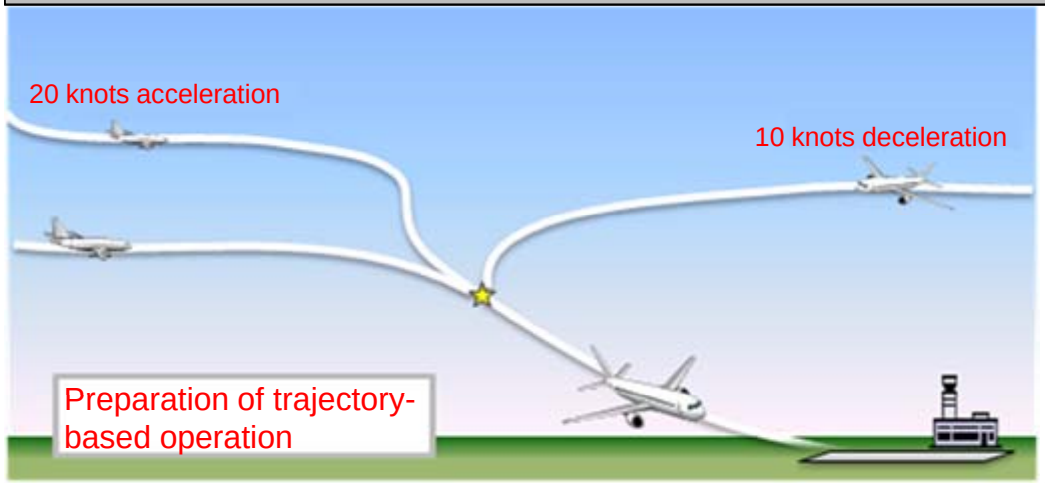
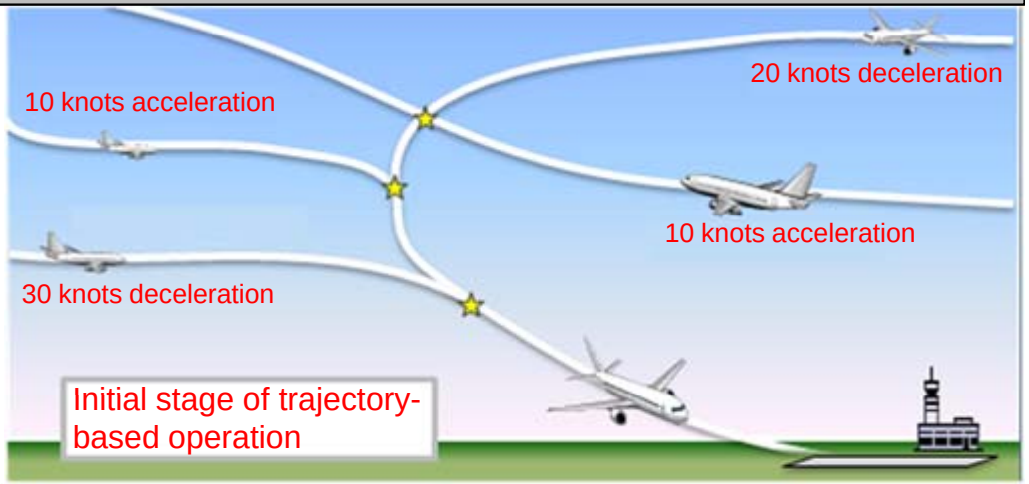
Realizing Trajectory-based operation which optimizes a trajectory of an aircraft without depending on fixed airspace and routes.
⇒An aircraft flies the trajectory which introduced time-based management while receiving support of a system. As a result, the aircraft keeps the efficient trajectory.

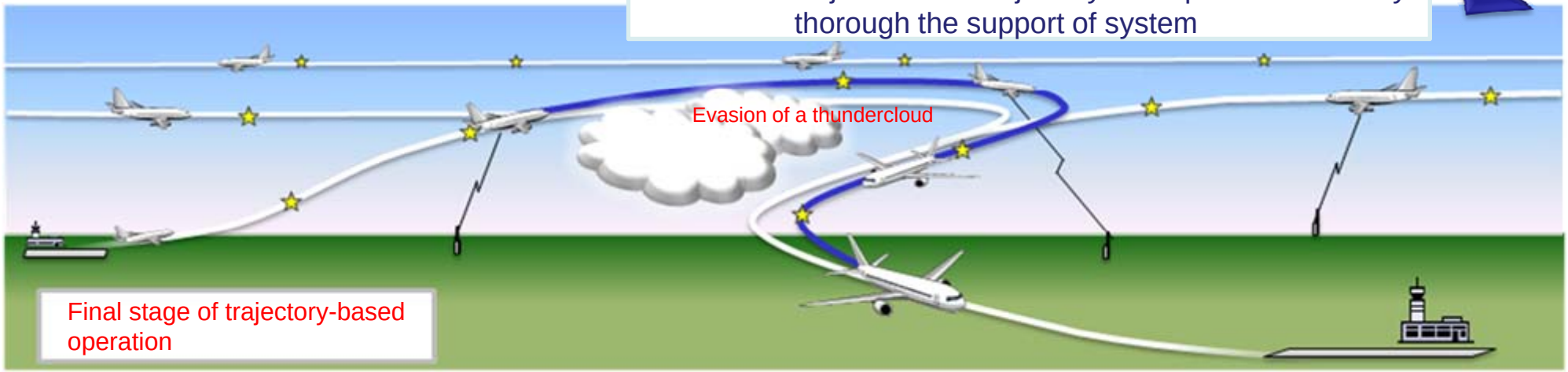




2011- Implementation of time management at a crossing point

2019- Implementation of time management at several crossing point

2026- Adjustment of trajectory as required to flexibility thorough the support of system



Example of Activities：Continuous descent operations

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- Realizing CDO (continuous descent operations) which specifies the passage time and the passage altitude of a specific point and enables continuous descent without temporary level flight in descent and approach phase.
- Reduction of fuel consumption, CO2 emission and noise are expected.

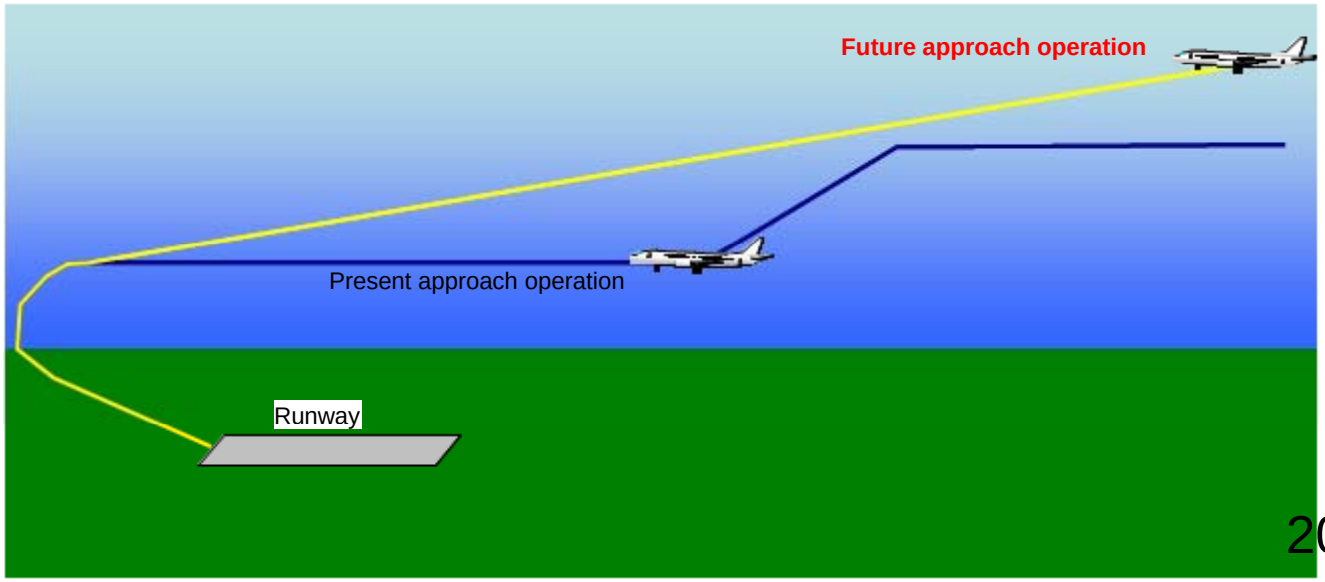
➢CDO is defined as the following three stages by procedures of operation.

- Initial stage　CDO by radio communication (This is introduced at Kansai airport)
- 2nd stage　CDO realized by the uplink of a 3D trajectory from the ATC system
  (This is applied in limited time zone because it is difficult to apply in the congestion time.)
- 3rd stage　CDO realized by the uplink of a 4Dtrajectory which indicate time
  (This is applied in all the situations including the congestion time and congested airport.)

2009-
CDO with radio communication

2017-
CDO with data link

2026-
CDO with time specification



Example of Activities：Prediction of wake vortex

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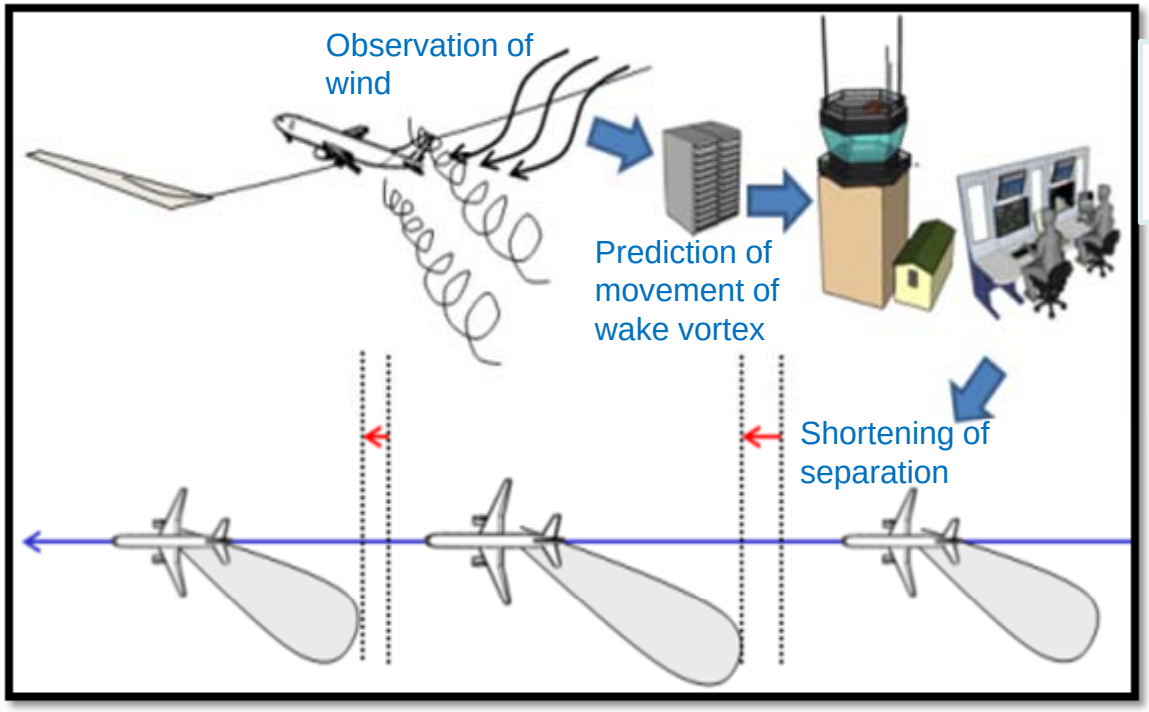
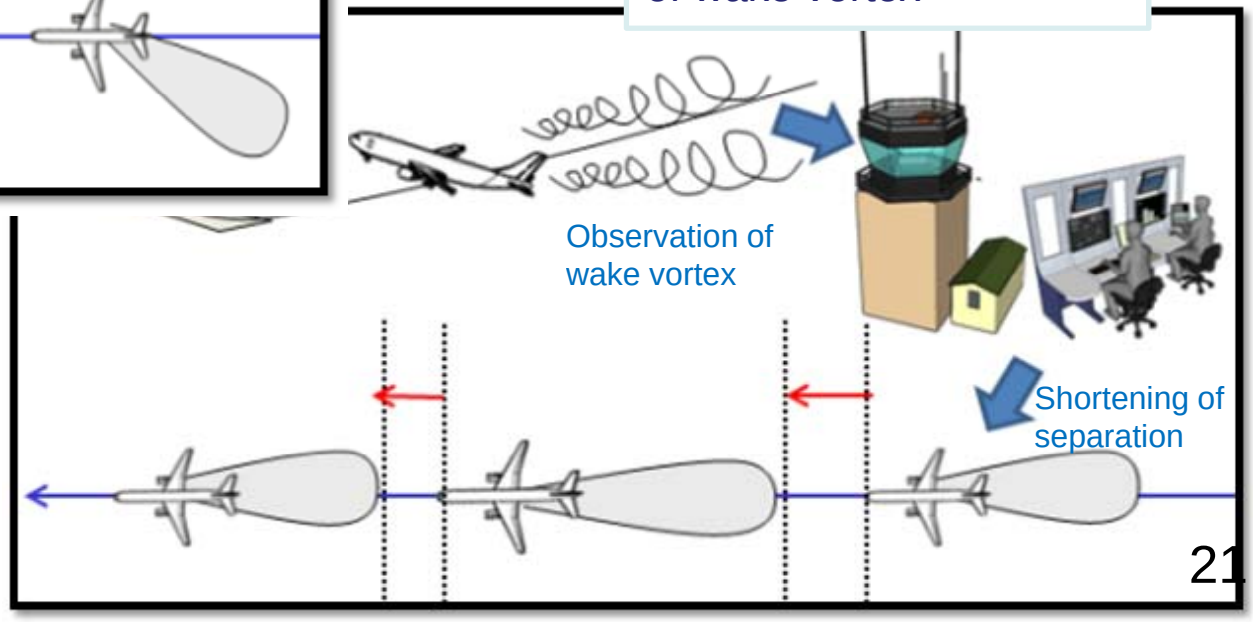
Realizing high-density operation by shortening an separation resulting from wake vortex

⇨ A separation can be shortened by predicting movement of wake vortex by observation of a wind.
A separation can be shortened by detecting and predicting wave vortex.



2022-
Prediction based on the wind observation

2024-
Detection and prediction of wake vortex



Example of Activities：Establishment of SWIM

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Establishment of the network (SWIM：System Wide Information Management) which manages all the information concerning operation comprehensively, and can access required information when required.