



OVERVIEW OF AIR NAVIGATION SERVICES IN JAPAN (2025)

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CONTENTS

Outline	
1	Introduction
2	Relationship between ANS and Operation of Aircraft
Air Navigation Services in Japan	
3	World FIR (Flight Information Region)
4	Jurisdiction Area of Japan
5	Airspace
6	Control Areas
7	Traffic Volume of Aircraft in Japan
8	Number of Aircraft under Air Traffic Control
Operation of Aircraft	
9	Flight Plan
10	IFR and VFR
11	Conventional Airway and RNAV/RNP Route
12	The outline of Instrument Approach Procedures
13	ILS Approach
14	RNP Approach
15	GLS Approach
Airport/Airspace	
16	Location of Regional Civil Aviation Bureaus
17	ATC Services Provided at Aerodromes
18	Approach Control Area
19	Positive Controlled Airspace
Air Traffic Control	
20	Air Traffic Control Service
21	Aerodrome Control
22	Approach Control
23	En-route Control
24	Oceanic Control
25	International Air-Ground Communication
26	Air Traffic Flow Management (ATFM)
27	Aerodrome Flight Information Service (AFIS)
28	ATIS
29	Search and Rescue (SAR) Service
30	Aerodrome Information Service
31	Flight Inspection

Organization Supporting ANS	
32	ATMC (Air Traffic Management Center)
33	A E C (Air Navigation Services Enhancement Center)
34	FAIB (Flight & Airport Information BASE)
35	AISC (Aeronautical Information Service Center)
36	NPAC (Network Performance Assessment Center)
37	SDECC (Systems Development, Evaluation and Contingency Management Center)
38	SMC (System Operational Management Center)
39	TMC (Technical Management Center)
Radio Navigation Aids	
40	ILS (Instrument Landing System)
41	A/G (Air to Ground Radio)
42	MLAT (Multilateration)
43	VOR/DME
44	ASR (Airport Surveillance Radar)
45	ARSR (Air Route Surveillance Radar)/ ORSR (Oceanic Route Surveillance Radar)
46	RCAG (Remote Communications Air-Ground)
47	CAS.net (Civil Aviation Bureau Air Traffic Services Network)
48	Data Link Communication (CPDLC, DCL)
49	DAPs・ADS-B
50	SBAS (Satellite Based Augmentation System)
51	GBAS (Ground Based Augmentation System)
Visual Aids	
52	Aeronautical Lighting System
53	Runway Status Lights
ATC Data Systems	
54	ATC Data System Concept Chart
55	FACE (Flight Object Administration Center System)
56	TEPS (Trajectorized En-route Traffic Data Processing System)
57	TAPS (Trajectorized Airport Traffic Data Processing System)
58	TOPS (Trajectorized Oceanic Traffic Data Processing System)/ ADEX (ATC Data EXchange system)

59	TEAM (Trajectorized Enhanced Aviation Management System)
60	HARP (Hybrid Air-route suRveillance sensor Processing equipment)
61	ICAP (Integrated Control Advice Processing System)
Electrical Facilities/Contingency Facilities	
62	Airport Electric Power Supply Facilities
63	Standby Power Supply Equipment
64	Emergency ATC Towers and Emergency Radar Facilities
65	Emergency TAPS
66	Emergency Equipment (Aerodrome Lights and Electrical Facilities)
Future of Air Navigation Services	
67	Restructure of Domestic Airspace (En-route airspace)
68	Restructure of Domestic Airspace (Terminal Airspace)
69	Collaborative Actions for Renovation of Air Traffic Systems (CARATS)
70	SWIM (System-Wide Information Management)
71	TBO (Trajectory Based Operations)
72	Trajectory Negotiations for TBO (FF-ICE R1/R2)
73	Next Generation of Air Mobility
74	Traffic Management for AAM
Budget/Personnel Engaged	
75	Air Navigation Service Charges
76	Changes in Appropriations
77	Number of Aircraft under Air Traffic Control and Number of AirNavigation Servicers
SMS/Education	
78	ATS Safety Management System (SMS)
79	Education System for Aeronautical Safety Personnel
International Cooperation	
80	ICAO (International Civil Aviation Organization)
81	CANSO (Civil Air Navigation Services Organization)

1 Introduction



Every day, more than 5,000 aircraft fly in the sky above Japan, and the type varies from large jets to small airplanes and helicopters. Aircraft need some external assistance to operate safely and efficiently because they are characterized by following features.

- ① Flying in three-dimensional space adding up and down directions to front/back/left/right.
- ② Moving at high speed and inability to increase or decrease speed to an extreme level or stop in mid-air for safety reasons.
- ③ Limited takeoff/landing locations.
- ④ Susceptible to various weather condition.

Therefore, Air Navigation Services Department, Japan Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism provides ANS (Air Navigation Services) in the airspace known as the Fukuoka FIR (Flight Information Region). We work at airports and Area Control Center (ACC) 24-hour per day.

ANS consists of the following services, which work together organically to ensure safe and efficient air traffic.

○Air traffic control services :

Duties related to instruction of flight routes, altitude, order of landing/take-off etc. to aircraft.

○Air traffic information services/Air traffic communication services :

The wide range of duties such as examination of flight plans, provision of aeronautical information, coordination of search and rescue etc.

○Air traffic engineering services :

Duties related to the development and maintenance of radio navigation aids, radar, ATC data processing systems.

○Visual aids and electrical systems services :

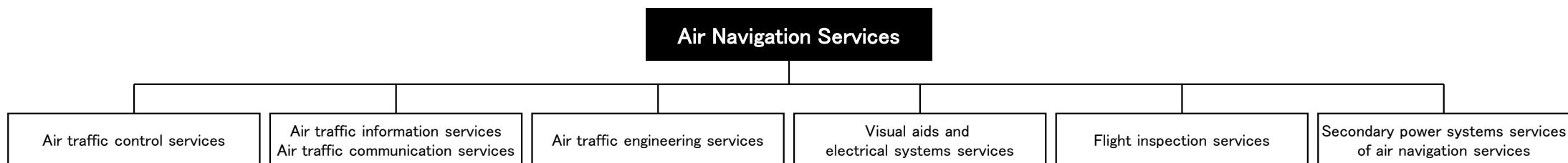
Duties related to installation and maintenance of aeronautical lighting and other electric facilities.

○Flight inspection services :

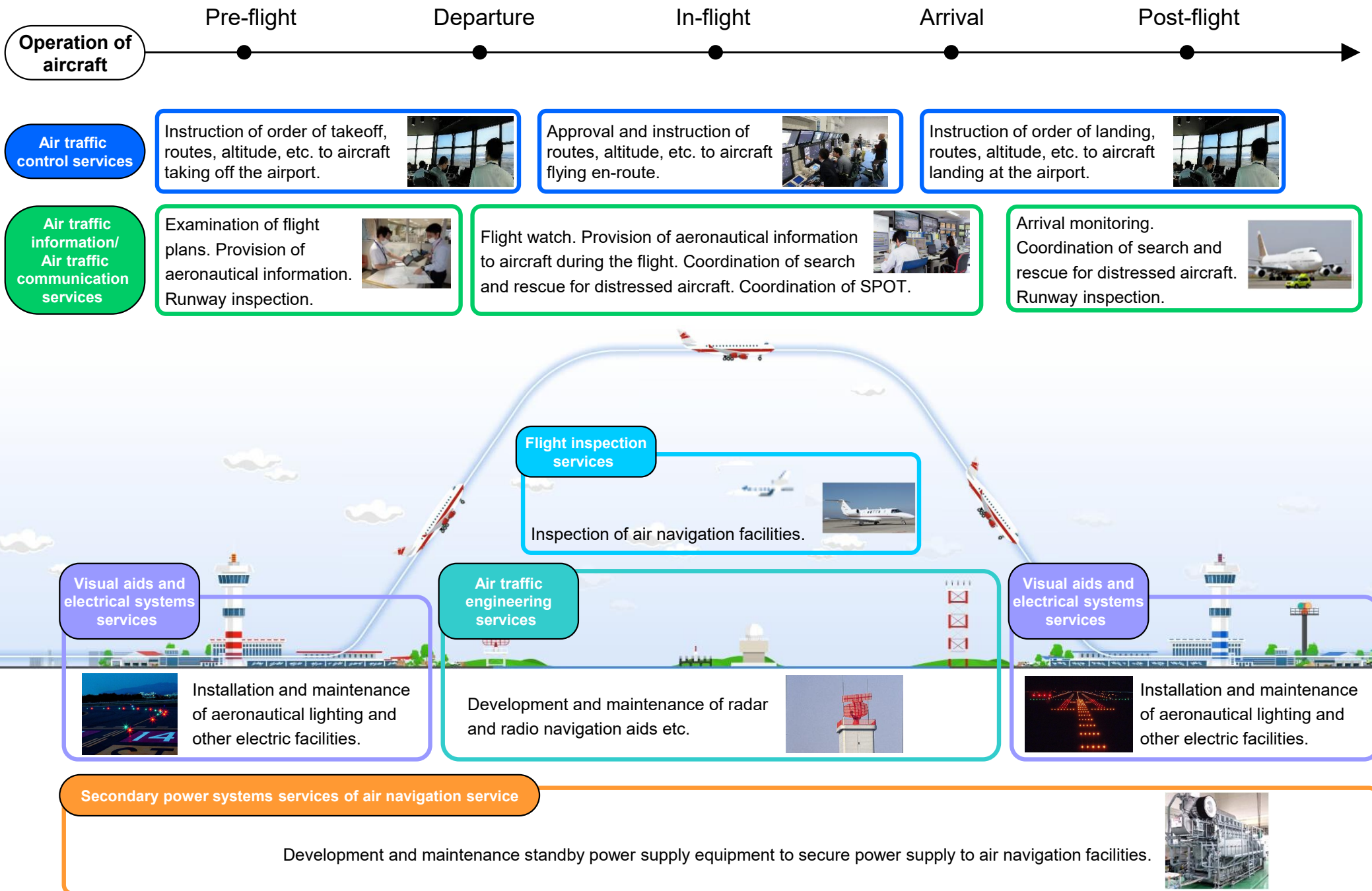
Duties related to implementing the tests by flight inspection aircraft that air navigation facilities are functioning properly.

○Secondary power systems services of air navigation services :

Duties related to standby power supply equipment to secure power supply to air navigation facilities.



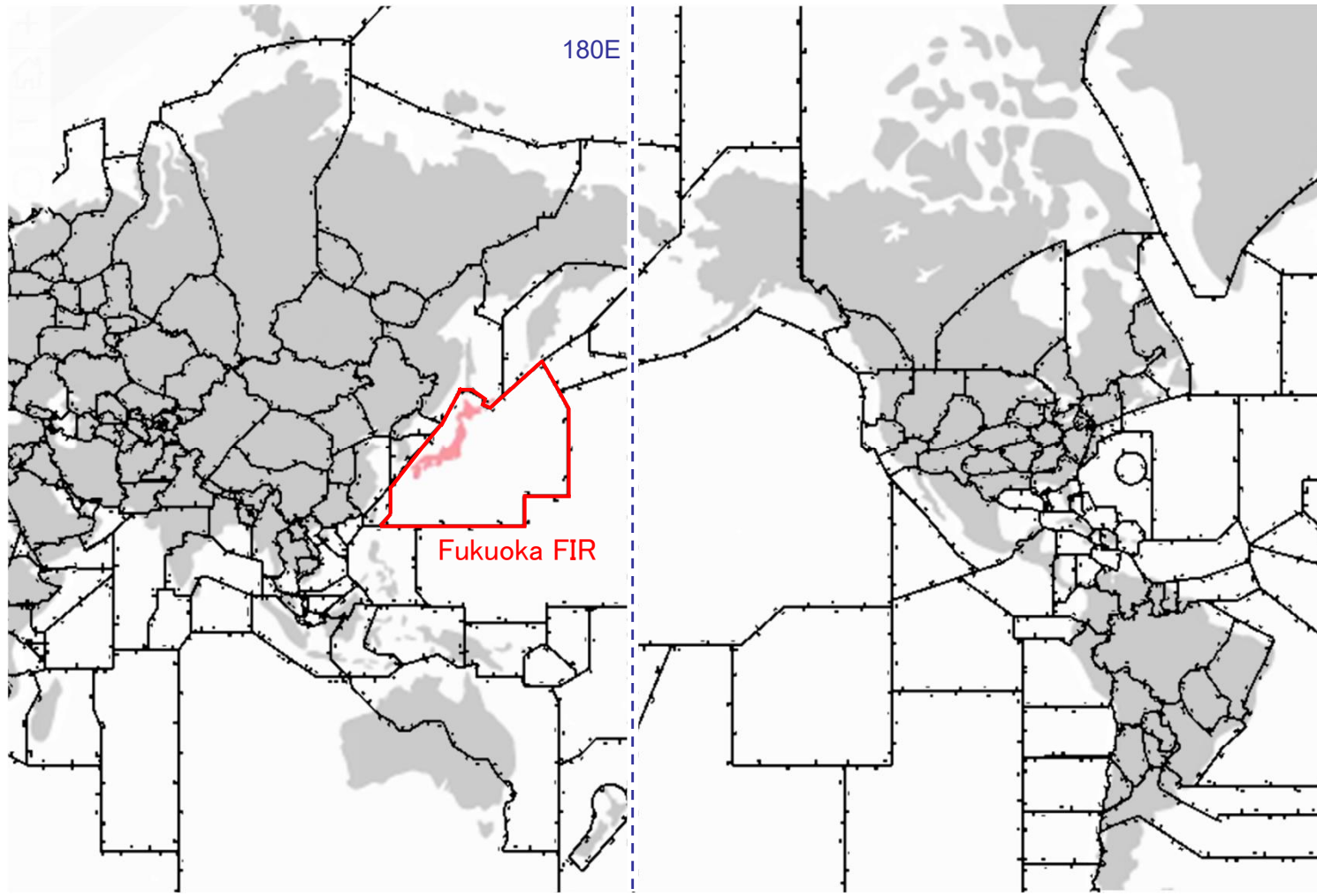
2 Relationship between ANS and Operation of Aircraft



3 World FIR (Flight Information Region)

FIR (Flight Information Region)

An airspace of defined dimensions within which flight information service and alerting service are provided.
In Japan, two FIRs, Tokyo FIR and Naha FIR, were merged into Fukuoka FIR in February 2006.

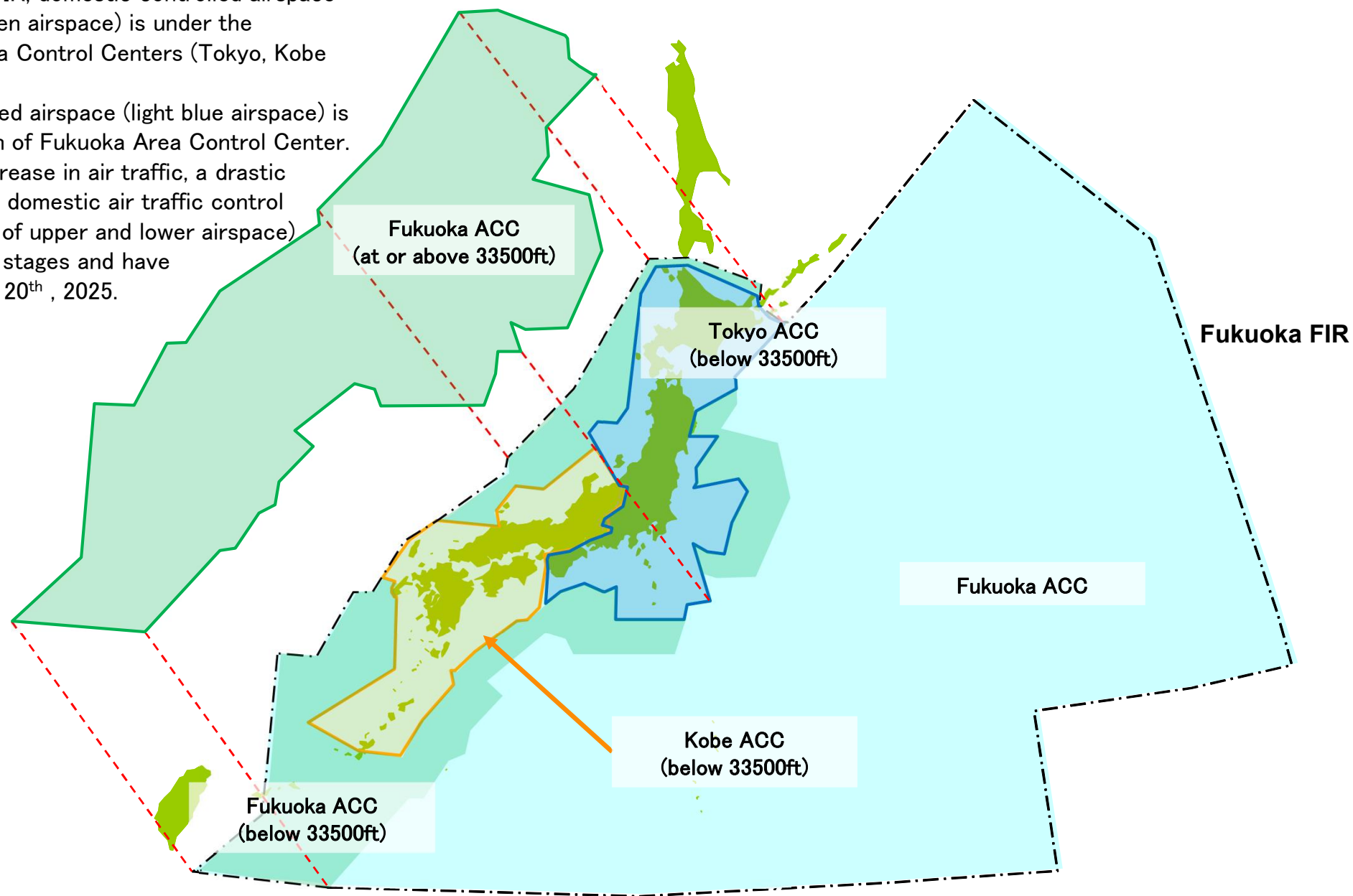


4 Jurisdiction Area of Japan

Within the Fukuoka FIR, domestic controlled airspace (blue, yellow and green airspace) is under the jurisdiction of 3 Area Control Centers (Tokyo, Kobe and Fukuoka).

The oceanic controlled airspace (light blue airspace) is under the jurisdiction of Fukuoka Area Control Center.

To cope with the increase in air traffic, a drastic reorganization of the domestic air traffic control airspace (separation of upper and lower airspace) was implemented in stages and have completed on March 20th, 2025.



5 Airspace

Controlled Airspace

- Air Traffic Control Area ······ Airspace 200 meters or more above the land or water
- Air Traffic Control Zone ······ Aerodrome frequently used for landing and take-off of aircraft and the adjacent airspace
- Air Traffic Information Zone ··· Aerodrome and its airspace other than the above and designated by the Ministry of Land, Infrastructure, Transport and Tourism
- Approach Control Area ······ Airspace in which aircraft climb following the take-off and descend prior to landing within an air traffic control area
- Positive Controlled Airspace ··· Airspace within an air traffic control zone or air traffic control area where air traffic is congested
- Oceanic Control Area ··· Oceanic airspace within the Flight Information Region (FIR) and 1,700 meters or more above water

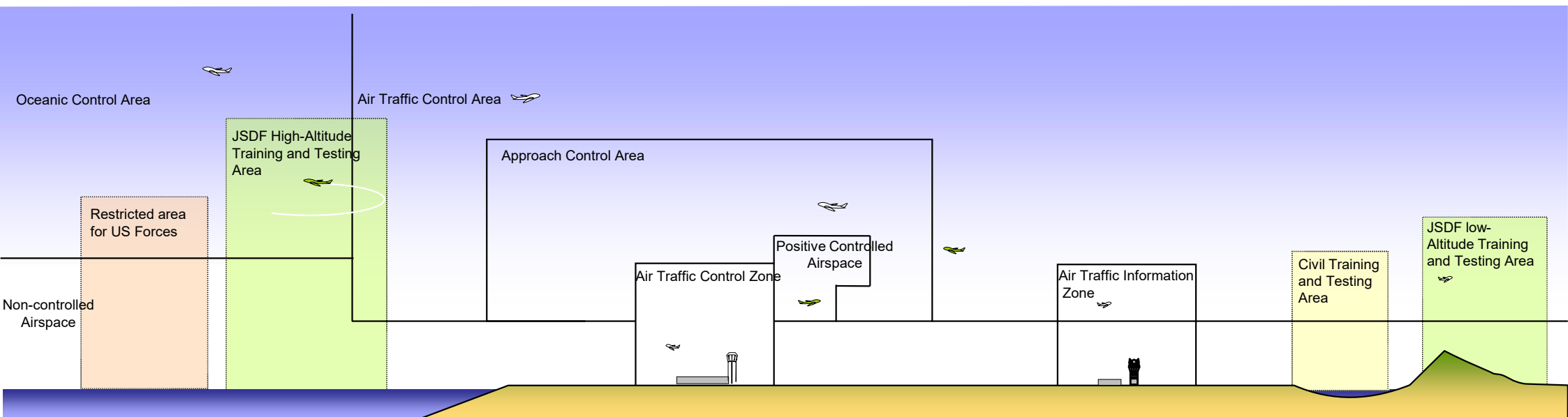
※Other than the above, there is Civil Training and Testing Area which is specifically used for flight training.

Non-controlled Airspace ··· Airspace other than the above

* Among the airspace mentioned above, there are airspace controlled by the JSDF and the U.S. Forces

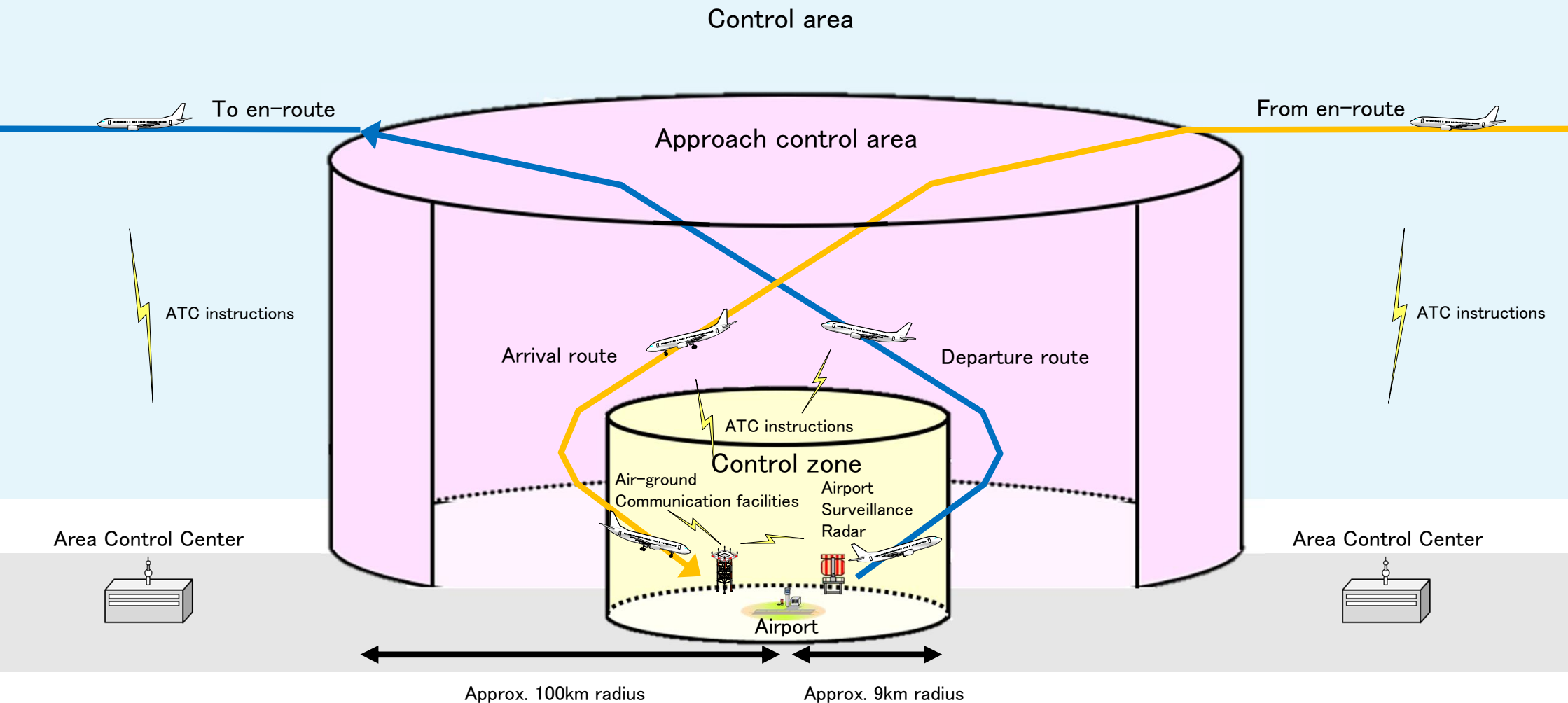
JSDF ······ Air Traffic Control Zone/Approach Control Area of JSDF-controlled airports (Matsushima, Hamamatsu, etc.) and joint use airports (Chitose, Sapporo, Misawa, Hyakuri, Komatsu, Miho, Tokushima), as well as JSDF Training and testing Areas etc.

US Forces ··· Airports controlled by the US Forces (Yokota, Iwakuni, etc.) and the adjacent airspace, as well as the US Forces restricted areas, etc.



6 Control Areas

Image of air traffic control airspace



A control zone is an airspace with a radius of approximately 9 km from an airport.

An approach control area is generally an airspace of about 100 km around an airport. Some approach control areas are more extensive, such as Tokyo Approach Control Area surrounding Tokyo International Airport.

7 Traffic Volume of Aircraft in Japan

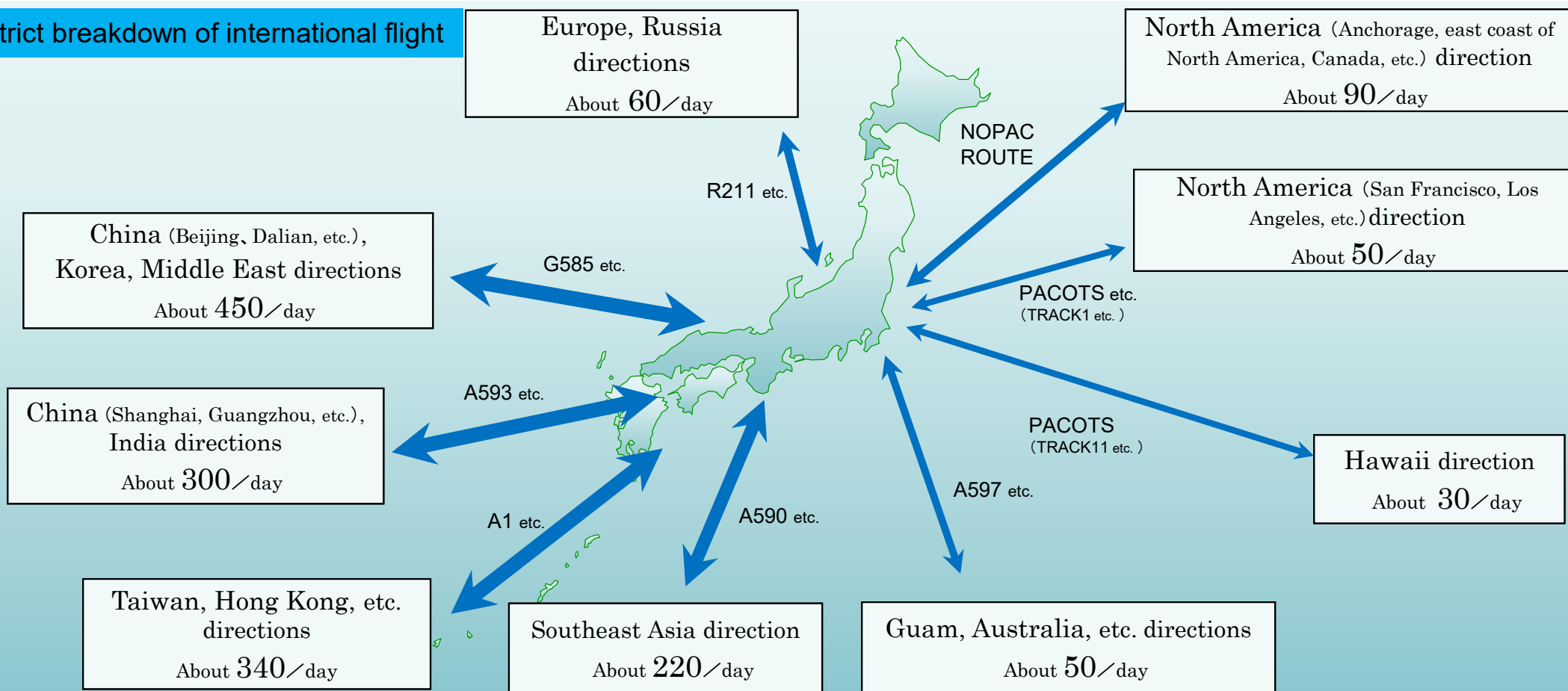
Number of aircraft to fly in IFR (Number of aircraft/day)

	Domestic	International	Passage through IFR
Number of aircraft/day	About 2,310	About 1,600	About 820

Number of aircraft to fly in VFR (Number of aircraft/day)

Number of aircraft/day	About 670
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District breakdown of international flight



※NOPAC ROUTE : North Pacific route

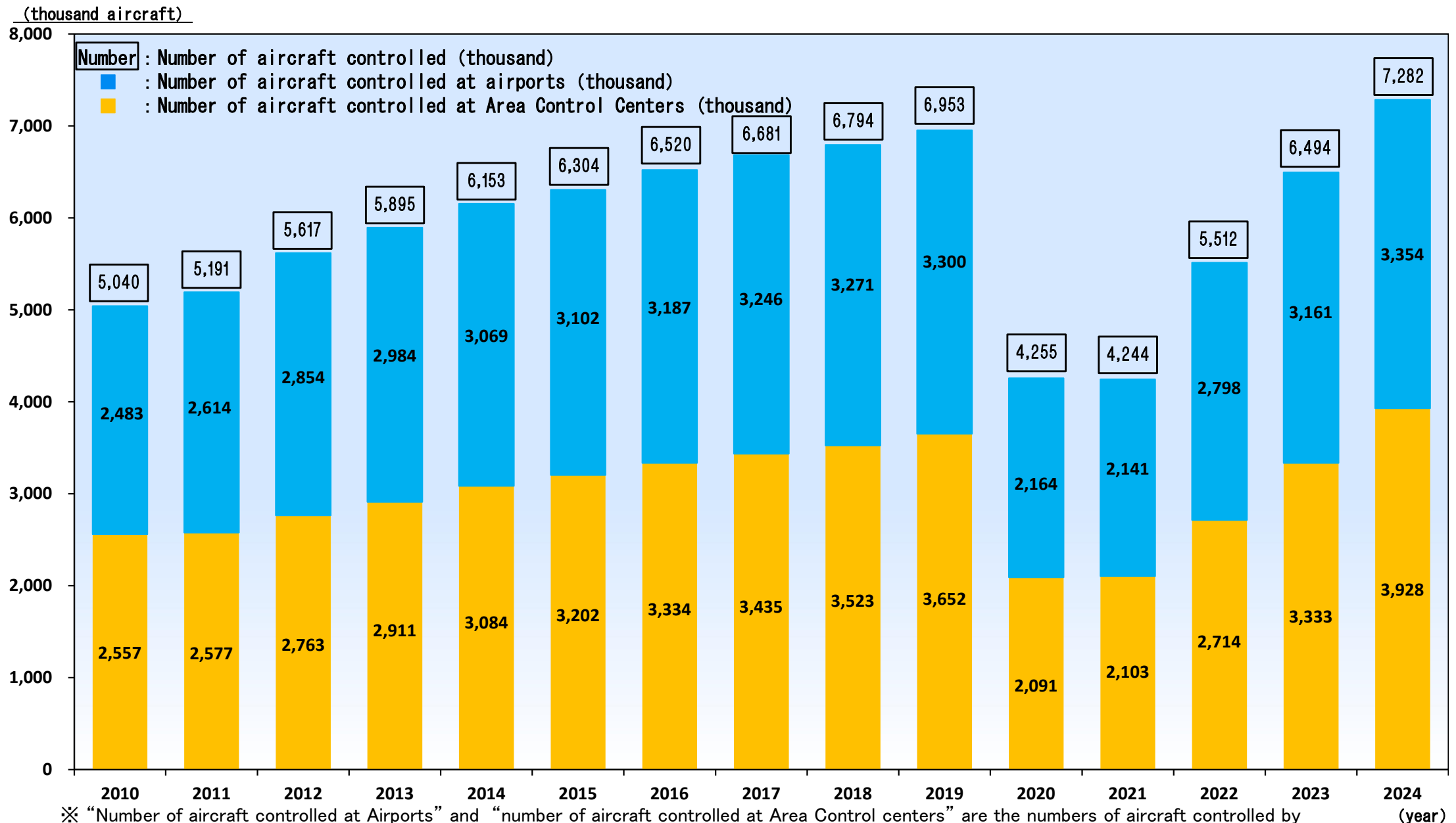
※PACOTS : Pacific Organized Track System

(The variable path set for each day over the Pacific Ocean in consideration of weather conditions.)

DATA: Daily average calculated from the flight plan for one month of August 2024.

The figures do not include military aircraft.

8 Number of Aircraft under Air Traffic Control



※ “Number of aircraft controlled at Airports” and “number of aircraft controlled at Area Control centers” are the numbers of aircraft controlled by each air traffic control facilities.

※ “Number of aircraft controlled” is a total of number of aircraft controlled at airports and ACCs. The breakdown and the total do not necessarily match for fractional adjustment.

9 Flight Plan

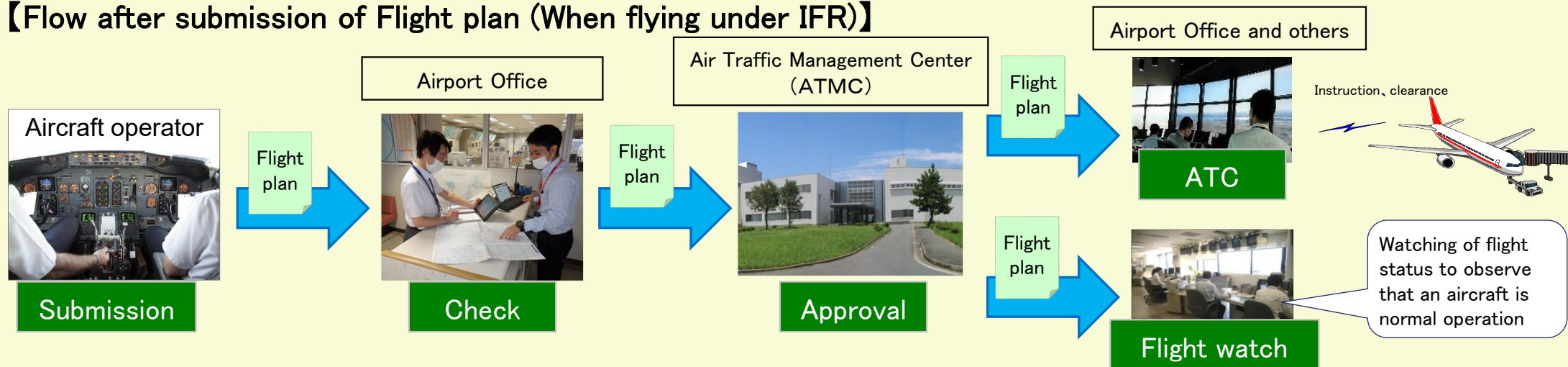
- In order to properly carry out search and rescue services in case of an aircraft accident or emergency state occurs, the flight plan shall be submitted to the Minister of Land, Infrastructure, Transport and Tourism.
 - When flying under IFR(※), the flight plan shall be submitted with including the details such as route, altitude etc, and shall be approved by the Minister of Land, Infrastructure, Transport and Tourism, to ensure the safe and smooth air traffic.
- (※IFR(Instrument Flight Rules) : Always on flying in accordance with the instructions of ATC.)

【Details of Flight plan】

- ①Nationality, registration marks and radio call sign
- ②Type and number of aircraft
- ③Name of pilot-in-command (in case of formation flight, name of flight leader)
- ④Flight rules (IFR or VFR)
- ⑤Point of departure and the estimated off block time
- ⑥Cruising altitude and route
- ⑦Point of first intended landing and the total estimated elapsed time
- ⑧True airspeed at cruising altitude
- ⑨Radio equipment (communication equipment/navigation and approach aids/ATC transponder)
- ⑩Alternate airports (exempted in case of IFR (no ALTN AP designated) or VFR)
- ⑪Amount of fuel on board expressed in hours
- ⑫Total persons on board
- ⑬Other information necessary for ATS/SAR

＜記入様式＞

【Flow after submission of Flight plan (When flying under IFR)】

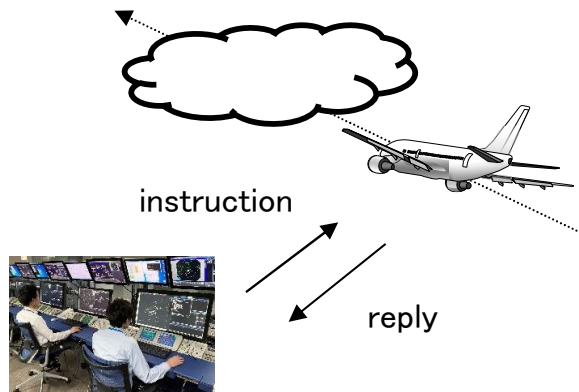


10 IFR and VFR

IFR (Instrument Flight Rules)

A method that an aircraft follows the flight plan approved by the ATC authority and flies under the direction of the ATC authority at all times during the flight.

(scheduled flights, etc.)



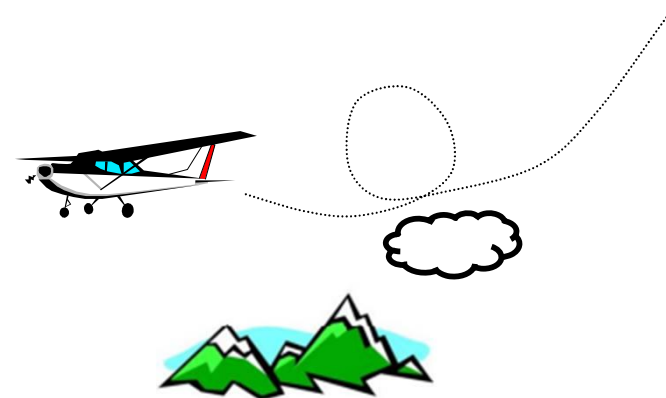
Aircraft flying under IFR may fly during instrument meteorological conditions* under the direction of ATCs.

*Instrumental Meteorological Conditions: Weather conditions that are poor in terms of visibility, as determined by considering visibility and cloud conditions.

VFR (Visual Flight Rules)

A method in which the pilot visually observes other aircraft and obstacles and avoids collisions on his/her own.

(sightseeing flights, aerial photography, etc.)



As a general rule, aircraft flying under VFR may only fly under Visual Meteorological Conditions*.

*Visual Meteorological Conditions: Weather conditions that are favorable in terms of visibility, as determined by considering visibility and cloud conditions.

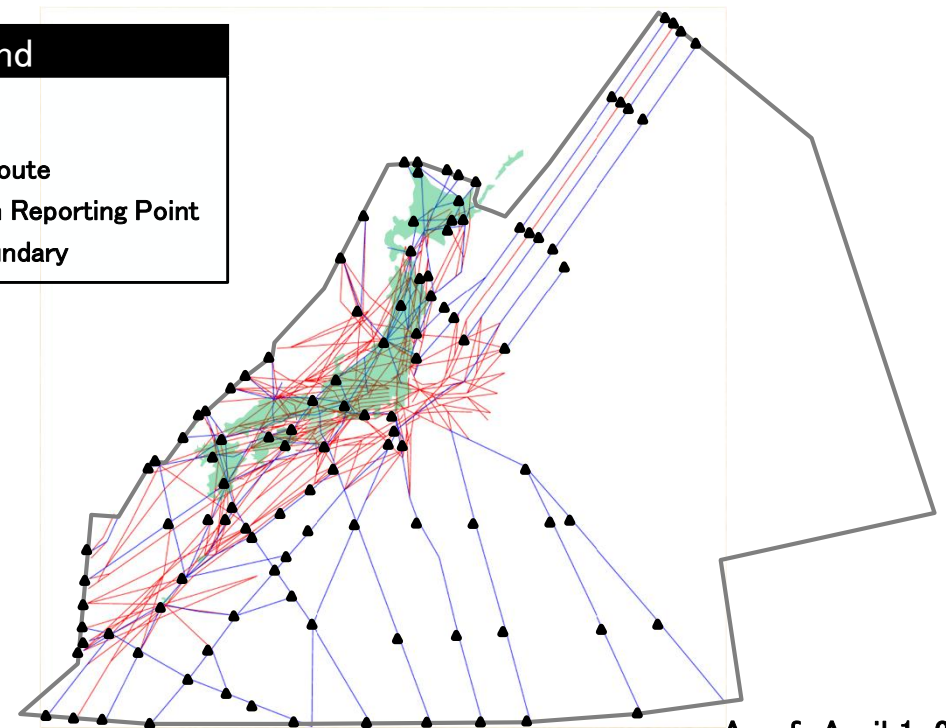
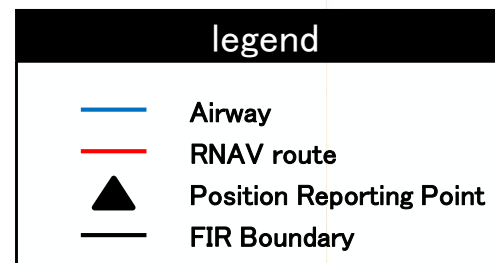
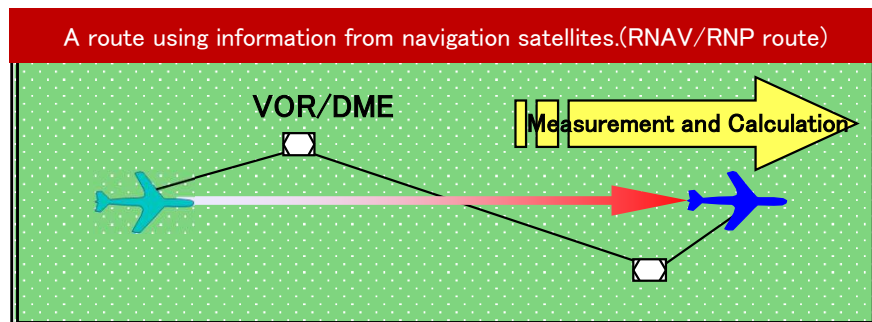
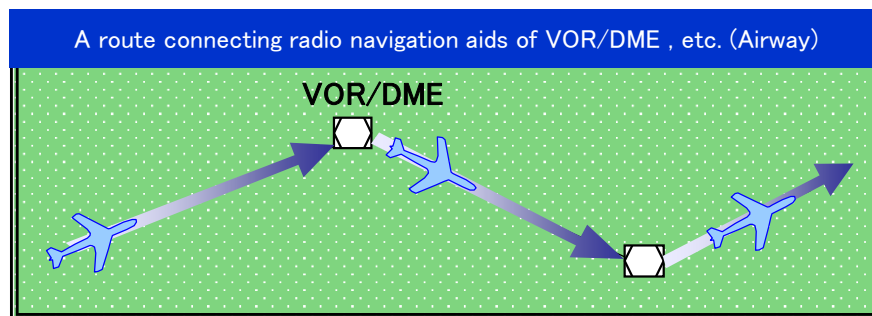
11 Conventional Airway and RNAV/RNP Route

Airway

- Airways are the route connecting radio navigation aids. Aircraft fly guided by the information (distance, direction, etc.) obtained from the radio navigation aids.
- Aircraft by instrument flight rules fly a defined route.

RNAV (Area Navigation)

- RNAV (Area Navigation) : It is a method of navigation that uses latitude and longitude information mainly from navigation satellites to calculate the aircraft's position and fly along a desired route using the aircraft's onboard FMS (flight management system) and other equipment.
- There are two navigational specifications: **RNAV specification** and **RNP specification**.
 - RNAV specification**: A navigational specification that do not include requirements for onboard performance monitoring equipment and warning functions to monitor route deviations and that require radar monitoring.
 - RNP specification**: A navigational specification that is the same in principle as RNAV but does not require radar monitoring by means of onboard equipment with onboard performance monitoring and warning functions.
- A route flown by RNAV is called **RNAV/RNP route**.



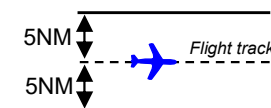
12 The outline of Instrument Approach Procedures

Instrument Approach Procedure (IAP): IAPs are classified into Precision Approach, Approach procedure with vertical guidance (APV) and Non Precision Approach. (ICAO ANNEX6)

Instrument Approach Procedure

Precision Approach		An instrument approach procedure that can be made by receiving azimuth and glide path information or instructions.	
	ILS Approach	An instrument approach procedure following the accurate radio waves from ILS on the ground.	53 Airports
	GLS Approach	An instrument approach procedure following the GBAS message from GLS on the ground	1 Airport
	PAR Approach	An instrument approach procedure following the ATC's instruction utilizing precision approach radar.	1 Airport
Approach procedure with vertical guidance (APV)		An RNP instrument approach procedure with horizontal and vertical guidance. (except Precision Approach)	
	RNP Approach	An instrument approach procedure which apply navigation specification*	62 Airports
	LPV Approach (APV I)	Approach procedure using SBAS signals for horizontal and vertical guidance at final approach	25 Airports
	RNP AR Approach	More advanced instrument approach procedure that can apply constant radius circle and adjust navigation accuracy among other RNP procedures.	40 Airports
Non Precision Approach		An instrument approach procedure with horizontal guidance only.	
	LOC (LDA) Approach	An instrument approach procedure utilizing LOC for getting the position information of own airplane in horizontal direction. (especially, LDA approach procedure is the one to use LOC away from the RWY and approach to where pilots can see the RWY then descend to the RWY, introduced at only TOKYO INTL airport.)	15 Airports
	VOR Approach	An instrument approach procedure utilizing VOR for getting the position information of own airplane in horizontal direction.	78 Airports
	RNP Approach (LNAV/LP)	Of the RNP approach, an instrument approach procedure that do not have vertical guidance.	6 Airports

* Navigation specification: The numerical value of the range (nautical miles) of said required value for the difference in the intended position and actual position for at least 95% of the total flight time of an aircraft.



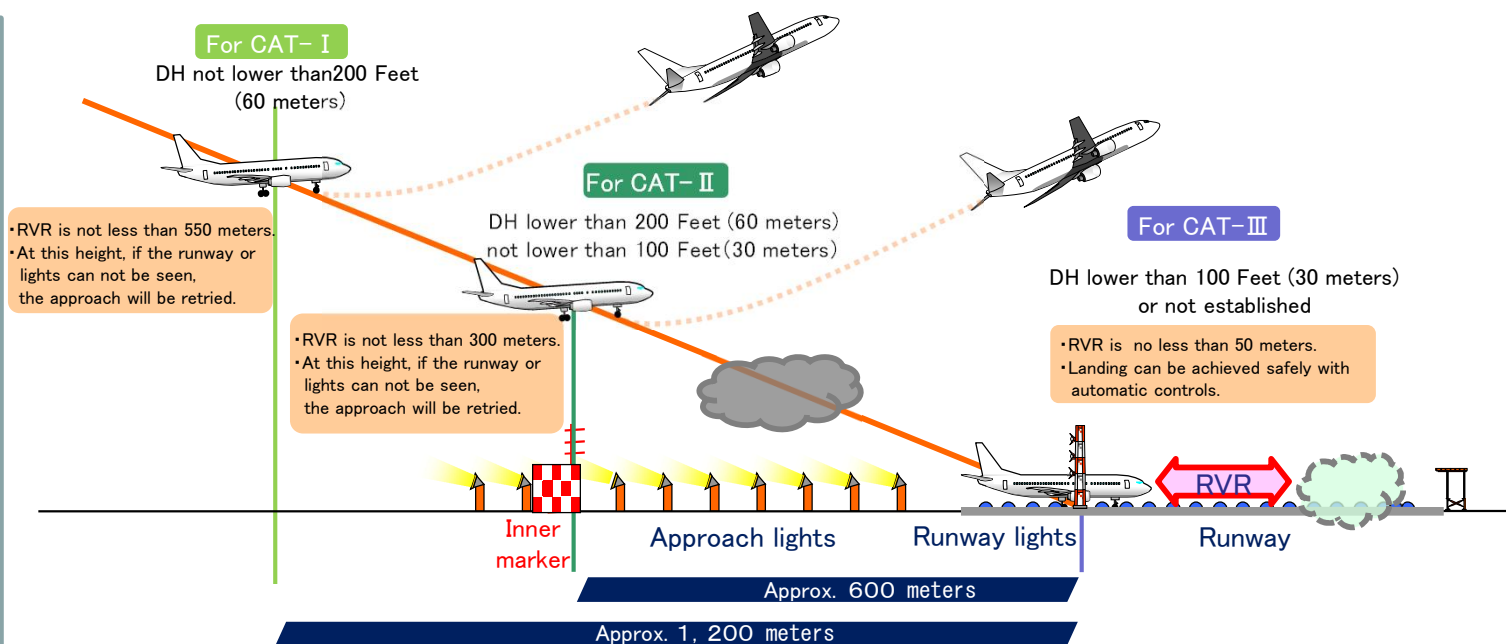
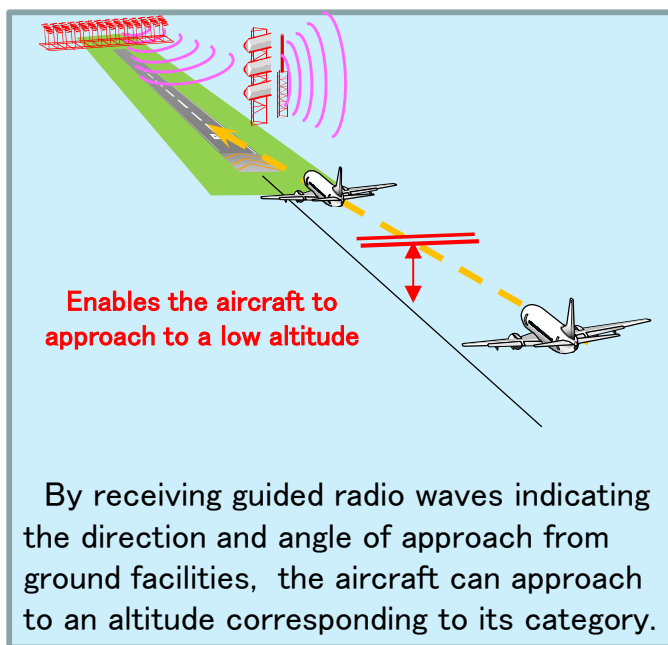
※The approach used by civil aircraft
 ※The number of airports is based on airports served by civil aircraft.

As of April 1, 2025

13 ILS Approach

ILS approach is an instrument approach procedure in which using precise guidance radio waves from ground facilities. Therefore, it enables the aircraft to approach to a low altitude and determine whether to land, even in bad weather conditions.

There are three categories of ILS approach: CAT-I, CAT-II, and CAT-III, with higher numbers allowing approach to lower altitudes.



Classification	Introduction Airport
CAT-I	Wakkanai, Monbetsu, Memanbetsu, Asahikawa, Nakashibetsu, Kushiro, New Chitose, Obihiro, Hakodate, Aomori, Odate-noshiro, Akita, Hanamaki, Yamagata, Sendai, Niigata, Shonai, Fukushima, Hyakuri, Narita, Tokyo, Shizuoka, Chubu, Nagoya, Noto, Komatsu, Kansai, Osaka, Kobe, Hiroshima, Okayama, Yamaguchi-ube, Iwami, Miho, Tottori, Takamatsu, Matsuyama, Kochi, Tokushima, Fukuoka, Saga, Kitakyushu, Nagasaki, Oita, Kumamoto, Miyazaki, Kagoshima, Tanegashima, Amami, Naha, Miyako, Ishigaki, Shimojishima
CAT-II	New Chitose, Aomori, Narita, Tokyo, Chubu, Kansai, Kumamoto
CAT-III	New Chitose, Kushiro, Aomori, Narita, Tokyo, Chubu, Hiroshima, Kumamoto

As of August 7, 2025

【DH】

A specified height in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been identified.

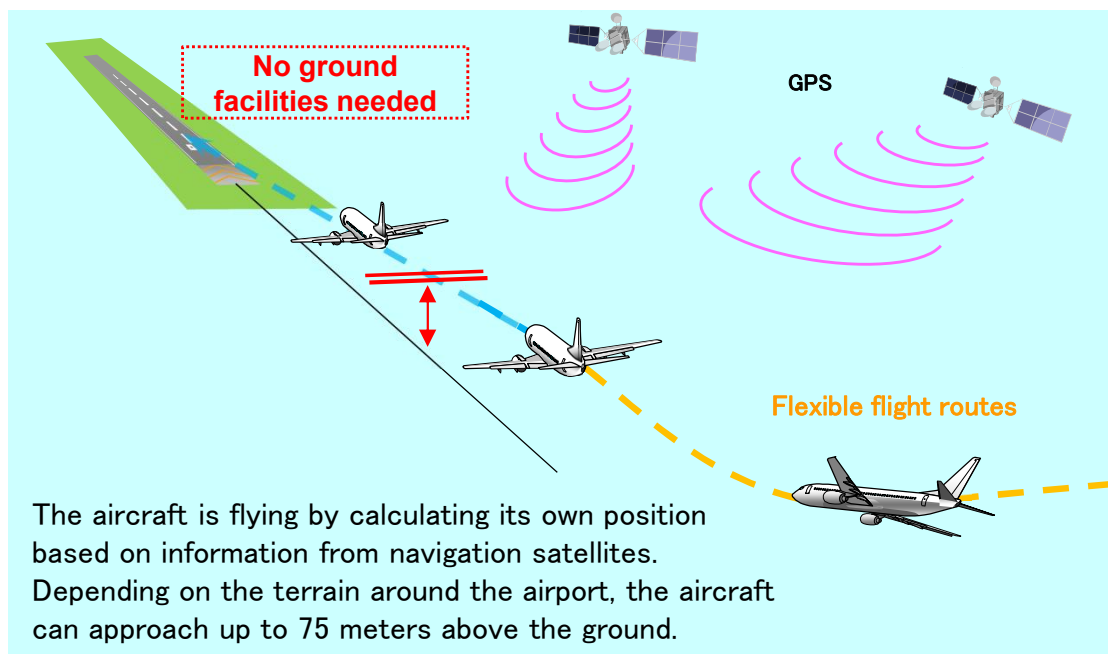
【RVR】

The range over which the pilot of an aircraft on the center line of a runway can see the runway surface markings or the lights delineating the runway or identifying its center line.

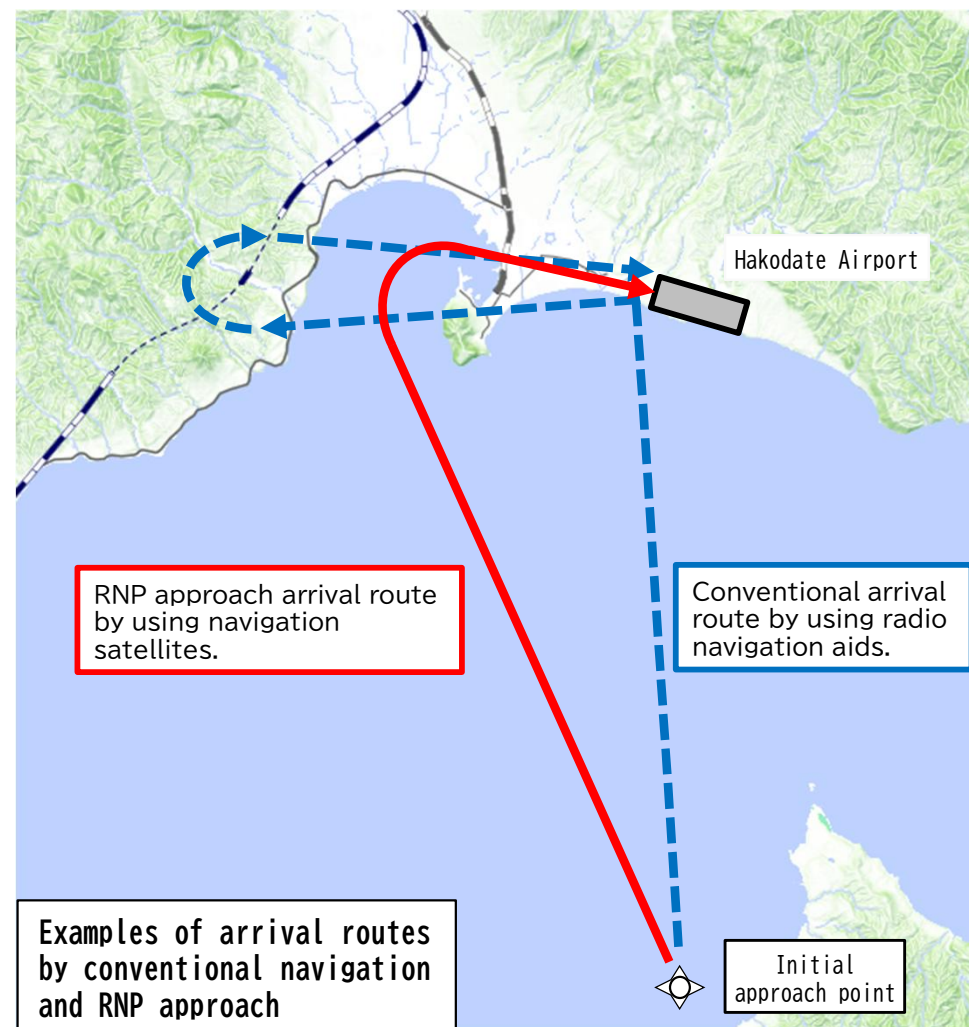
14 RNP Approach

RNP approach is an instrument approach procedure in which using navigation satellites. It is not affected by ground facilities and terrain characteristics, which allows to set flexible flight routes, and is expected to shorten flight distances and routes.

There are requirements for implementing RNP approach, such as onboard equipment and navigation permission. Approach that enable the use of constant radius circle and adjust navigation accuracy is called RNP AR approach, while approach that using SBAS signals is called LP/LPV approach.



Classification	Introduction Airport
RNP approach	Rishiri, Okushiri, Asahikawa, Memanbetsu, Sapporo, Kushiro, Nakashibetsu, New chitose, Hakodate, Hanamaki, Akita, Shonai, Yamagata, Sendai, Fukushima, Niigata, Hyakuri, Tokyo, Narita, Toyama, Komatsu, Fukui, Nagoya, Chubu, Osaka, Kansai, Nanki-Shirahama, Tajima, Miho, Oki, Izumo, Hiroshima, Tokushima, Fukuoka, Nagasaki, Tsushima, Fukue, Iki, Amakusa, Oita, Tanegashima, Yakushima, Amami, Kikai, Tokunoshima, Okierabu, Yoron, Naha, Kitadaito, Minami Daito, Tarama, Kumejima, Miyako, Shimojishima, Ishigaki, Yonaguni, Kouzujima, Nijima, Kagoshima, Choufu, Kobe, Kumamoto,
RNP AR approach	Odate-noshiro, Tokyo, Kochi, Kitakyushu, Hakodate, Okayama, Yamaguchi-ube, Matsuyama, Kumamoto, Miyazaki, Tottori, Sendai, Wakkanai, Toyama, Monbetsu, Oita, Shizuoka, Kushiro, Obihiro, Saga, Hiroshima, Amami, Nakashibetsu, Akita, Aomori, Hachijojima, Asahikawa, Memanbetsu, Iwami, Noto, Miyako, Shonai, Matsumoto, Ishigaki, Hanamaki, Tokushima, Kumejima, Tokunoshima, Niigata, Miho
LP/LPV approach	Amakusa, Okushiri, Rishiri, Sapporo, Kushiro, Memanbetsu, Hakodate, Nagasaki, Iki, Tsushima, Fukue, Yakushima, Tanegashima, Fukuoka, Yoron, Amami, Kagoshima, Osaka, Kumamoto, Nakashibetsu, Akita, Izumo, Kikai, Oki, Okierabu



15 GLS Approach

GLS approach is an instrument approach procedure in which satellite signals (GPS) are augmented by message from GBAS architecture on the ground, and aircraft fly according to GBAS message. It is an approach method with the same precision as ILS. Currently, GLS approach CAT-I is set, and it is expected that the category will be upgraded in the future as aircraft become more compatible with this system.

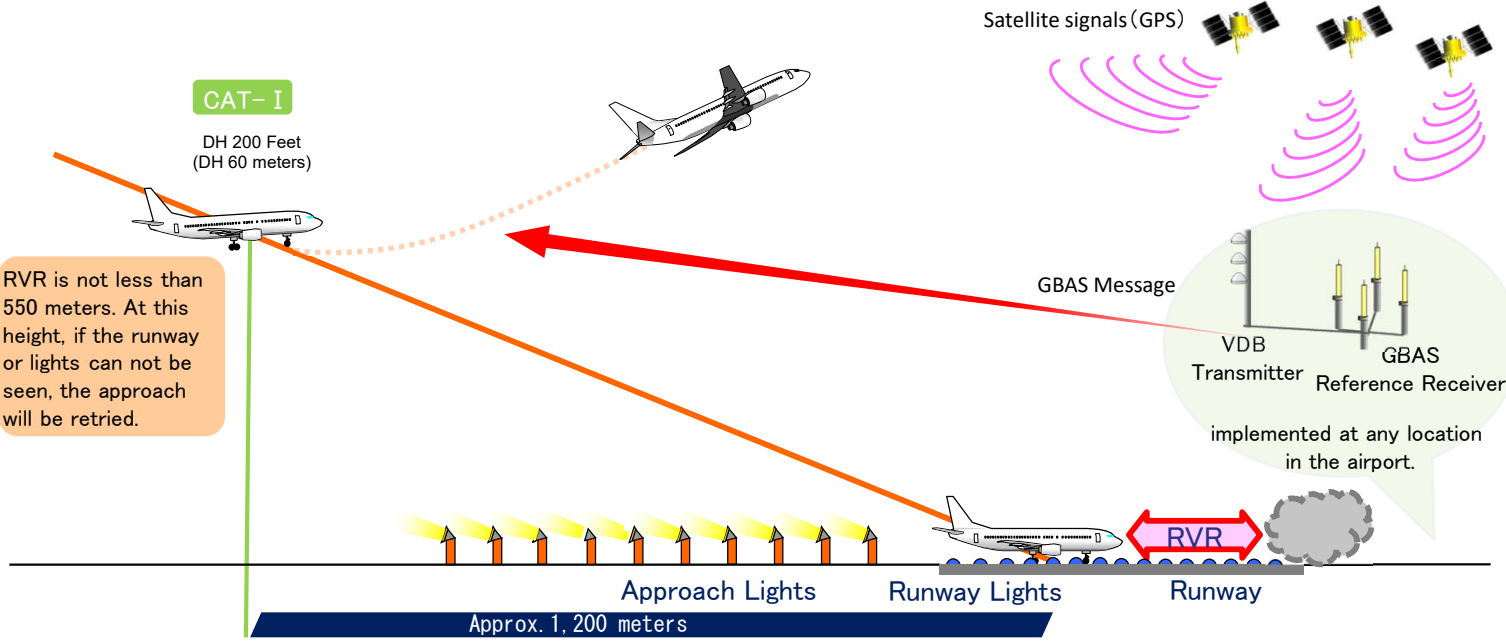


○Comparing GLS with RNP approach and RNP AR approach

RNP approach and RNP AR approach use barometric altitude as vertical guidance for landing, known as Baro-VNAV, while GLS approaches use data from GBAS for vertical guidance. The GLS approach enables precise guidance without being affected by factors such as temperature.

Classification	Introduction Airport
CAT-I	Tokyo

As of April 1, 2025



○Comparing GLS with ILS approach

ILS approach is a landing procedure that use the ground facilities implement at each runway, but GLS makes it possible to implement landing procedures for multiple runways with a single GBAS facility.

In addition, even when ILS must be offset from the set position, GLS enables for an onset approach. However, aircraft must be equipped with GLS equipment..

	horizontal guidance	vertical guidance
GLS approach procedure	Based on a message from the GBAS	Based on a message from the GBAS
ILS approach procedure	Receive induction radio wave from the LOC	Receive induction radio wave from the GS
RNP approach procedure	Based on a signals from the GPS/SBAS	Obtained from altimeter onboard (In some cases, there is no vertical guidance.)
RNP AR approach procedure		

16 Location of Regional Civil Aviation Bureaus

Airport offices, Airport branch offices and Area control centers have been provided air navigation services. Airport offices and Airport/air route surveillance radar offices have been maintained air navigation facilities.

<Legend>

- ◎ Airport office 31
(Military/Civil joint Airport *underline notation)
- Airport branch office 16
- △ Airport/air route surveillance radar office 2
- ◇ Area control center 3
- ◆ Air traffic management center 1
- ★ Other airport

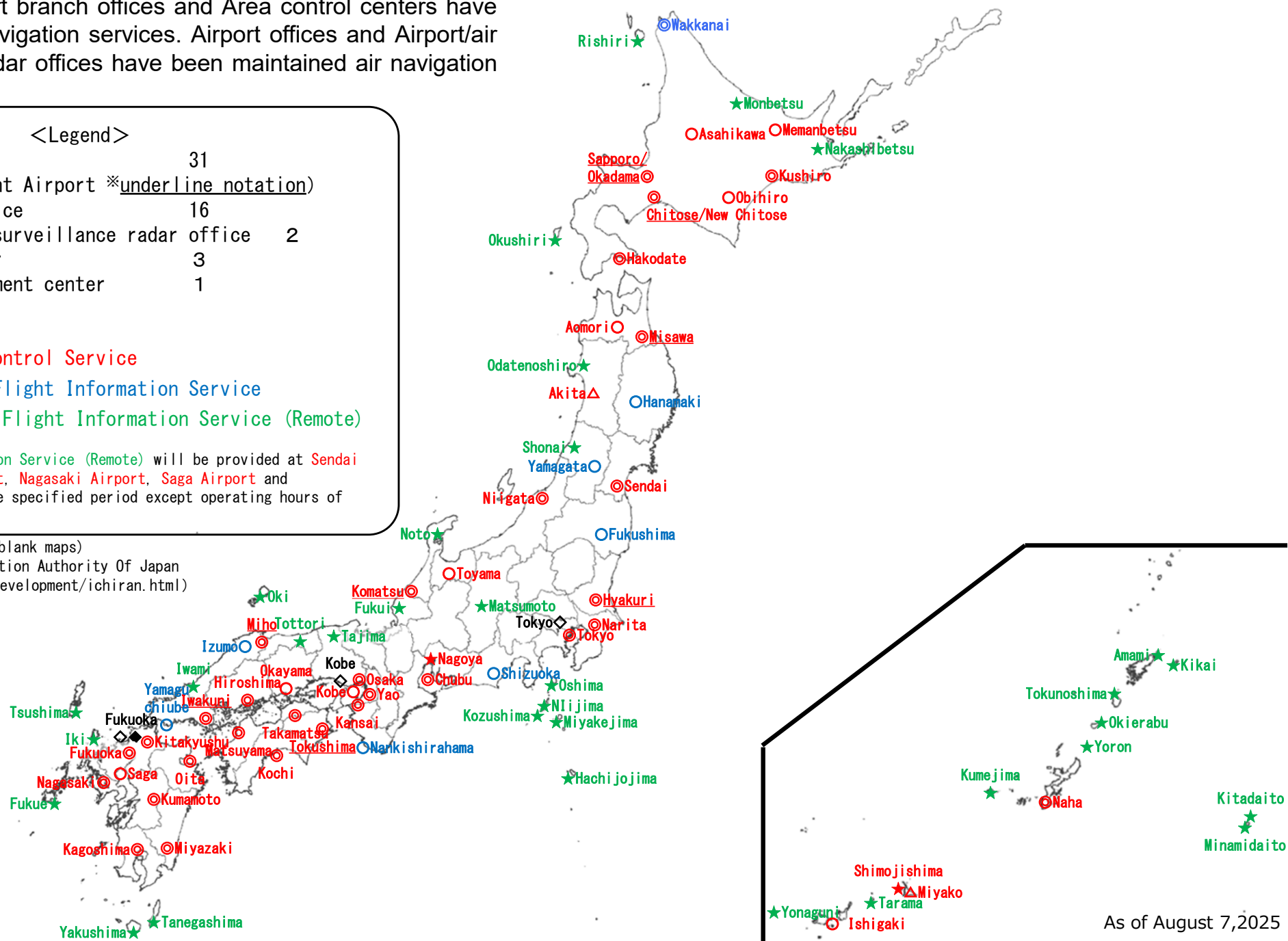
Red text : Aerodrome Control Service

Blue text : Aerodrome Flight Information Service

Green text : Aerodrome Flight Information Service (Remote)

※Aerodrome Flight Information Service (Remote) will be provided at Sendai Airport, Kitakyushu Airport, Nagasaki Airport, Saga Airport and Shimojishima Airport for the specified period except operating hours of Air Traffic Control Service.

※Processing the GSI Tiles (blank maps)
source : Geospatial Information Authority Of Japan
(<https://maps.gsi.go.jp/development/ichiran.html>)



As of August 7, 2025

17 ATC Services Provided at Aerodromes

	Aerodrome Control Service	Aerodrome Flight Information Service (※1)	Approach control services, Terminal radar control services
Tokyo international	○	—	Tokyo airport office
Narita international	○	—	
Oshima	—	New Chitose airport office	
Niijima	—	New Chitose airport office	
Shimofusa	○ (JSDF)	—	
Kisarazu	○ (JSDF)	—	
Tateyama	○ (JSDF)	—	
Chubu Centrair international	○	—	Chubu airport office
Nagoya	○ (JSDF)	—	
Gifu	○ (JSDF)	—	
Kansai international	○	—	Kansai airport office
Osaka international	○	—	
Takamatsu	○	—	
Kochi	○	—	
Kobe	○	—	
Okayama	○	—	
Yao	○	—	
Fukuoka	○	—	
Saga	○	Fukuoka airport office (the specified period)	Fukuoka airport office
Iki	—	Fukuoka airport office	
Ashiya	○ (JSDF)	—	
Metabaru	○ (JSDF)	—	
Kagoshima	○	—	Kagoshima airport office
Miyazaki	○	—	
Nyutabaru	○ (JSDF)	—	
Naha	○ (※2)	—	Naha airport office
Amami	—	Naha airport office	
Kikai	—	Kagoshima airport office	
Tokunoshima	—	Kagoshima airport office	
Okinoerabu	—	Kagoshima airport office	
Yoron	—	Kagoshima airport office	
Kumejima	—	Naha airport office	
Miyako	○	—	
Shimojishima	○	Naha airport office (the specified period)	
Tarama	—	Naha airport office	
Ishigaki	○	—	
Kadena	○ (US Military)	—	
Futenma	○ (US Military)	—	

	Aerodrome Control Service	Aerodrome Flight Information Service (※1)	Approach control services, Terminal radar control services
Kushiro	○	—	New Chitose airport office
Asahikawa	○	—	
Obihiro	○	—	
Nakashibetsu	—	New Chitose airport office	
Memambetsu	○	—	
Aomori	○	—	
Akita	○	—	
Hanamaki	—	○	
Odate-noshiro	—	New Chitose airport office	
Hakodate	○	—	
Tokachi	○ (JSDF)	—	
Sendai	○	New Chitose airport office (the specified period)	Sendai airport office
Niigata	○	—	Niigata airport office
Hiroshima	○	—	Hiroshima airport office
Nagasaki	○	Fukuoka airport office (the specified period)	Nagasaki airport office
Omura	○	Fukuoka airport office (the specified period)	
Oita	○	—	Oita airport office
Kumamoto	○	—	Kumamoto airport office
Amakusa	—	—	—
Toyama	○	—	—
Matsuyama	○	—	○ (US Military)
Iwakuni	○ (US Military)	—	○ (US Military)
Kitakyusyu	○	Fukuoka airport office (the specified period)	○ (JSDF)
Wakkanai	—	○	—
Yamagata	—	○	—
Fukushima	—	○	—
Shizuoka	—	○	—
Nanki-shirahama	—	○	—
Izumo	—	○	○ (JSDF)
Yamaguchi Ube	—	○	○ (JSDF)
Fukui	—	Osaka airport office	○ (JSDF)
New Chitose	○ (JSDF)	—	○ (JSDF)
Sapporo	○ (JSDF)	—	○ (JSDF)
Chitose	○ (JSDF)	—	○ (JSDF)
Misawa	○ (JSDF)	—	○ (JSDF)
Hyakuri	○ (JSDF)	—	○ (JSDF)
Komatsu	○ (JSDF)	—	○ (JSDF)
Miho	○ (JSDF)	—	○ (JSDF)

	Aerodrome Control Service	Aerodrome Flight Information Service (※1)	Approach control services, Terminal radar control services
Tokushima	○ (JSDF)	—	○ (JSDF)
Asahikawa	○ (JSDF)	—	—
Ominato	○ (JSDF)	—	—
Hachinohe	○ (JSDF)	—	○ (JSDF)
Matsushima	○ (JSDF)	—	○ (JSDF)
Kasuminome	○ (JSDF)	—	—
Utsunomiya	○ (JSDF)	—	○ (JSDF)
Soumagahara	○ (JSDF)	—	—
Kasumigaura	○ (JSDF)	—	—
Maizuru	○ (JSDF)	—	—
Shizuham	○ (JSDF)	—	—
Hamamatsu	○ (JSDF)	—	○ (JSDF)
Akeno	○ (JSDF)	—	○ (JSDF)
Ozuki	○ (JSDF)	—	○ (JSDF)
Houfu	○ (JSDF)	—	○ (JSDF)
Komatsujima	○ (JSDF)	—	○ (JSDF)
Tsuiki	○ (JSDF)	—	○ (JSDF)
Kanoya	○ (JSDF)	—	○ (JSDF)
Iojima	○ (JSDF)	—	○ (JSDF)
Yokota	○ (US Military)	—	○ (US Military)
Iruma	○ (JSDF)	—	○ (US Military)
Tachikawa	○ (JSDF)	—	○ (US Military)
Atsugi	○ (JSDF)	—	○ (US Military)

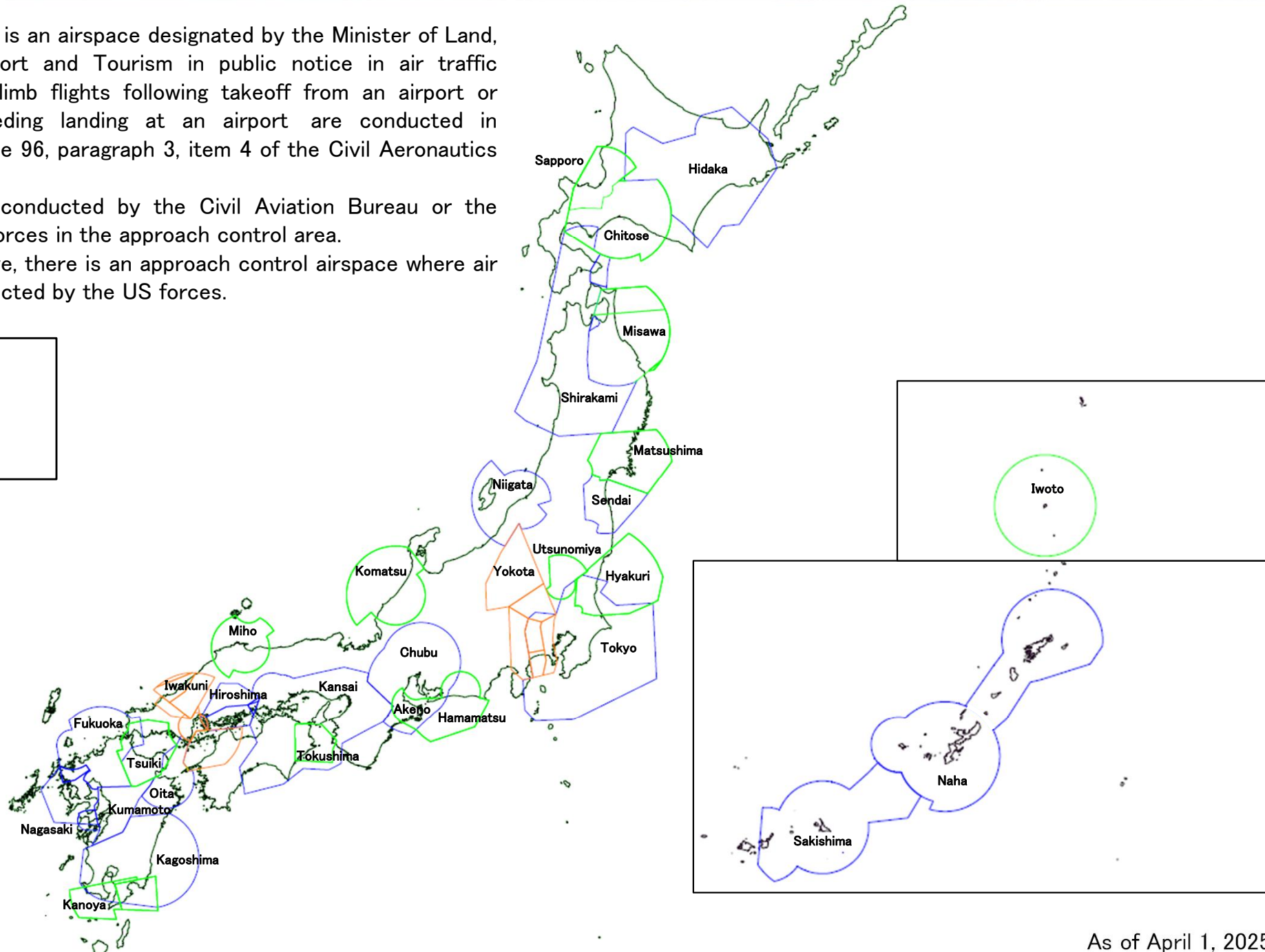
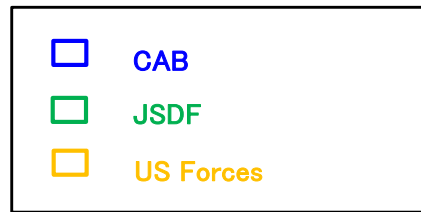
	Aerodrome Flight Information Service (※1)
Rishiri	New Chitose airport office
Okushiri	
Monbetsu	
Shonai	
Matsumoto	
Kozushima	
Miyakijima	Osaka airport office
Hachijojima	
Noto	
Tottori	
Ok	Fukuoka airport office
Iwami	
Tajima	
Tsushima	Kagoshima airport office
Fukue	
Tanegashima	Naha airport office
Yakushima	
Minamidaito	
Kitadaito	Naha airport office
Yonaguni	

※1 : Aerodrome Flight Information Service will be provided from airport offices listed here in.
 ※2 : Ground controlled approach services in Naha airport also have been provided by Civil aviation bureau.

18 Approach Control Area

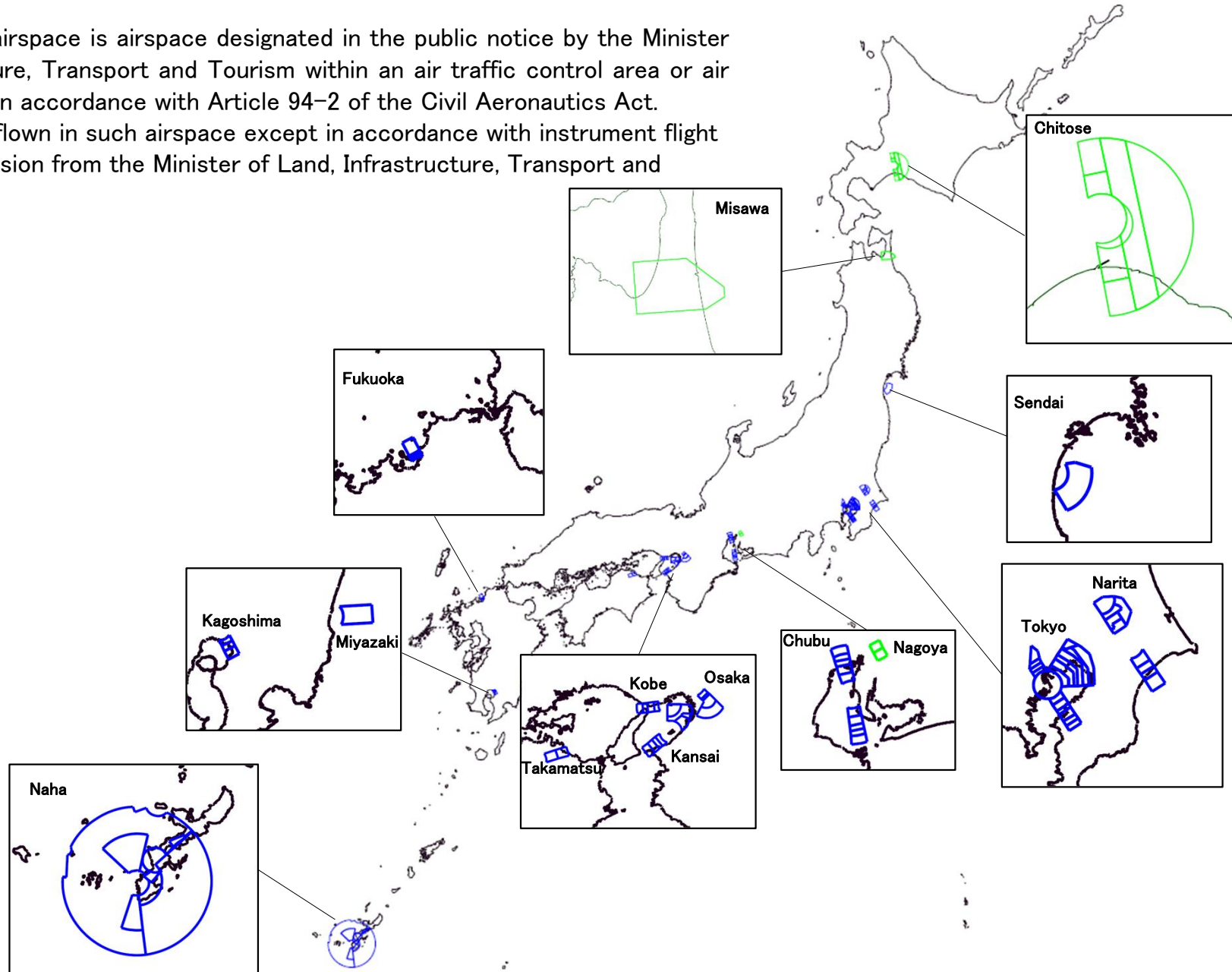
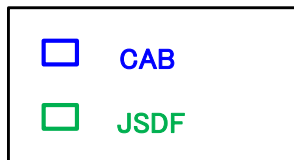


- Approach control area is an airspace designated by the Minister of Land, Infrastructure, Transport and Tourism in public notice in air traffic control area where climb flights following takeoff from an airport or descent flights preceding landing at an airport are conducted in accordance with Article 96, paragraph 3, item 4 of the Civil Aeronautics Act.
- Air traffic control is conducted by the Civil Aviation Bureau or the Japan Self-Defense Forces in the approach control area.
- In addition to the above, there is an approach control airspace where air traffic control is conducted by the US forces.

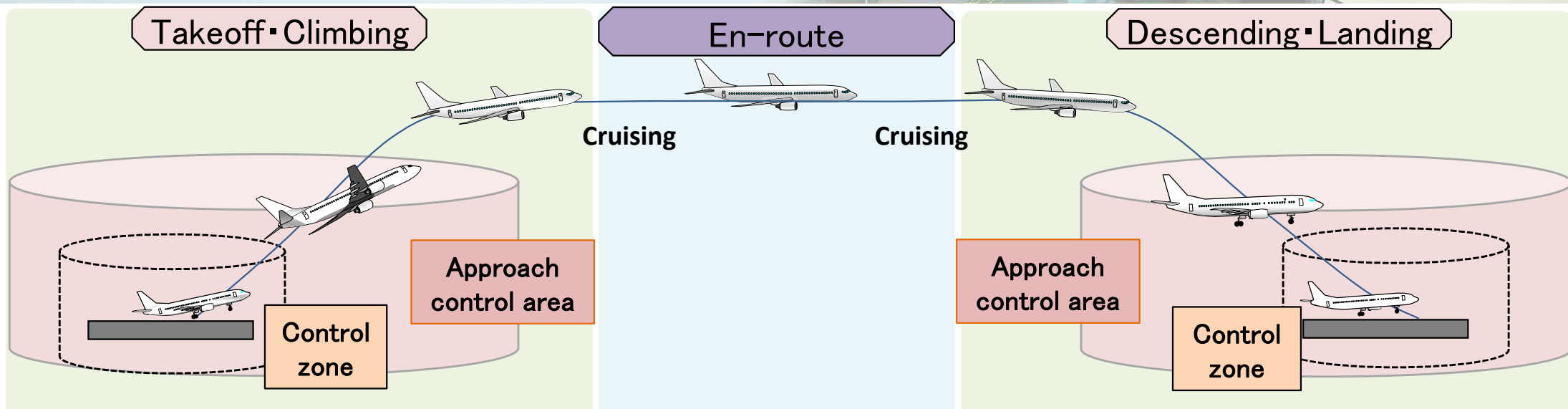


19 Positive Controlled Airspace

- Positive controlled airspace is airspace designated in the public notice by the Minister of Land, Infrastructure, Transport and Tourism within an air traffic control area or air traffic control zone in accordance with Article 94-2 of the Civil Aeronautics Act. No aircraft shall be flown in such airspace except in accordance with instrument flight rules without permission from the Minister of Land, Infrastructure, Transport and Tourism.



20 Air Traffic Control Services



Airport Surface Detection Equipment
Detects positions of aircraft on the ground



Airport Surveillance Radar
Detects positions of flying aircraft



Remote Center Air-ground Communication
Enables voice communication with aircraft



Air Route Surveillance Radar
Detects positions of flying aircraft



Radio navigation aids VOR/DME
Provides information of direction and distance to aircraft



Airport Surveillance Radar
Detects positions of flying aircraft



Instrument Landing System
Transmits landing course to aircraft by radio wave



- < Aerodrome control service >**
- Recognizes positions of aircraft visually
 - Provides clearance on flight plan
 - Gives taxi instructions to the runway
 - Gives takeoff clearance



- < Approach control service >**
- Recognizes positions of aircraft by airport surveillance radar
 - Provides radar vectors from airport to airways
 - Sets separation among aircraft



- < En-route control service >**
- Recognizes positions of aircraft flying on airways by air route surveillance radar
 - Provides instruction regarding route of flight, altitude, etc.



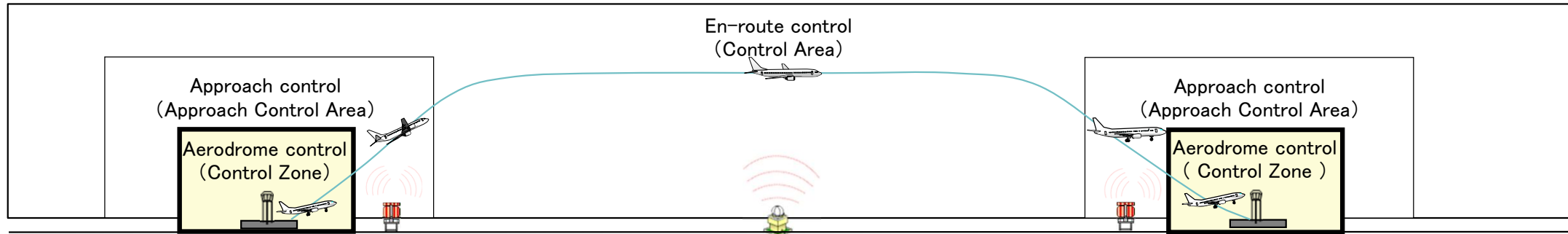
- < Approach control service >**
- Recognizes positions of aircraft by airport surveillance radar
 - Provides radar vectors from airways to airport
 - Sets separation among aircraft



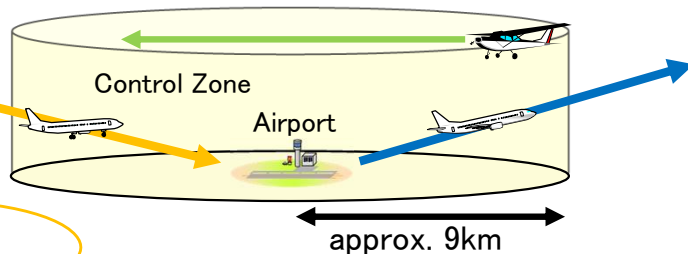
- < Aerodrome control service >**
- Recognizes positions of aircraft visually
 - Gives landing clearance
 - Gives taxi instructions to terminal building

21 Aerodrome Control

Aerodrome control is a service which Air Traffic Controllers provide instructions regarding the method of flight, sequence, timing and permission of takeoff and landing. ATCs control the aircraft flying around the airspace within an approximately 9 km radius centered on the airport (control zone) by observing the aircraft visually from the control tower. ATCs also provides instructions regarding the route for taxiing to the aircraft and vehicles on the ground.



Traffic control around the airport and on the runway



[read back]
Cleared to land.

Cleared to land.

(ATC)

Hold short of runway.

[read back]
Hold short of runway.

ATCs prevent aircraft from approaching or colliding with each other by providing instructions to aircraft flying in the vicinity of the airport on how to fly.

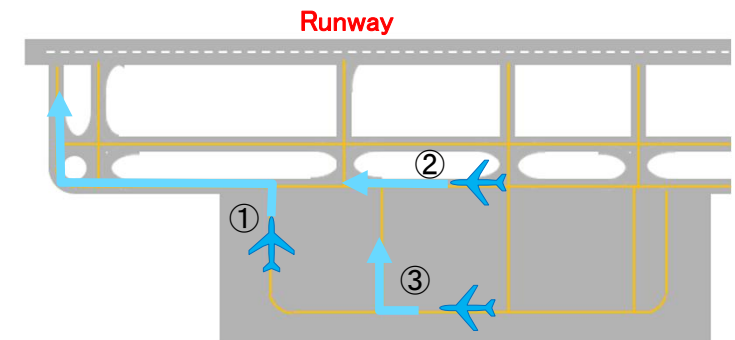
ATCs provide instructions to aircraft using the runway regarding the sequence, timing and permission for takeoff and landing.

(Aerodrome
control facility)



Control
tower

Traffic control on the ground

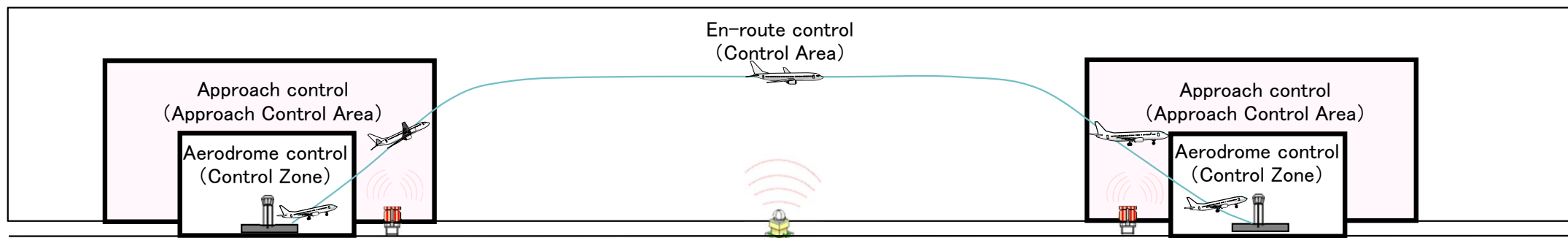


ATCs provide instructions on route for taxiing to aircraft and vehicles. ATCs decide the order of ground traffic and provides instructions to stop or detour.

22 Approach Control

Approach control is a service which ATCs decide the sequence for arriving and departure aircraft flying in approach control area*, and provide instructions on direction, altitude and speed of flight and on holding. ATCs provide this service by observing aircraft on radar.

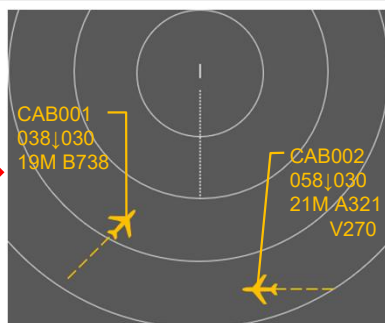
*In general, an airspace within radius of approximately 100km from an airport.



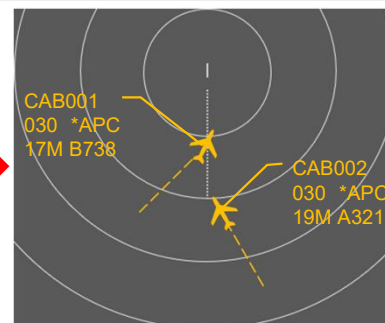
Arr.



Arriving aircraft CAB001 and CAB002 are in the same distance from an airport.



Decide the approach sequence. Instruct CAB001 to fly to the airport as no.1, and instruct CAB002 to fly behind.



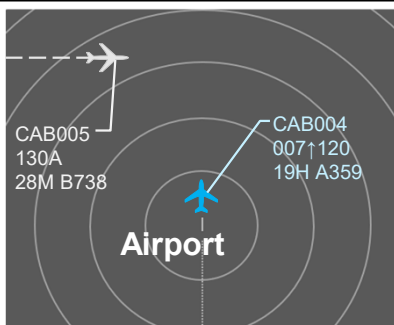
Set a safe separation between them and let them fly toward the runway by giving approach clearance.

After taking over arriving aircraft coming from various directions from the area control center, ATCs decide the order of arrival. ATCs also guide the aircraft to the runway extension while setting a safe separation between them, and hand them over to the aerodrome control facility.



(Terminal control facility)

Dep.



CAB004 has taken off from an airport. Instruct CAB004 to climb to an altitude lower than CAB005 to avoid collision.



Instruct CAB004 to fly behind CAB005 and let it climb further higher.

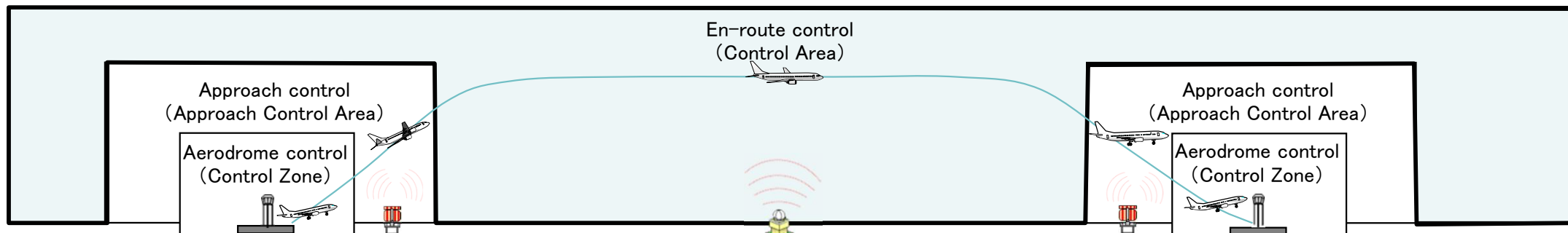
ATCs instruct departure aircraft, which have taken off from an airport, to climb to cruising altitude, while setting a safe separation between others flying around, then hand them over to the area control center.

- ① CAB004
 ② 034↑150
 ③ 23H A359 ⑤
 ④ V330 ⑥

- ① Flight number : CAB004
 ② Altitude : leaving 3,400ft, climbing to 15,000ft
 *APC: Approach clearance is given.
 ③ Ground speed: 230kts
 ④ Wake turbulence categories: Heavy
 ⑤ Type of aircraft: Airbus 350-900
 ⑥ Magnetic heading (direction): 330 degrees

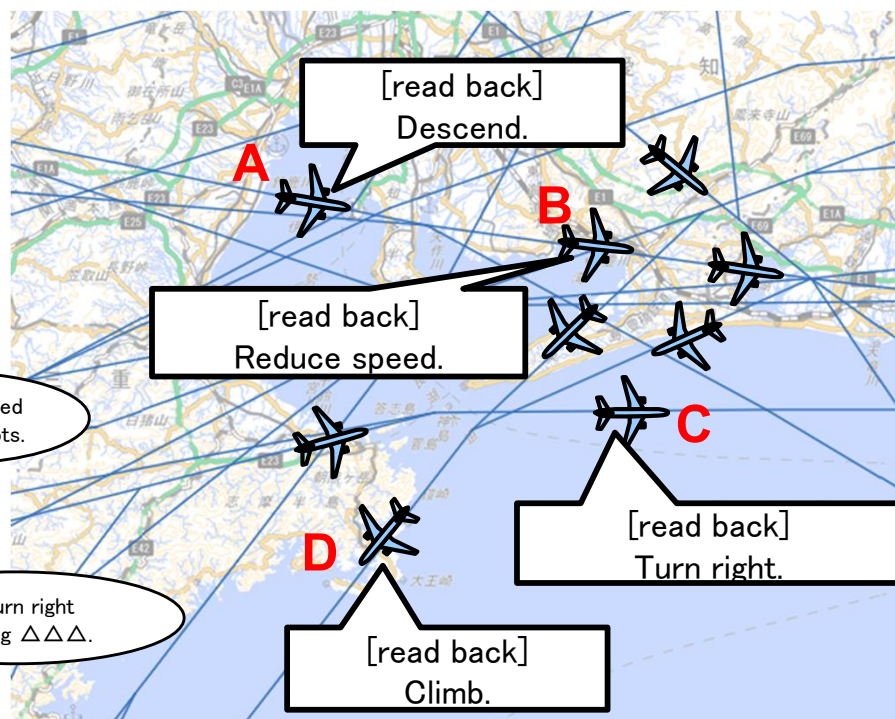
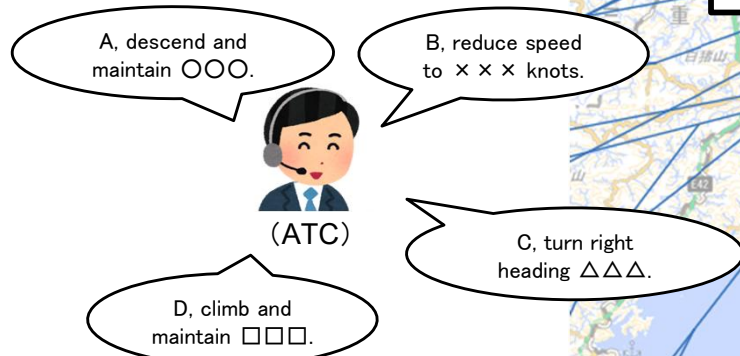
23 En-route Control

En-route control is a service which ATCs provide instructions regarding flight direction, altitude, speed, etc., to aircraft flying in a control area. ATCs detect positions of aircraft flying in the control area on radar.



Traffic control on en-route

ATCs form an orderly traffic flow while setting safe separations among aircraft flying between airports and aircraft from overseas passing over Japan.



(Area control center)

Today, control area is divided into 3 areas. Area control centers located in Tokyo, Kobe and Fukuoka provide air traffic control service in control area.

24 Oceanic Control

- Fukuoka Area Control Center provides oceanic control for aircraft flying between Japan and other countries and aircraft passing through the Fukuoka FIR (Flight Information Region). His/her jurisdictional area includes the Pacific Ocean which is approximately 200km from land.
- In the airspace over the Pacific Ocean, control operations are conducted using voice communications (international air-ground communications) using short wave (HF: High Frequency) and data links using satellite communications and surveillance technology.
- Efficient oceanic control operations with shortened separations are being implemented for datalink-capable aircraft.

Image of oceanic control of using satellite

- ◆ Conducting control operations using data link
Aircraft position reporting, altitude change requests and approvals, etc.
- ◆ Reducing separations ⇒ Expansion of traffic capacity

Fukuoka ACC
Oceanic control



Aeronautical
Satellite Center



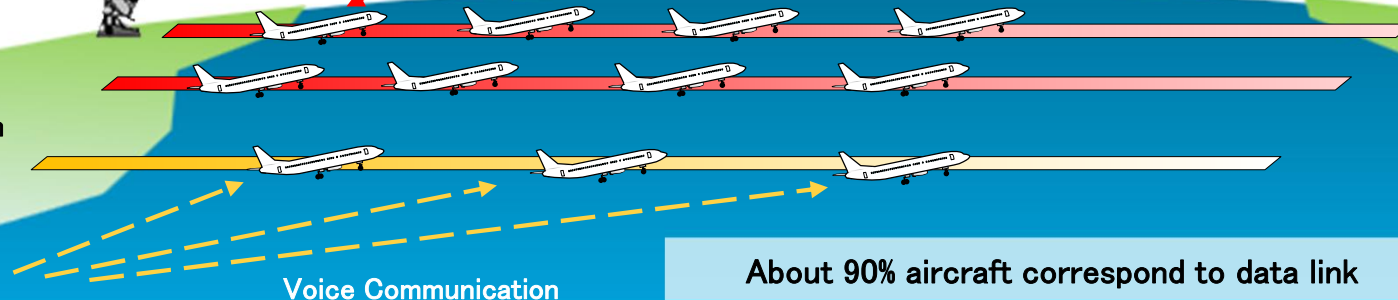
Tokyo International
air-ground
communication station



Artificial satellites



Data link



About 90% aircraft correspond to data link

25 International Air-Ground Communication

International Air-Ground Communication is a service that provides reports necessary for air traffic control and safe navigation to aircraft operating mainly at sea in the Fukuoka FIR.

Currently, satellite-based data link is widely used at sea, when the data link becomes unstable, voice communication using HF (High Frequency) is available.



Tokyo international air-ground communication station

【Distinctive operational procedure】

Validation of information

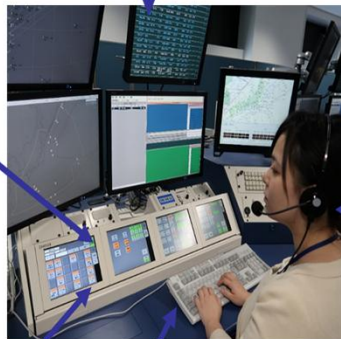
Check for discrepancies between the information displayed and the information reported by the aircraft.

Frequency selection

The optimum frequency is selected in consideration of HF characteristics (propagation characteristics by season and time of day), frequencies used by neighboring communication stations, and communication conditions that vary by aircraft type.

Equipment adjustment

Radio equipment and antennas used are switched according to the communication status of each aircraft and noise contamination.



Distinguishing Voice

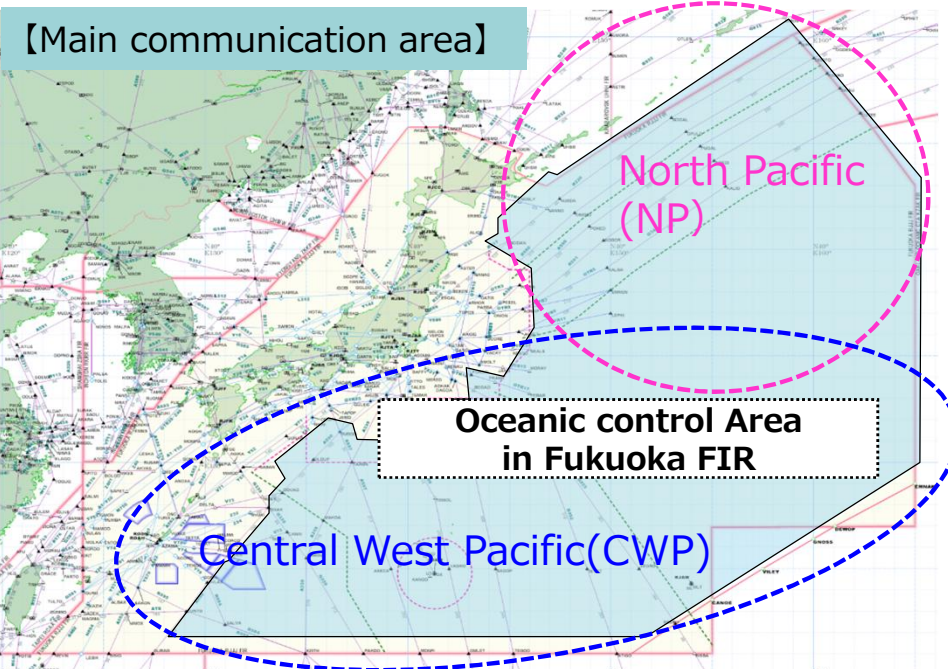
Since multiple frequencies are operated at the same time, it is possible to distinguish which aircraft is transmitting. In addition, it is possible to distinguish the voice from the one accompanied by the static and fading characteristic of HF.

Communication details typing

Typing its contents at the same time as the communication in order to send it to air traffic control, Airlines, and other concerned parties.

◆ The Tokyo international air-ground communication station is one of the communications bureaus of the worldwide organized communications network, responsible for the North Pacific (NP) and Central West Pacific (CWP) areas, and performs the following operations for aircraft flying over the ocean airways using HF.

1. Relaying of position reports and control requests between aircraft and ATC, and transmission of ATC clearance.
2. Providing weather and other information necessary for the safe navigation of aircraft.
 - a) In-flight observation information on severe weather
 - b) Airspace severe weather information/volcanic ash information
 - c) Closure of major airports and airways
3. Other communications related to the safety of aircraft navigation



26 Air Traffic Flow Management (ATFM)

1. Air traffic flow management ensures the appropriate use of airspace and safe and ensure efficient traffic flow by implementing adjustments related to route of flights and traffic flow control when traffic demand is expected to exceed airspace capacity. ATFM has the following three components.

○ Management of flight planned route.

Manage flight planned routes to form an orderly traffic flow and implements coordination such as route changes to avoid congestion and bad weather.

○ ATC clearance

Monitors the ATC capacity of each airspace (sector) and airport and traffic volume, and issue clearance to aircraft to fly on IFR through the ATC facilities.

○ Implementation of traffic flow control

When traffic volume prediction exceeds the air traffic control processing capacity, ATFM measures will be issued in the following manner to sustain the largest and appropriate traffic flow.

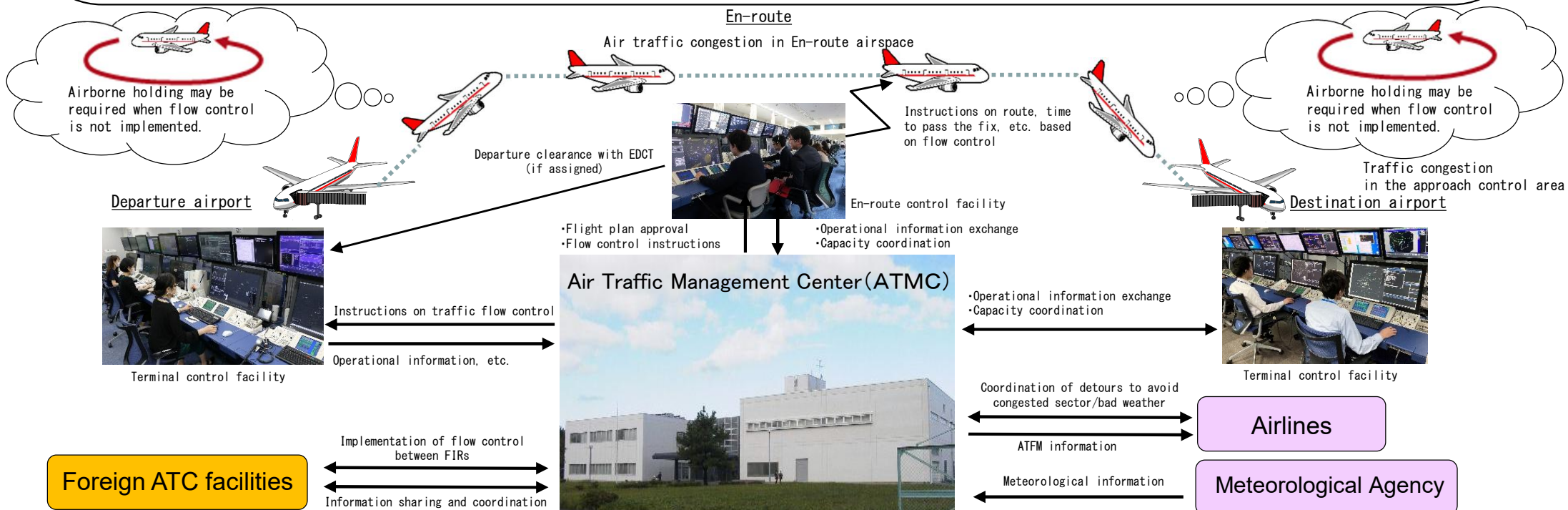
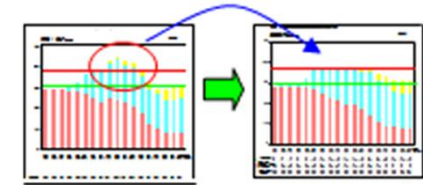
1. Specifies the appropriate departure time (expected departure clearance time/EDCT) and minimum departure interval for aircraft.

2. Specifies treatments for aircraft in flight, such as inflow intervals and entry time for congested airspace.

2. In order to conduct precise and responsive air traffic management in airspace with heavy and complexed traffic, ATM center liaison called traffic management units (TMUs) have been established in major ATC facilities, and they are managing air traffic flow. (New Chitose AP “New Chitose TMU”, Tokyo INTL AP and Narita INTL AP “Haneda TMU”, Kansai INTL AP “Kansai TMU”, Fukuoka AP “Fukuoka TMU”, Naha AP “Naha TMU”, Tokyo ACC “Tokorozawa TMU”, Kobe ACC “Kobe TMU”)

• Setting of ATC capacity : Sets precise ATC capacities in accordance with the events and weather conditions that affect the operation of the airspace.

• Implementation of local traffic flow control : Implements immediate and responsive traffic flow control in response to changes in traffic volume and ATC capacity in the airspace.



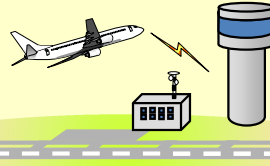
27 Aerodrome Flight Information Service (AFIS)

- AFIS (Aerodrome Flight Information Service) is a service that provides aircraft at or in the vicinity of airports with information necessary for operating and message relay between ATC facility and aircraft, using A/G communication.
- AFIS is provided by ATS flight information officer in two ways;
 1. From Tower at the airport
 2. From AFIS and AEIS center remotely using TV equipment.

Services provided by AFIS

- ◆ Air traffic information around the airport
- ◆ Meteorological Information
- ◆ Significant runway surface conditions
- ◆ Relay an ATC clearance

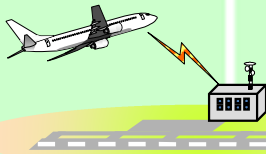
Information is provided
From Tower at the airport



Airport (Aerodrome Control **Service is not provided**)

Information is provided
from AFIS and AEIS center remotely using TV equipment

AFIS



Airport (Aerodrome Control **Service is not provided**)



For airports provided AFIS, refer to item 17.

28 ATIS

- ATIS (Automatic Terminal Information Service) is a service that provides aircraft taking off or landing at airports with information necessary for operating aircraft, such as weather and runway conditions. ATIS is provided at Tokyo FAIB, Kansai FAIB and other CAB office at each airport.
- ATIS is provided by both voice broadcasting and data link. Data link enables users to obtain ATIS of airports in JAPAN even when flying overseas.

【ATIS information】

- ① ATIS station
(include name of airport)
- ② Identification number
- ③ Time of observation
- ④ Approach type
- ⑤ Runway(s) in use
- ⑥ Runway condition code and braking action reported by pilot
- ⑦ Information from the control facility with specific significance concerning ATC
- ⑧ Other essential operational information
- ⑨ Weather information
- ⑩ Request acknowledgement of receipt (Broadcast only)

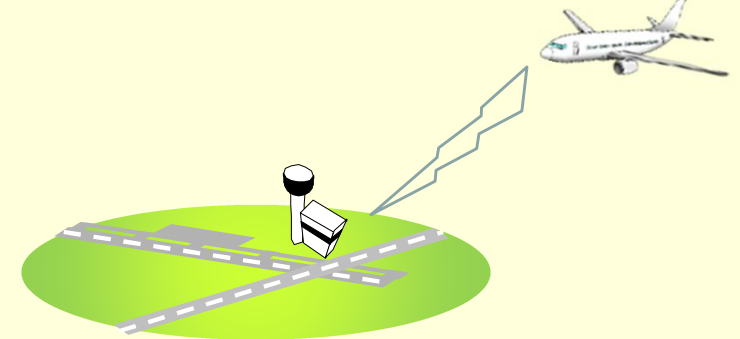
※Some items may be omitted when no information to be provided.

Sample of ATIS

ATIS RJAA I
①Narita airport ②Identify with A~Z
M0800 ③0800UTC(17:00JST)
(APCH)ILS Y RWY16R/ILS Y RWY16L
④Type of approach
LDG RWY 16R/16L ⑤Landing runway
DEP RWY 16R ⑤Departure runway
PARL APCHS INPR. DEP FREQ 124.2.
⑦Parallel approach in progress. Departure
frequency for terminal air traffic control is
124.2MHz.
M
060800Z 22023G38/12KT 10KM
SCT025SC BKN030SC 10/04
Q1015/A2998=
Q/TWO NINE NINE EIGHT ⑨Weather

【How to provide ATIS】

- ① Voice Broadcasting
(Repetitive and automatic broadcasting)



- ② VHF data link
(Data communication by onboard equipment)



Onboard equipment



【Airports providing ATIS】 TOTAL 23 Airport as of August 7th,2025

NEW CHITOSE, HAKODATE, SENDAI, NARITA INTL, TOKYO INTL, NIIGATA, CHUBU CENTRAIR INTL, OSAKA INTL, KANSAI INTL, KOBE, HIROSHIMA, TAKAMATSU, MATSUYAMA, KOCHI, FUKUOKA, SAGA, NAGASAKI, KUMAMOTO, OITA, MIYAZAKI, KAGOSHIMA, NAHA, ISHIGAKI

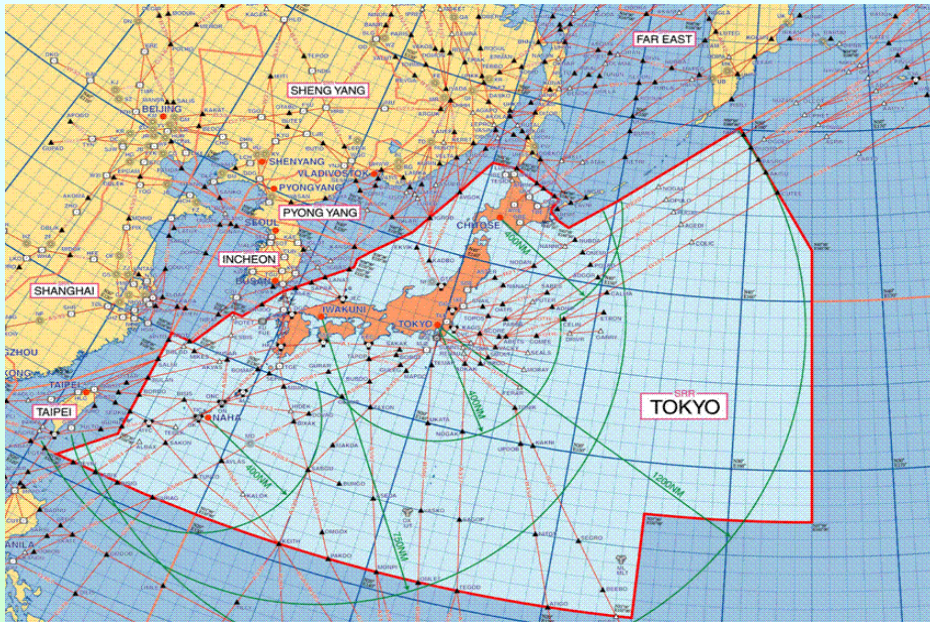
29 Search and Rescue (SAR) Service

- As a framework to implement SAR services pursuant to Annex 12 of the Convention on International Civil Aviation, “Agreement on Search and Rescue of Aircraft and Details Implementation” has been concluded among the National Police Agency, the Fire and Disaster Management Agency, the Japan Coast Guard and the Ministry of Defense, and the search and rescue services have been carried out in cooperation among these organizations.
- The Civil Aviation Bureau has the only rescue coordination function. The service is carried out by Air Traffic Services Flight Information Officers at the Tokyo Rescue Coordination Center located in the Tokyo Airport Office.

Scope of responsibility of the Tokyo RCC

Tokyo Search and Rescue Region (Tokyo SRR)

The SAR region are assigned to each state by the regional air navigation plan of the ICAO. “Tokyo Search and Rescue Region (TOKYO SRR)” has been allocated as Japan’s responsible area. When an aircraft is in an emergency phase in this area, Japan takes responsibility for search and rescue operations. Conclusion of agreements and arrangement on necessary coordination and cooperation with RCCs in the neighboring SRR are currently underway.

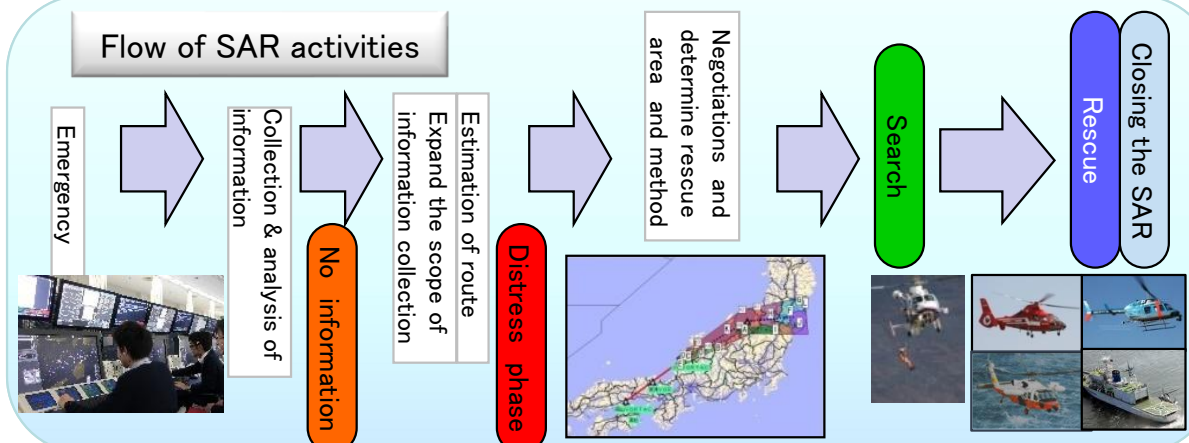


Framework of SAR activities in Japan

※As the Chairman of SAR Conference, the Tokyo International Airport Administrator has been designated.



Flow of SAR activities



30 Aerodrome Information Service

Purpose

Operations aimed at the safe operation of national and shared airports (safety of air traffic, safety of personnel working at airports).

【 Safety inspections of restricted areas 】



Inspection of aircraft movement areas to ensure the safety of aircraft taking off and landing.

【 Apron operation and safety management 】



Necessary operations and safety management to ensure the safety of aircraft moving or standing on the apron. (Response to accidents in restricted areas, etc.)

【 Prevention of wildlife strikes 】



Develop a wildlife strikes prevention plans (especially birds). Implementation of wildlife strikes prevention measures based on those plans.

【 Driver permit scheme and driving rules in restricted areas 】



Establishment of driver permits and driving rules to ensure safety and order in driving within restricted areas.

【 Removal of disabled aircraft 】



Prepare procedures for early recovery of airport operations and take appropriate measures.

Safety of aerodrome operations

【 Granted access to restricted areas 】



A procedure for permitting persons and vehicles to enter a restricted area.

- Issuance of restricted area entrance certificate for persons and vehicles

【 Coordination of construction work in restricted areas 】



Coordination with construction workers in restricted areas.

- Construction plan, Flight restrictions, adjustment of entering or using vehicle
- Sharing of construction information, issuance of NOTAM

【 Low Visibility operations 】



Ensuring the safety of aircraft and vehicles when the airport experiences low visibility due to fog, snowfall.

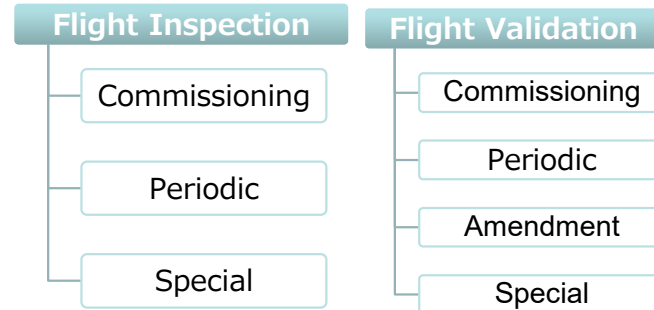
- Vehicle guidance upon request from aircraft
- Coordination to evacuate vehicles

31 Flight Inspection

■ Flight Inspection

•Flight inspection consists of two tasks: flight inspection to verify normality of the air navigation facilities in Japan , and flight validation to verify safety of the instrument flight procedures set up at airports, airways.

•These operations consist of various types of flight inspection and flight validation, such as commissioning inspections for newly installed facilities and periodic inspections, as shown in the diagram on the right.



■ Flight Inspection Center & Flight Inspection Aircraft

For flight inspection operations, the Flight Inspection Center has an office and a hangar on the island of Chubu Centrair International Airport and operates six flight inspection aircraft of two types.

**Flight Inspection Center
Office and Hangar**



**Cessna Citation Longitude C700
Call Sign "CKSTR7"**



Max T/O wt.	17,920 kg
Cruise speed	476 kt
Max ops alt.	45,000 ft
Max range	6,482 km
Seats	10
Number of aircraft	1

**Cessna 525C Citation CJ4
Call Sign "CKSTR8" ~ "CKSTR12"**



Max T/O wt.	7,700 kg
Cruise speed	450 kt
Max ops alt.	45,000 ft
Max range	3,300 km
Seats	6
Number of aircraft	5

■ Flight Inspection System

A device installed on the flight inspection aircraft and equipped with a computer independent of the original aircraft system to inspect the normality and soundness of radio signals received during flight.



■ Flight Validation Device

In addition to inspection using flight inspection aircraft, FIC also owns a flight simulator called a Flight Validation Device. It simulates various weather conditions to verify the safety of the instrument flight procedures set up at airports, airways.



32 ATMC (Air Traffic Management Center)

Air Traffic Management Center (ATMC) was established in 2005 as a core organization to play a leading role in the steady and effective promotion of air traffic management in Japan.

ATMC is responsible for coordinating traffic volume at the Fukuoka FIR, sharing various information, and comprehensively managing radio navigation aids nationwide, thereby ensuring air traffic safety and expanding air traffic capacity.



ATM officers

- Air traffic flow management
- Air space management



ATM information officers

- Spot information management and planning
- Coordinating operations information
- Information management
- Aeronautical fixed telecommunications

Air Traffic Management Center
(ATMC)
Fukuoka city, Fukuoka pref.



ATM engineering specialists

- CNS※operations coordination

※CNS: Generic term for C(Communication), N(Navigation), S(Surveillance). Refers to each radio navigation aids.

33 AEC(Air Navigation Services Enhancement Center)

The Air Navigation Services Enhancement Center (AEC, Fukuoka City, Fukuoka Pref.) was established in October 2024 to promote the enhancement of air navigation services. Taking future changes into account, such as the digitalization of information and the introduction of new technologies, the center is working with domestic and international stakeholders to promote the enhancement of air navigation services based on the analysis of data related to air traffic.

Planning and Coordination Division

- Overall coordination of all AEC operations
- Consideration of methods for introducing future measures
- Planning and coordination of crisis management training, and review of crisis management methods

Planning and coordination for the advancement of air traffic control services

Maintaining the safety and the robustness of air traffic and meeting the needs of society

Improving air traffic safety and security

Realizing high-density operations through improved operational methods and efficiency

Realizing “decarbonized society” through reduction of fuel consumption

Advanced Airspace Optimization Division

- Planning and coordination of efficient use of airspace for air traffic
- Data analysis for improving air traffic control services
- Analysis of the effects and impact of introducing future measures

Proposal for improving air traffic control operations based on data analysis

Information Enhancement Promotion Division

- Promotion of advanced utilization of air traffic control information, etc.
- Planning and formulation of measures to promote the strategic use of air traffic control information, etc.
- Coordination with relevant administrative agencies and other parties concerned regarding the use of air traffic control information, etc.

Planning, coordination, and operational support for digital information services

Safety Information Utilization Advancement Division

- Analysis, management and promotion of utilization of information on air traffic control safety
- Integrated and comprehensive safety management of air traffic control
- Coordination with related organizations regarding information on air traffic control safety

Utilization of safety information related to air traffic control

Technology Division

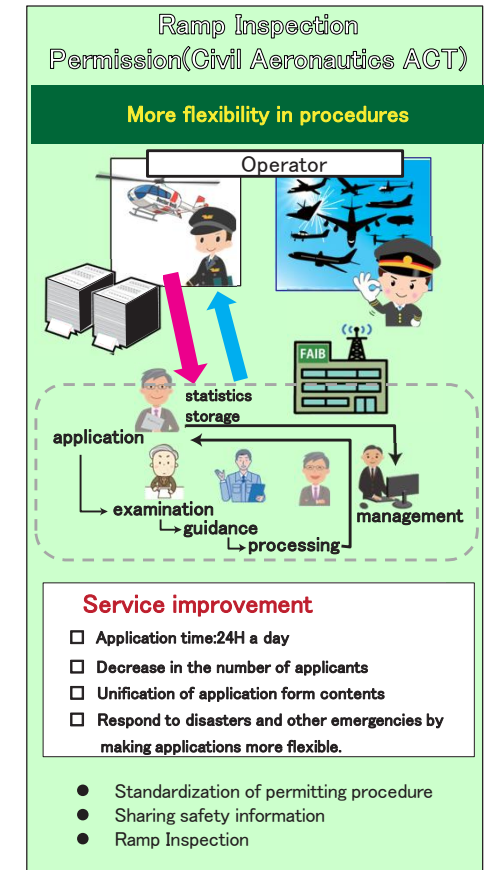
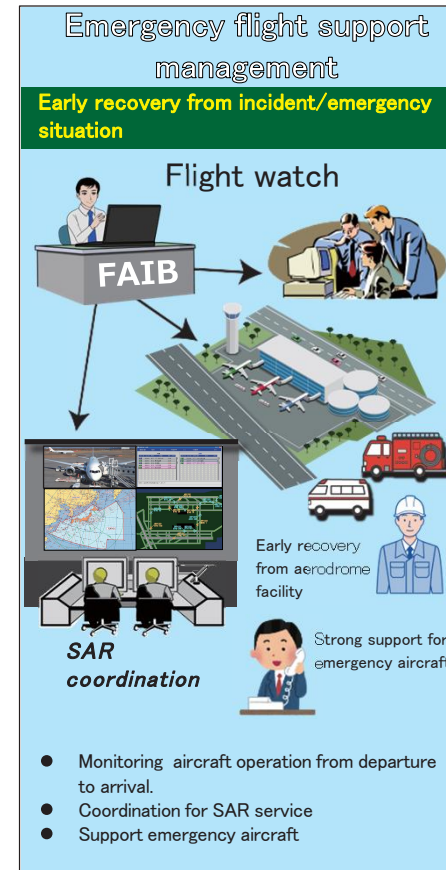
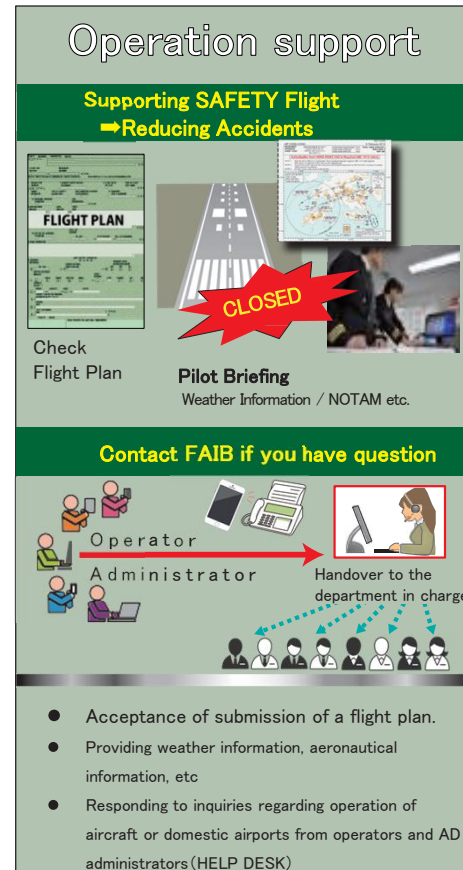
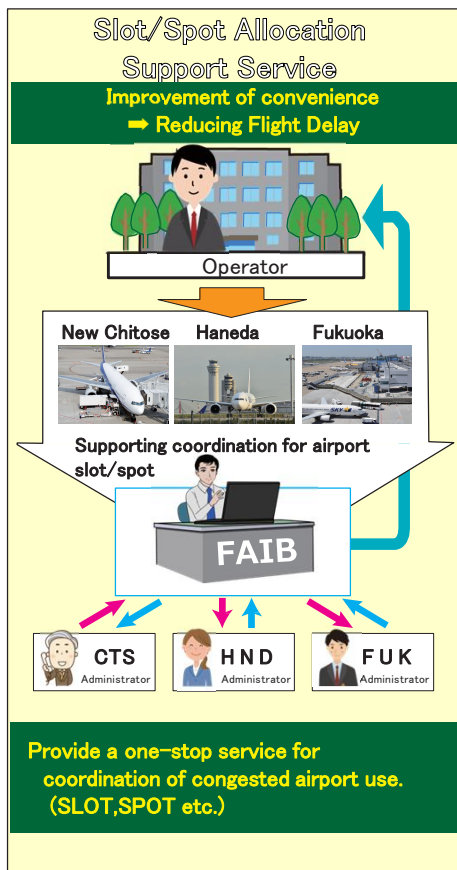
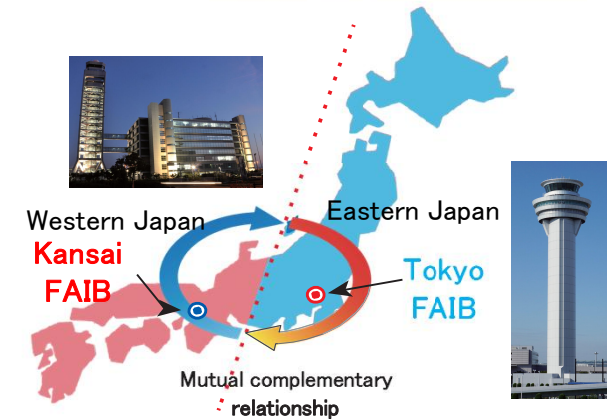
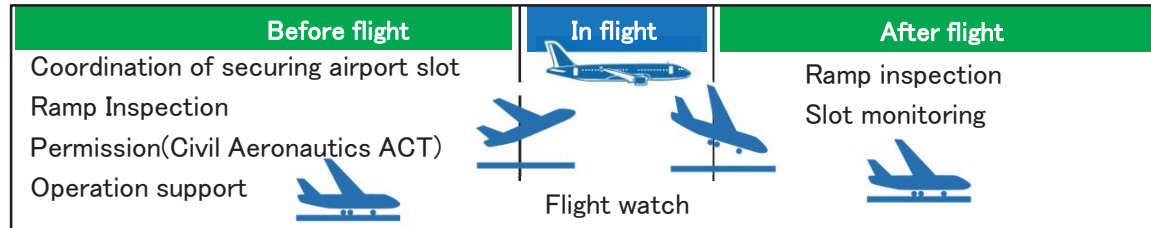
- Collection, analysis, and proposal for the utilization of advanced technologies aimed at improving the convenience and safety of air traffic control systems and facilities
- Consideration of the utilization of radio navigation aids data provided to SWIM
- Coordination with relevant administrative agencies and other parties concerned regarding the utilization of advanced technologies

Advanced utilization of control systems and facilities using new technologies



34 FAIB (Flight & Airport Information BASE)

Tokyo FAIB (Flight and Airport Information BASE) and **Kansai FAIB** centrally collect, manage and provide information necessary for the operation of aircraft as the base of this service, also make various support and coordination regarding the operation of aircraft.



35 AISC (Aeronautical Information Service Center)

AISC (Aeronautical Information Service Center, located in Narita city, Chiba pref.) is the organization that provides aeronautical information such as AIP or NOTAM to airlines, airport administrators and foreign NOTAM offices in 24 hours a day, seven days a week via internet and dedicated line, in compliance with Civil Aeronautics Act and ICAO annex15.

As the sole aeronautical information organization in Japan, AISC manages the quality of the aeronautical information, out step-by-step transition from AIS to AIM (transition from paper products to digital data) and improve sustainable information services by collaboration with service users.

AIS Aeronautical Information Service

Collect and edit necessary data, and provide aeronautical information.

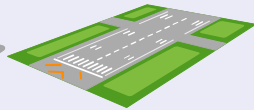
- Edit and create AIP and NOTAM
- Transit to paper products to digital data
- Analyze and share aeronautical information issued by foreign NOTAM offices

AIP
(Aeronautical Information Publication)

【Static data】

Length, width, direction

e.g.
Runway information



NOTAM

【Dynamic data】

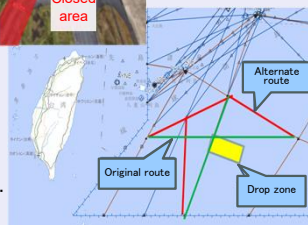
closure, out of lights

- Temporary change of facilities and services
- Issued 190,000 annually, average 520 per day



Display area of runway closure or point of lights out graphically.

Draw shapes on electronic chart, and display in layer.



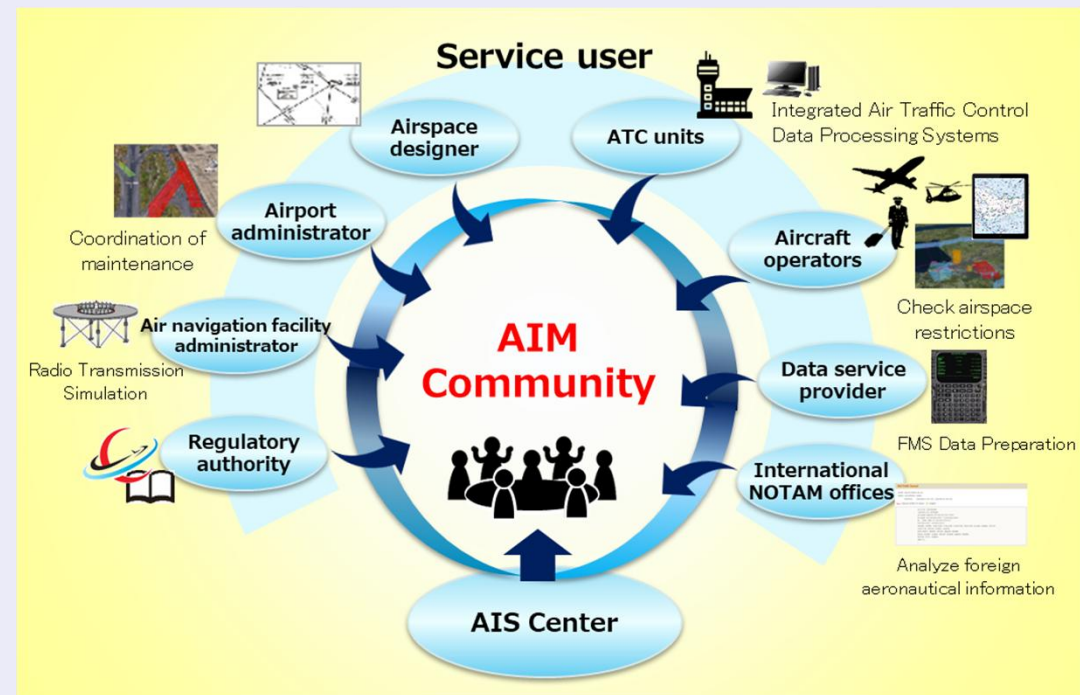
Transit to digital data

- By the end of FY2025, carry out transition from paper products to digital data
- Overlay information to the all-purpose maps, and be displayed visually
- Expect improvement of the efficiency to pre-flight checks and situational awareness for each flight

AIM Aeronautical Information Management

Improve and expand sustainable information services by collaboration with service users.

- Improve and expand sustainable information services under quality management system (QMS)
- Conform to international standards (ICAO standards, universal format)
- Usage promotion and developing specialist of digital data



36 NPAC (Network Performance Assessment Center)

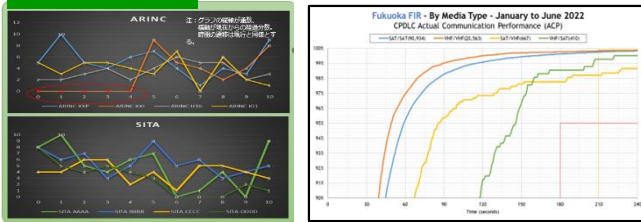
Network Performance Assessment Center (NPAC: Located Hitachiota City, Ibaraki Pref. / Kobe Branch Office located Kobe City, Hyogo Pref.) monitors, analyzes, and evaluates service performance in order to centrally manage the Communications, Navigation, and Surveillance performance required for Performance Based Operation (PBO), and also provides satellite-based services to support PBO.

【Main operations of NPAC】

Communication

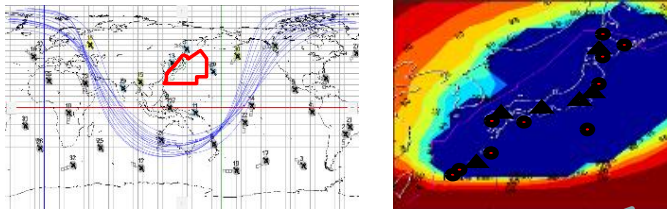
- ◆ Relay data communication messages related to control instructions and information necessary for safe aircraft operation.
- ◆ Measure and analyze data communication transmission delay time and message reachability.

Reception graph display for each ground earth station



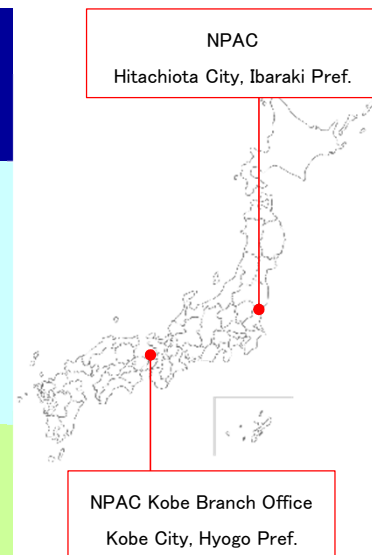
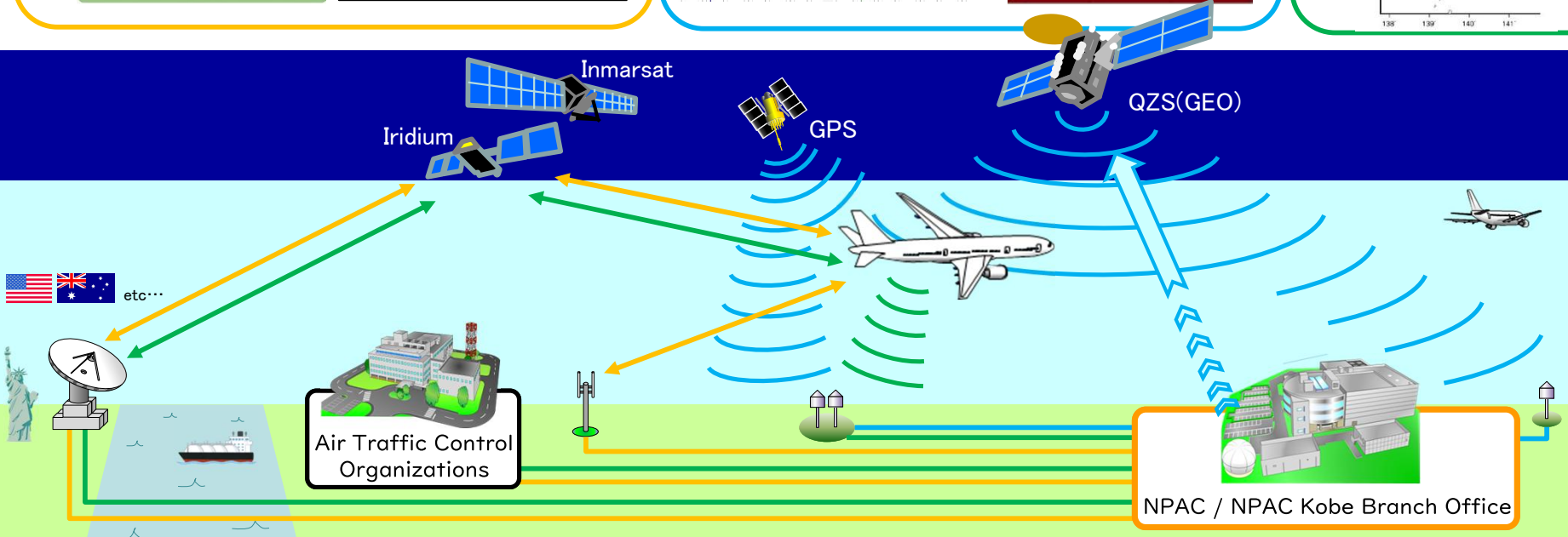
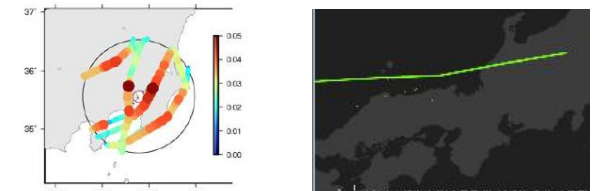
Navigation

- ◆ Generation and monitoring of augmentation signals (SBAS signals) necessary to use GPS for aircraft operations.
- ◆ Prediction of GPS availability for aircraft
- ◆ Monitoring of GPS signal degradation, interference.



Surveillance

- ◆ Monitoring of radio wave environment of surveillance frequencies.
- ◆ Accuracy monitoring of aircraft position in use of GPS.(navigation related)
- ◆ Transmission delay monitoring of aircraft position information using satellite data links.(communication related)



37 SDECC (Systems Development, Evaluation and Contingency Management Center)

SDECC is engaged in software development, evaluation and operational support of ATC systems.

In addition, it holds crisis management functions in the event of dysfunction of the ATC facility caused by a large-scale disaster or system failure.

Operational support & Crisis management

Support for troubleshooting, and system backup

- Recovery support
- Cause analysis
- Planning and practice recurrence prevention measures
- System backup as needed etc.

Software evaluation

System total evaluation

- Evaluate software by connecting with other systems
- Test with scenarios simulating on-site environment etc.

System design

Validation of program design

- ATC functions
- Operational functions
- HMI
- Security / Reliability
- Program management

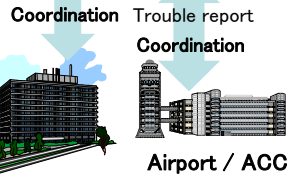
Software development

Management of software development

- Quality control
- Process check
- Schedule control
- Validation of test results

The cycle aiming at a better ATC system

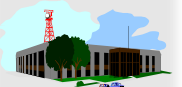
Exchange opinions and collaborate with the stakeholders



JCAB Headquarters



JCAB Headquarters



Ministry of Defense



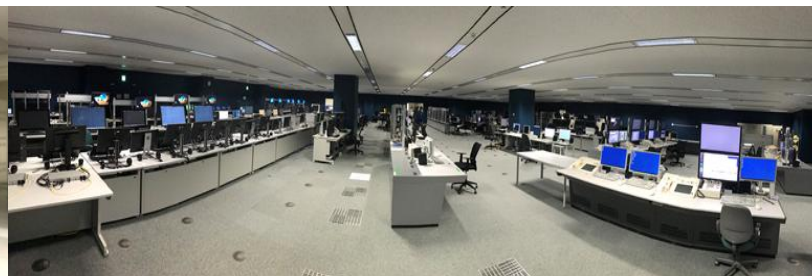
Airport / Airlines



Foreign Facilities

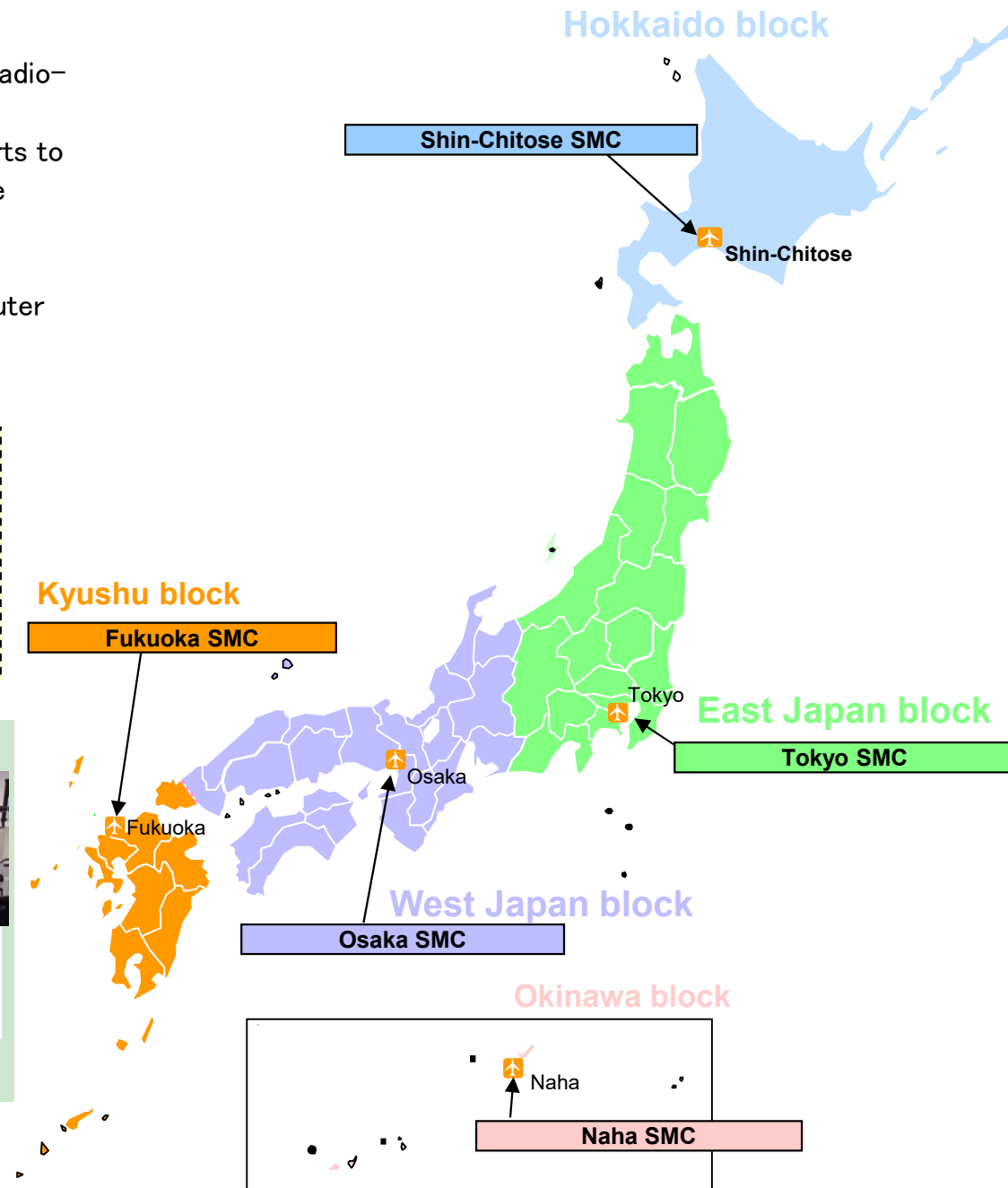
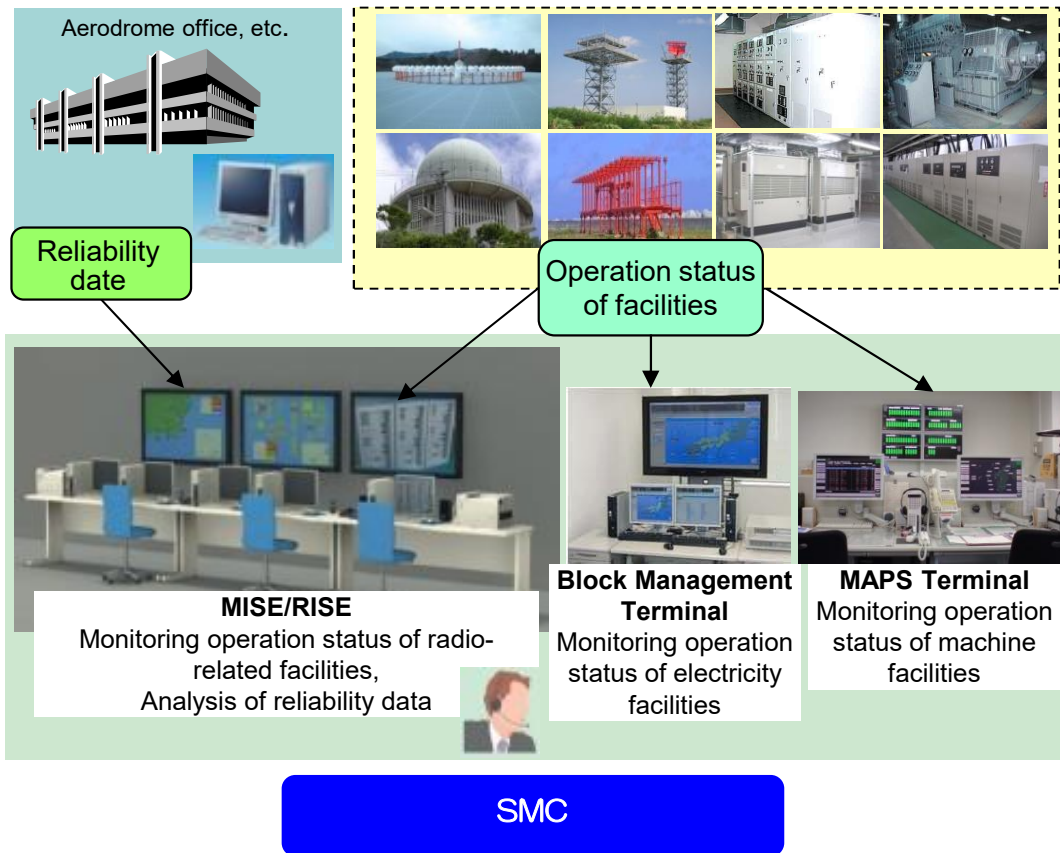


Software Developers



38 SMC (System Operational Management Center)

The System operation Management Center (SMC), located at five aerodromes throughout the country, oversees the operation status of radio-related facilities, aeronautical lights, electricity facilities and machine facilities within these jurisdictions in an integrated manner, making efforts to enhance the system for immediate response to an occurrence of failure under effective and efficient operation and management, by using the Monitor and Information Sharing Equipment / Reliability management Information Sharing Equipment (MISE/RISE), Block Management Computer system for electricity facilities and Machinery facilities Administration Preservation System (MAPS).



39 TMC (Technical Management Center)

TMC is located in Tokorozawa City, Saitama Prefecture (within the Tokyo Air Traffic Control Department). To ensure the safe and secure air traffic services through life cycle management * of air traffic services system (aeronautical communication, navigation and surveillance facilities, aviation lighting and electrical facilities, power generation equipment, uninterruptible power supply equipment) from development and manufacturing to operation and decommissioning by introducing new technologies and improving the performance of current system.

*Life cycle management is to develop facilities which realize to maintain stable operation and to improve efficiency of facility maintenance costs, through enhancing the quality of equipment

Development

- Researching international standards (ICAO), national law, and related standards, we develop standards that will be common to each device. We also define functional requirements and formulate specifications that reflect user needs, such as interfaces for system interconnection and air traffic controllers.



Machine Manufacturing/Procurement

- We conduct appropriate inspections at each step of the manufacturing process and ensure consistent manufacturing control. In addition, performance inspections are conducted from various perspectives based on our technical know-how.

Test Evaluation

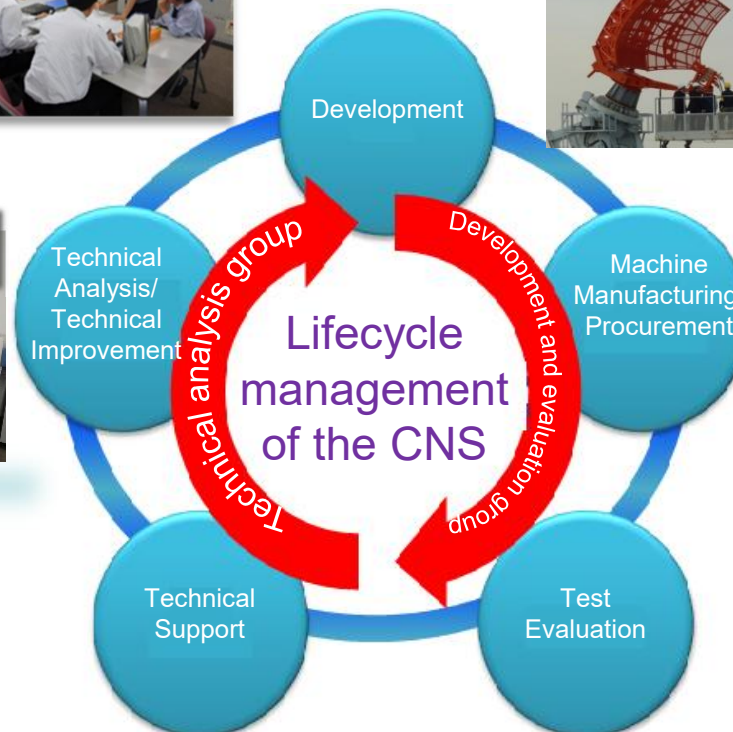
- Pre-operational evaluation is conducted on facilities prior to operation to assess continuity of service and availability, to ensure that they are compatible with the actual environment, and to ensure safety.



Technical Analysis

/ Technical Improvement

- We analyze various data from facility operation and maintenance, development, and test and evaluation to improve reliability and achieve efficient operation.
- In case that technical issues are exist and a countermeasure is necessary as a result of the analyzing system fault, we will modify facilities and functions, as well as operations and maintenance, to further enhance reliability and achieve efficient operations.



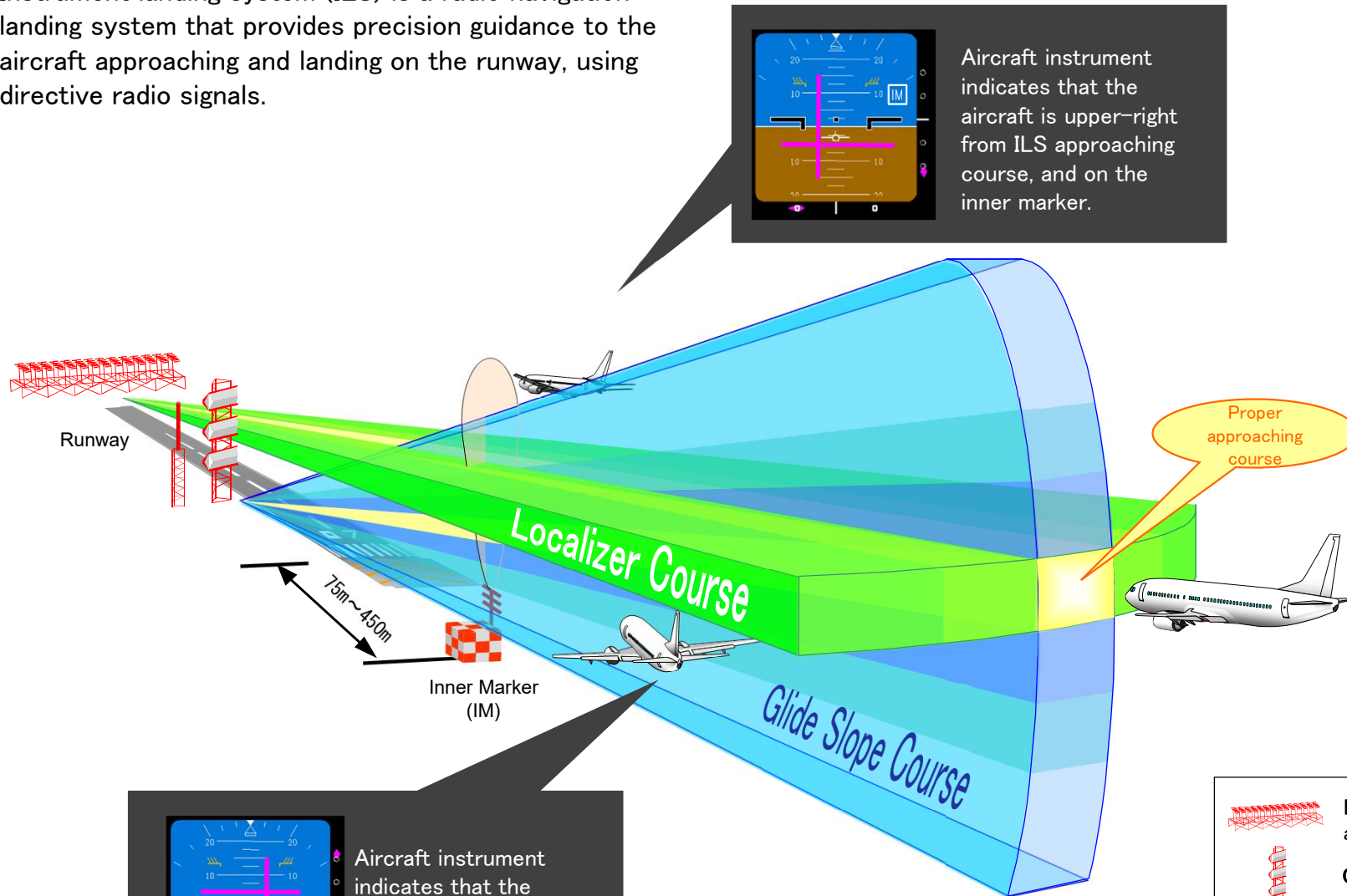
Technical Support

- Due to equipment failure or natural disasters, the air traffic services system may be unable to provide the services necessary for aircraft operations. When such unpredictable affairs occur, we provide technical information and make a technical analysis for prompt failure recovery.

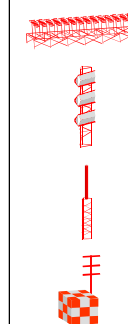
40 ILS (Instrument Landing System)

ILS (Instrument Landing System):

Instrument landing system (ILS) is a radio navigation landing system that provides precision guidance to the aircraft approaching and landing on the runway, using directive radio signals.



Aircraft instrument indicates that the aircraft is lower-left from ILS approaching course.



Localizer: Emission of radio signals indicating approaching course

Glide slope: Emission of radio signals indicating approaching angle (path)

Terminal DME: Emission of radio signals to measure the distance to the landing point

Each marker: Emission of radio signals to inform the aircraft flying decision height(DH).

41 A/G (Air to Ground Radio)

The facility used to perform airport control, landing guidance control, approach control, and terminal radar control for aircraft flying within traffic control area at airport office and other.

Air traffic controllers at airport offices give instruction using VHF (Very High Frequency) and UHF (Ultra High Frequency) radio waves emitted from the airport's air-to-Ground radio (A/G) to give permission to take off and land, instructions for taxiing, flight routes, and so on to aircraft.

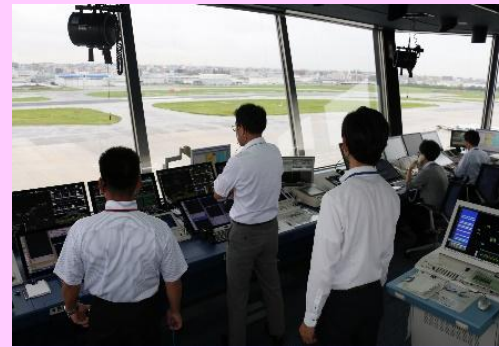
Air to Ground Radio (A/G) facility



A/G Antenna



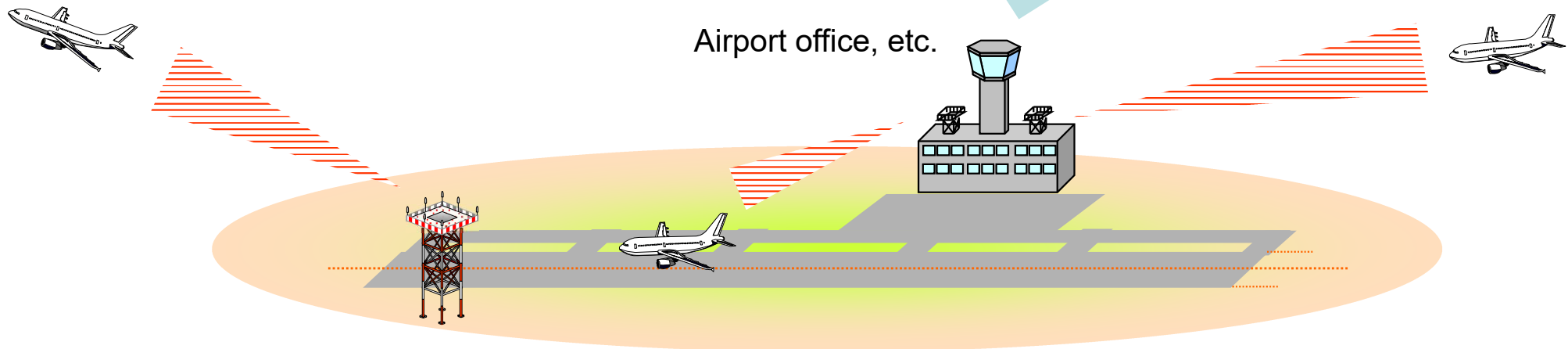
Radio facility



Aerodrome Control facility



Terminal Control facility



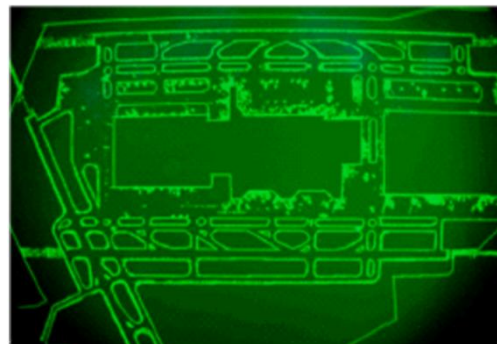
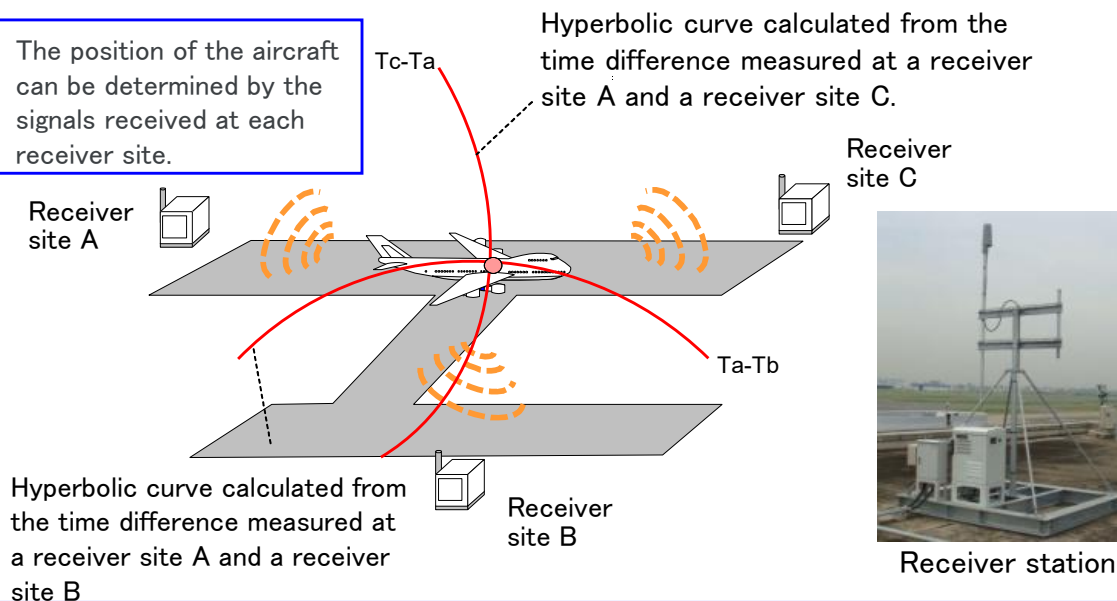
42 MLAT (Multilateration)

MLAT is used for the air traffic control service. It enables monitoring a blind area which cannot be covered by ASDE (Airport Surface Detection Equipment). In combination with ASDE※, the system can monitor the movement of aircraft and vehicles, etc. more effectively.

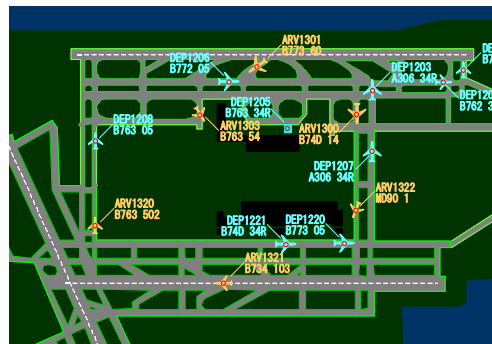
※ASDE is a high-resolution radar used for aerodrome control service by monitoring the movement of aircraft and vehicles, etc. on the airport ground to ensure their safety.

Positioning Principle of Multilateration

The position of the aircraft can be determined by the signals received at each receiver site.



Display of ASDE

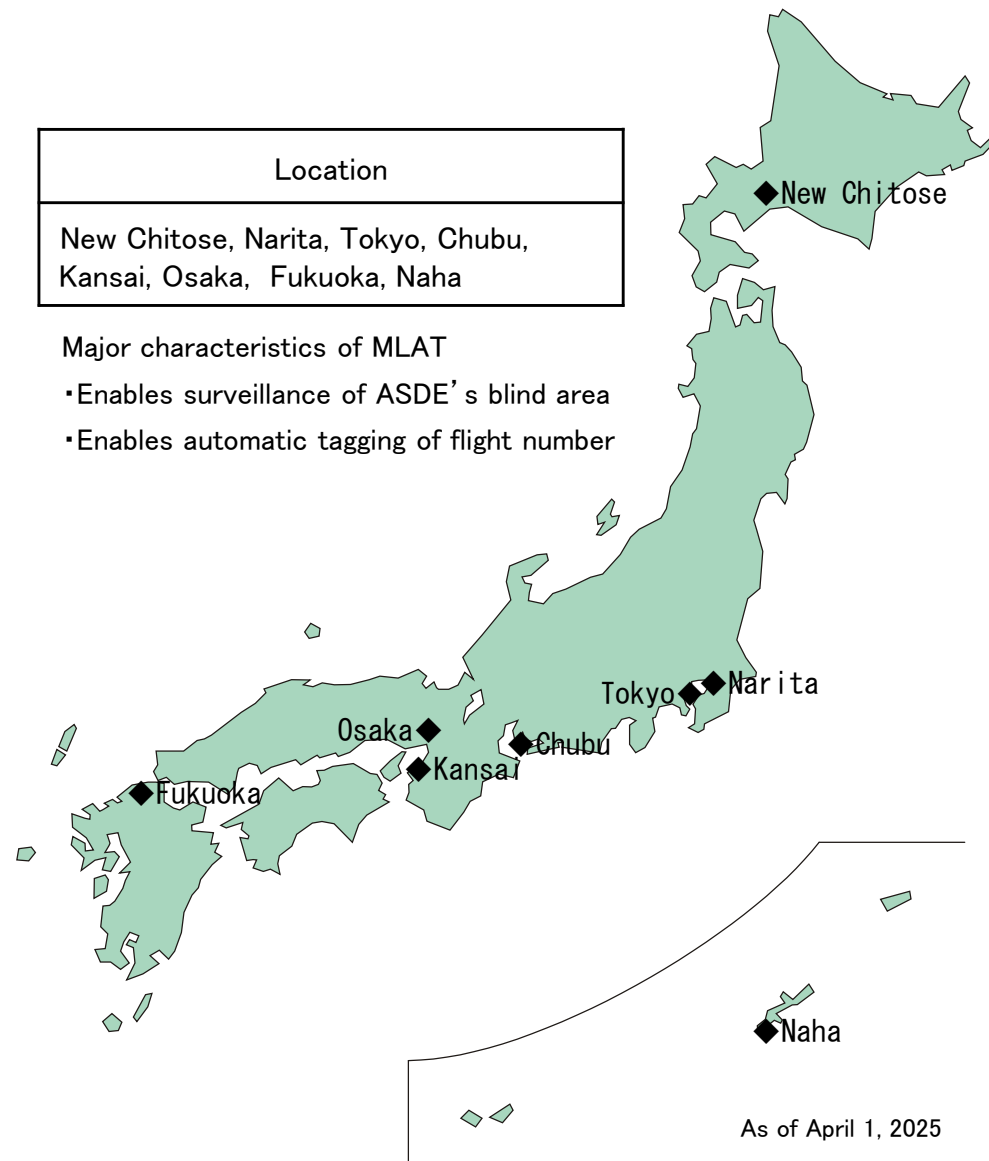


Display in combination with ASDE

Location
New Chitose, Narita, Tokyo, Chubu, Kansai, Osaka, Fukuoka, Naha

Major characteristics of MLAT

- Enables surveillance of ASDE's blind area
- Enables automatic tagging of flight number



As of April 1, 2025

43 VOR/DME

Aeronautical radio navigation facilities that provide direction and distance information to in-flight aircraft within the effective arrival distance of radio waves.

※the effective arrival distance: range of emitted radio waves

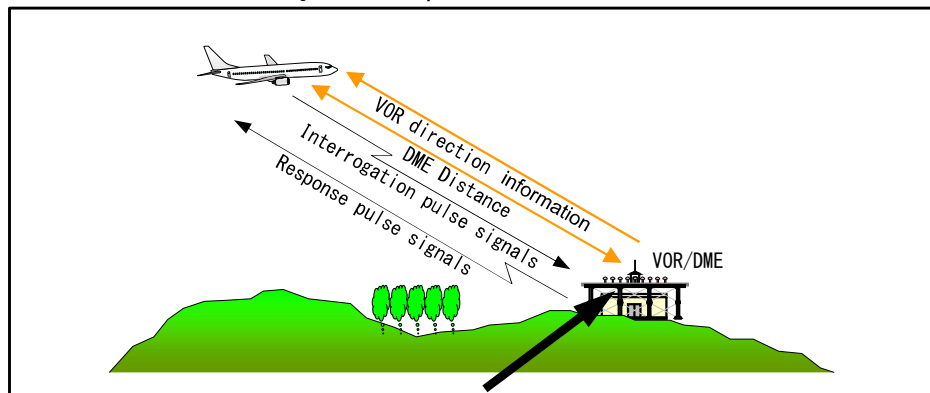
Facility	Function	Frequency Band	Aircraft	Remarks
V O R	Direction	VHF (108-118MHz)	Civilian	ICAO standard
D M E	Distance	UHF (960-1215MHz)	Civilian	ICAO standard
TACAN	Direction +Distance	UHF (960-1215MHz)	Military	Developed by US Marines

VOR : VHF Omnidirectional Radio Range

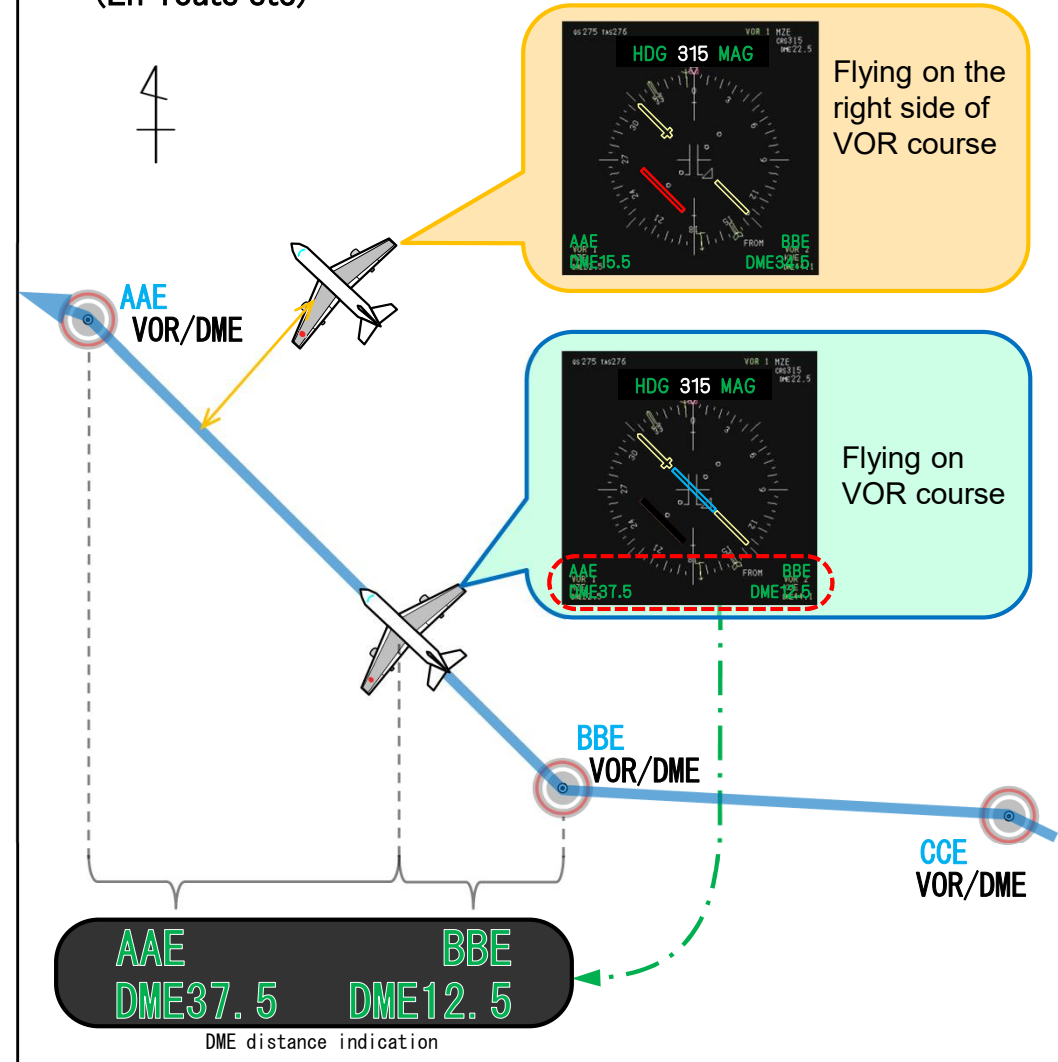
DME : Distance Measuring Equipment

TACAN : Tactical Air Navigation System

Note: TACAN is a system to provide direction and distance information.



VOR Course (En-route etc)



44 ASR (Airport Surveillance Radar)

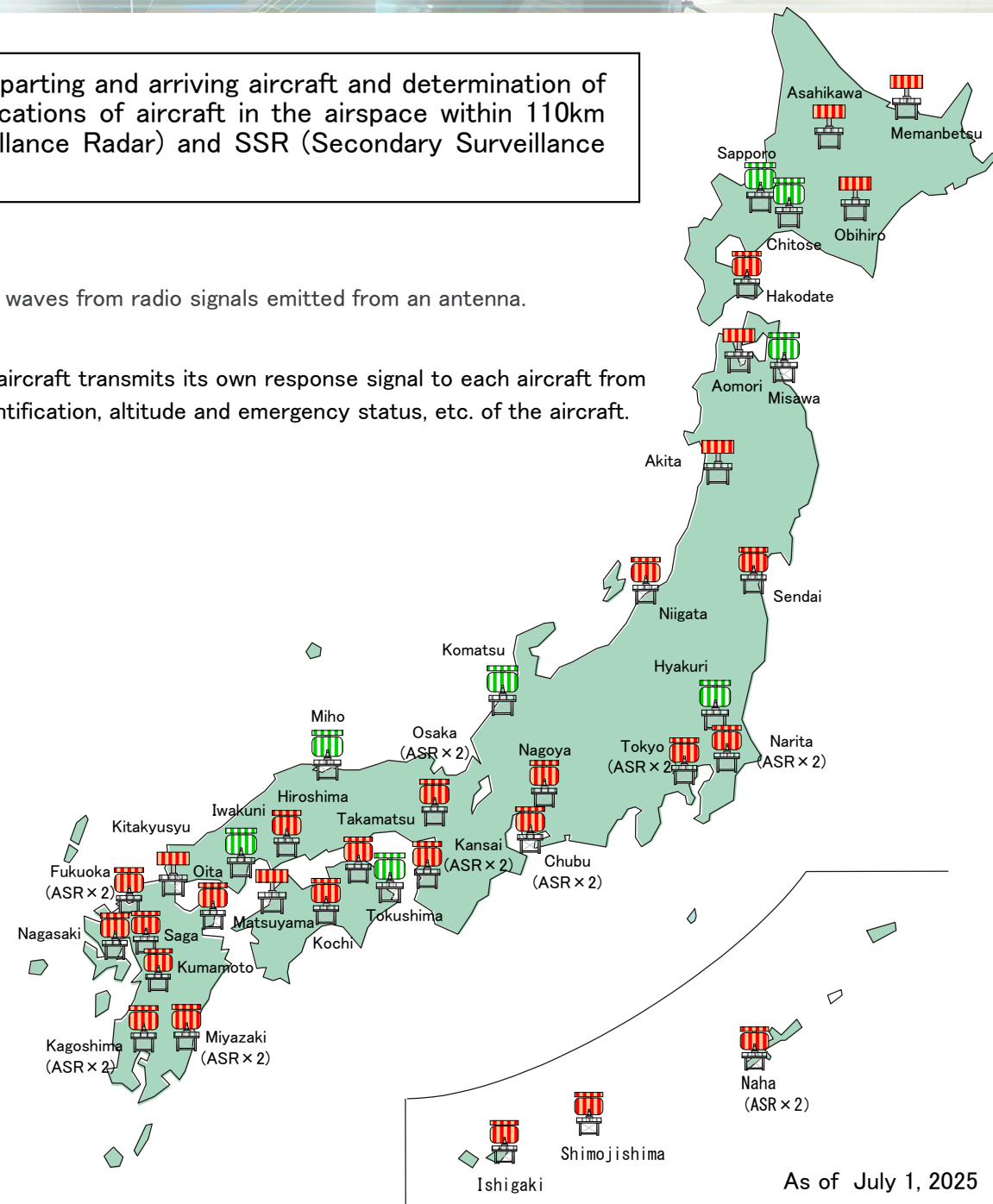
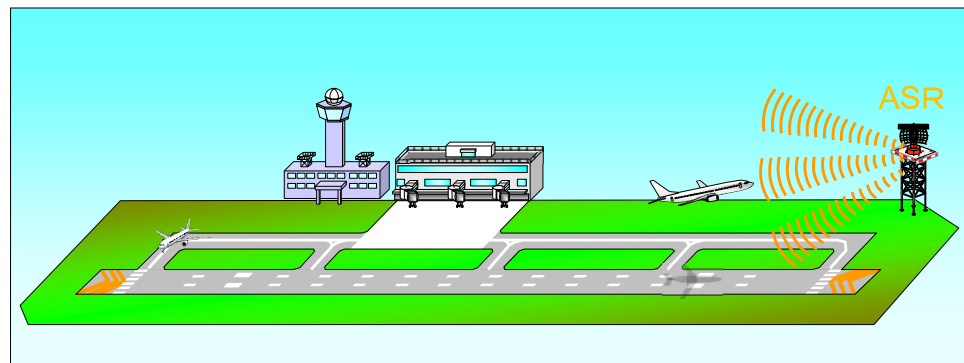
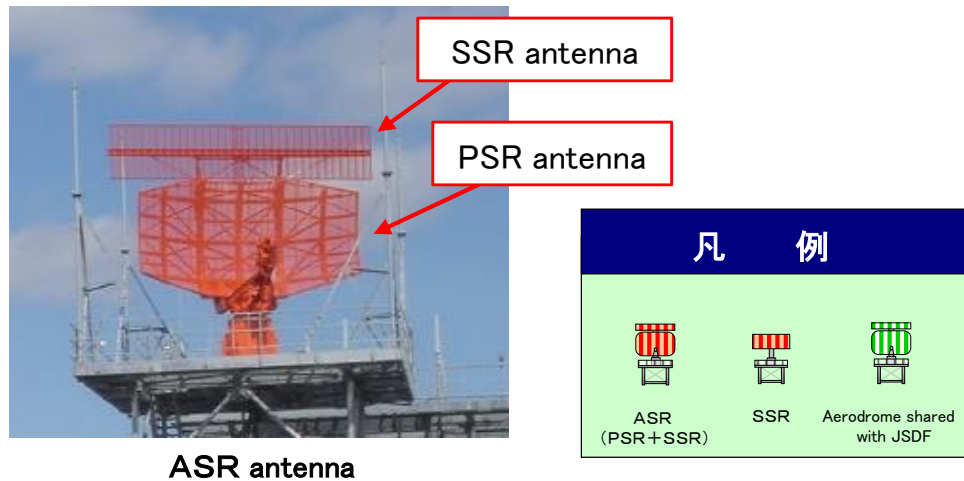
This system is used for terminal radar control, such as control of departing and arriving aircraft and determination of distance between two or more aircraft through the detection of locations of aircraft in the airspace within 110km (60NM) of an airport using a combination of PSR (Primary Surveillance Radar) and SSR (Secondary Surveillance Radar).

•PSR(Primary Surveillance Radar)

The system for detecting distance and direction to target(aircraft) using of reflected waves from radio signals emitted from an antenna.

•SSR(Secondary Surveillance Radar)

When an aircraft receives an interrogation radio signal emitted from this device, the aircraft transmits its own response signal to each aircraft from the on-board ATC transponder, and the ground-based radar screen displays the identification, altitude and emergency status, etc. of the aircraft.



As of July 1, 2025

45 ARSR (Air Route Surveillance Radar)/ ORSR (Oceanic Route Surveillance Radar)

ARSR or ORSR collects not only the aircraft position detected by the radio wave, but also the altitude or beacon code by sending and receiving signals.

This acquired information is relayed from radar facility to Air traffic Control Center (ACC) by dedicated communication network. By using this information air traffic controllers operate air traffic control service operation such as guiding aircraft and setting separations between aircraft.

Both ARSR and ORSR cover the airspace within the radius of 250NM, namely about 460km.



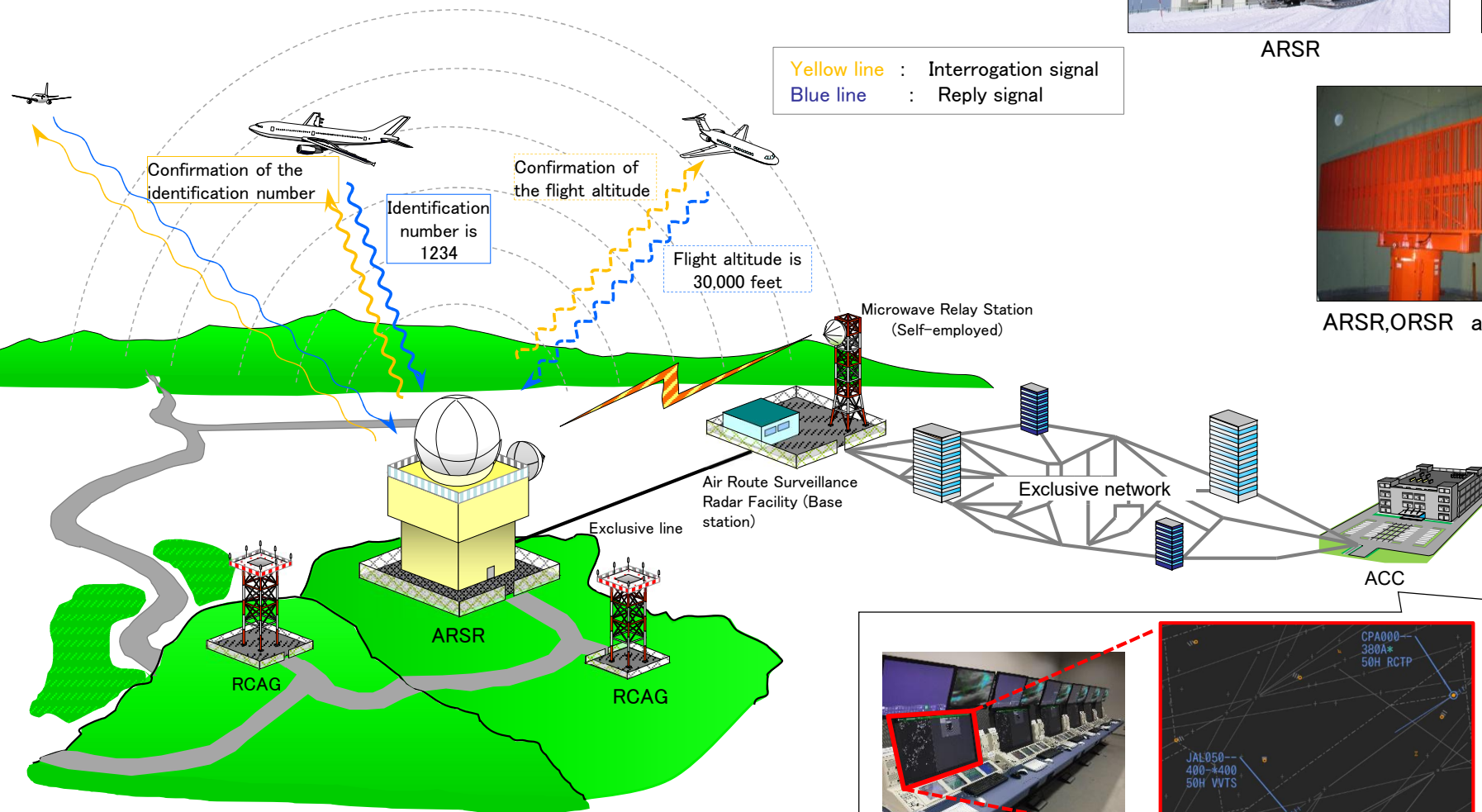
ARSR



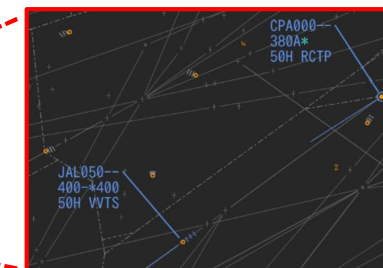
ORSR



ARSR,ORSR antenna



Display equipment



Display screen example

The delivered information to ACC by dedicated communication network displays on the console monitor for en-route control by processing other equipments. Air traffic controllers provide the air traffic control services by using this information.

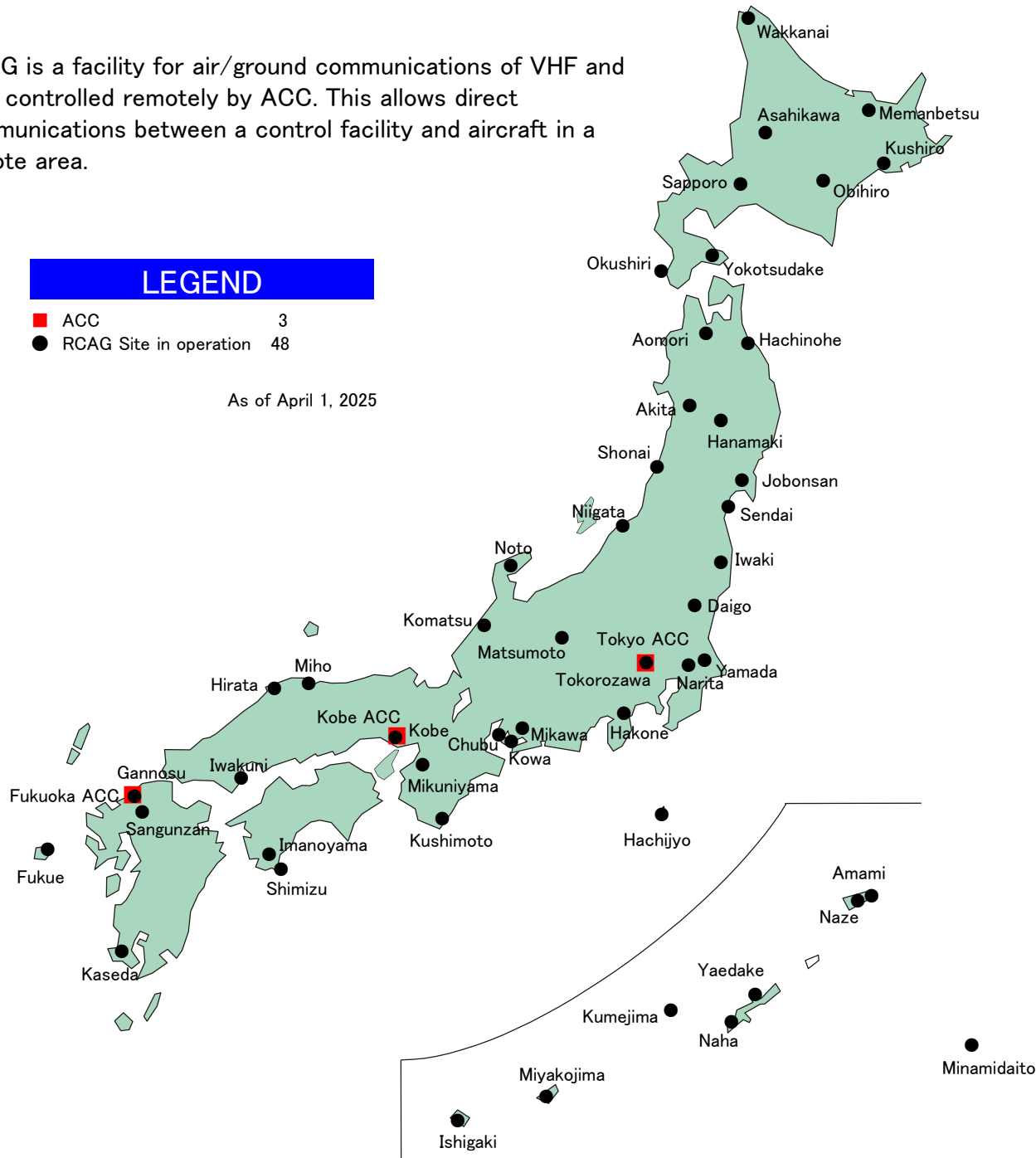
46 RCAG (Remote Communications Air-Ground)

RCAG is a facility for air/ground communications of VHF and UHF controlled remotely by ACC. This allows direct communications between a control facility and aircraft in a remote area.

LEGEND

- ACC 3
- RCAG Site in operation 48

As of April 1, 2025



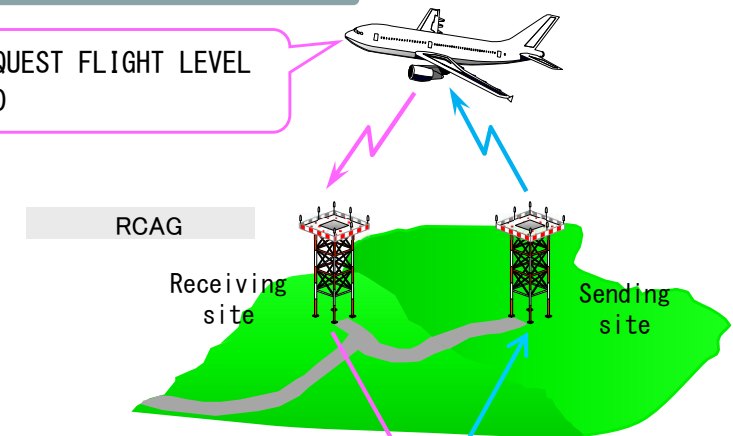
RCAG



ACC

Example of the use of RCAG

REQUEST FLIGHT LEVEL
280



CLIMB AND MAINTAIN
FLIGHT LEVEL 280



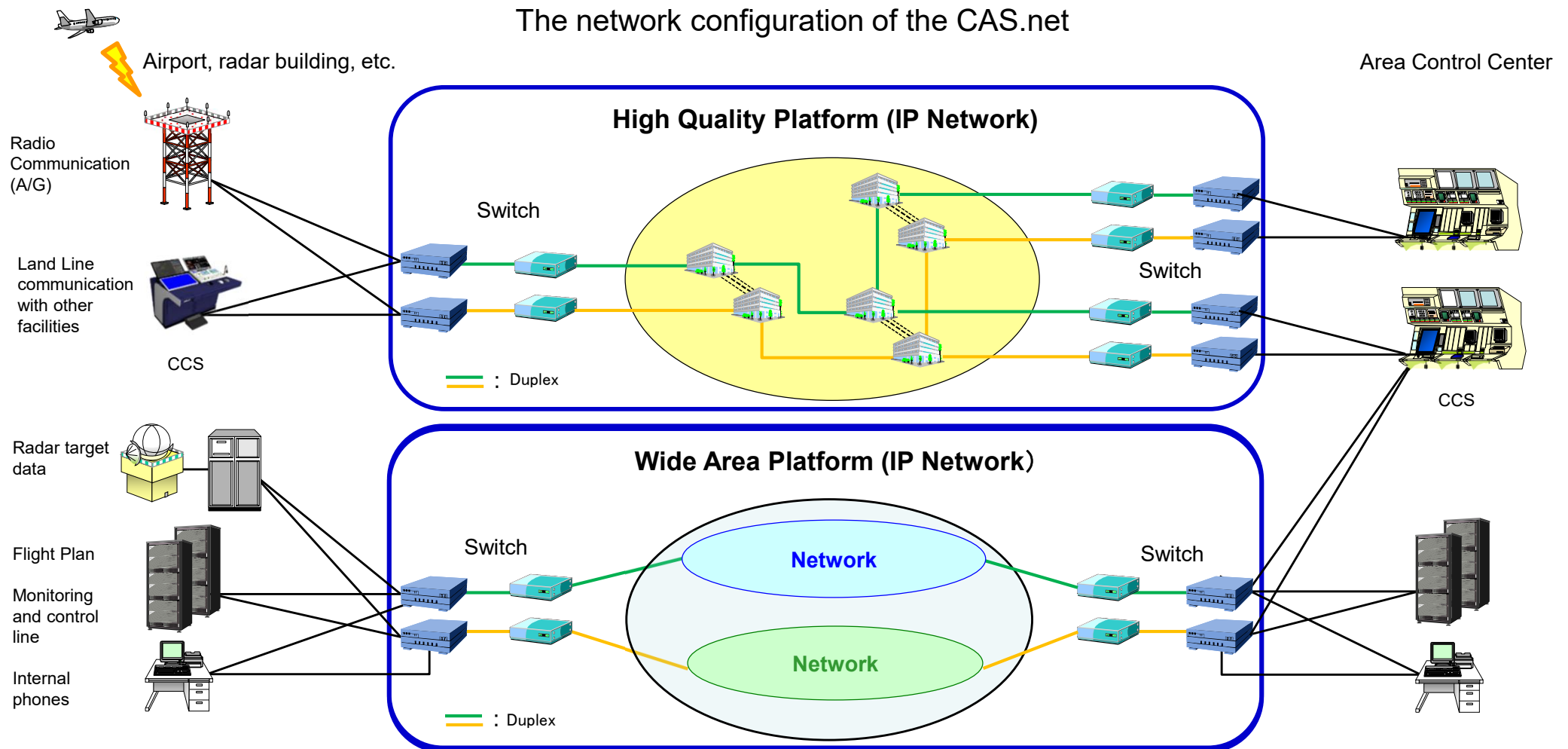
47 CAS.net (Civil Aviation Bureau Air Traffic Services Network)

CAS.net : Civil aviation bureau Air traffic Services network

CAS.net is a circuit network for reliable and stable aviation security operations and is constructed and operated as a network dedicated to the Civil Aviation Bureau to prevent unauthorized access from systems outside the Civil Aviation Bureau. The network is also duplicated to ensure safe and stable aircraft operations and is used for a wide variety of circuits required between various government offices, such as the ATC, airports, and radar stations.

High Quality Platform : Accommodates ATC communication that requires high quality such as low Transmission delay.

Wide Area Platform : Accommodates ATC communication other than High Quality Platform, and radar target data etc.



48 Data Link Communication (CPDLC, DCL)

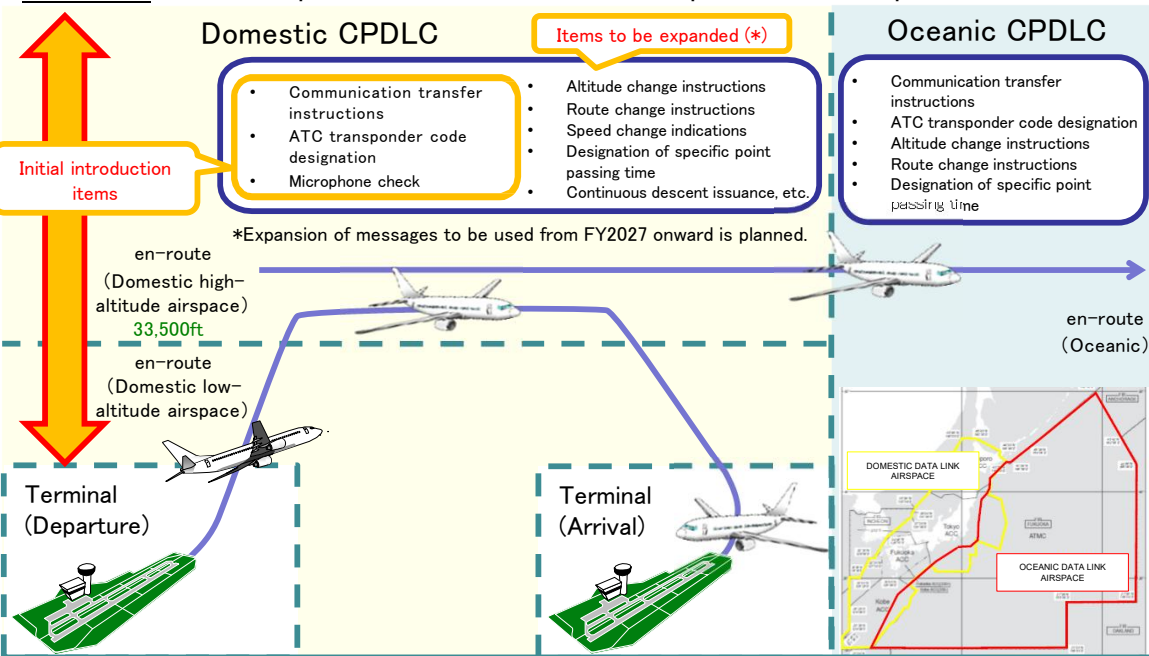
CPDLC: Controller – Pilot Data Link Communications

The CPDLC replaces voice communications with textual information between air traffic controllers and pilots. It contributes to the reduction of errors and workloads through the use of written information, and to the effective use of frequency resources through the reduction of voice communications. In addition, when used in conjunction with other position information monitoring equipment, the CPDLC contributes to shorter control intervals in offshore datalink airspace.

DCL: Departure Clearance by data link

The DCL is a datalink communication for flight plan approval.

CPDLC (Service provided at all altitudes except terminal airspace)



March 2022– Trial operation started (Altitude: 33,500 ft or higher, Message limited)

March 2023– Formal operation started (Altitude: unlimited (except terminal airspace), Message limited)

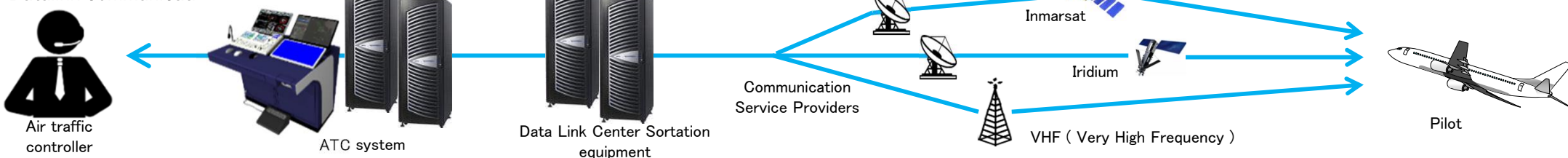
DCL

Introduced Airports: Narita INTL, Tokyo INTL, Chubu Centrair INTL, Kansai INTL, Osaka INTL, Fukuoka, Kagoshima, Naha (As of April 1, 2025)

Jun 2012– : Trial operation started at Narita INTL and Tokyo INTL
Aug 2015– : Formal operation started at Narita INTL and Tokyo INTL
Nov 2021– : Introduced at Kansai INTL and Osaka INTL
Mar 2022– : Introduced at Fukuoka
Feb 2023– : Introduced at Chubu Centrair INTL and Kagoshima
Jun 2024– : Introduced at Naha



Datalink communication flow



49 DAPs-ADS-B

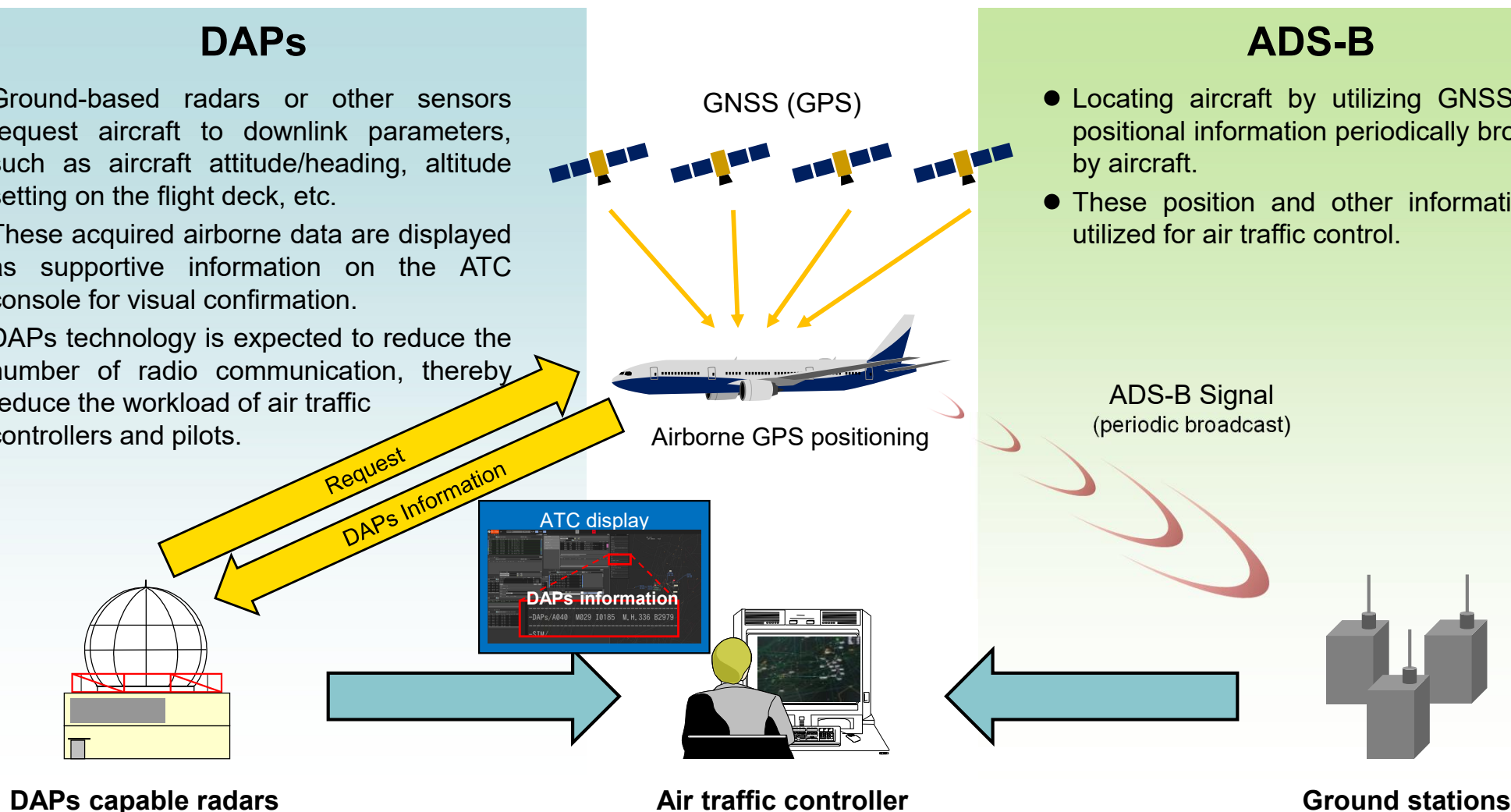
- DAPs (Downlink Aircraft Parameters) is the technology to acquire aircraft dynamic information, such as aircraft attitude and altitude setting, by sending request signal from the ground.
- ADS-B (Automatic Dependent Surveillance-Broadcast) is the technology in which aircraft periodically broadcasts its GNSS-based positional information.
- Both DAPs and ADS-B are technologies for acquiring various information from aircraft, and are expected to be utilized for supporting/enhancing air traffic service.

DAPs

- Ground-based radars or other sensors request aircraft to downlink parameters, such as aircraft attitude/heading, altitude setting on the flight deck, etc.
- These acquired airborne data are displayed as supportive information on the ATC console for visual confirmation.
- DAPs technology is expected to reduce the number of radio communication, thereby reduce the workload of air traffic controllers and pilots.

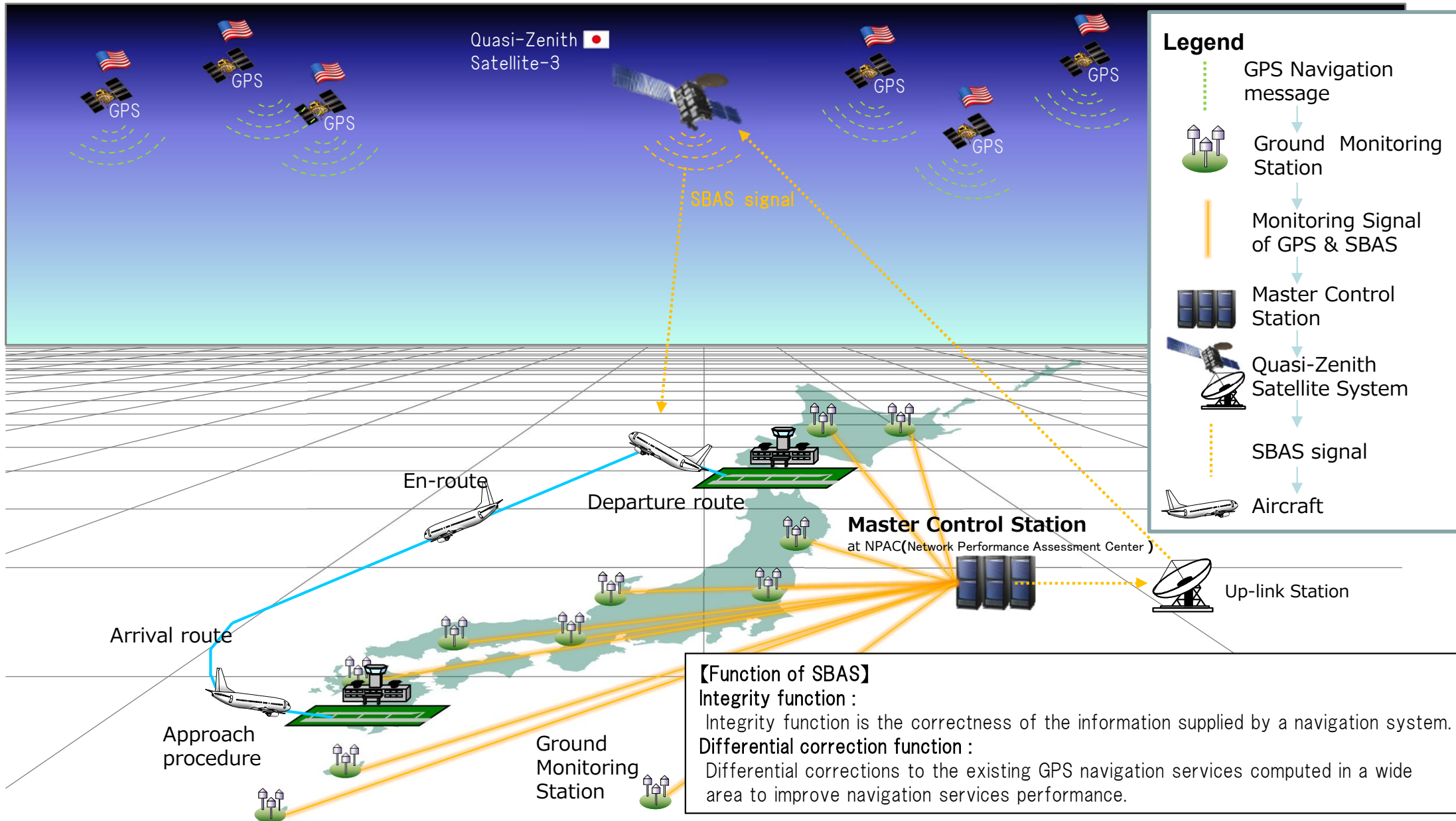
ADS-B

- Locating aircraft by utilizing GNSS-based positional information periodically broadcast by aircraft.
- These position and other information are utilized for air traffic control.



50 SBAS (Satellite Based Augmentation System)

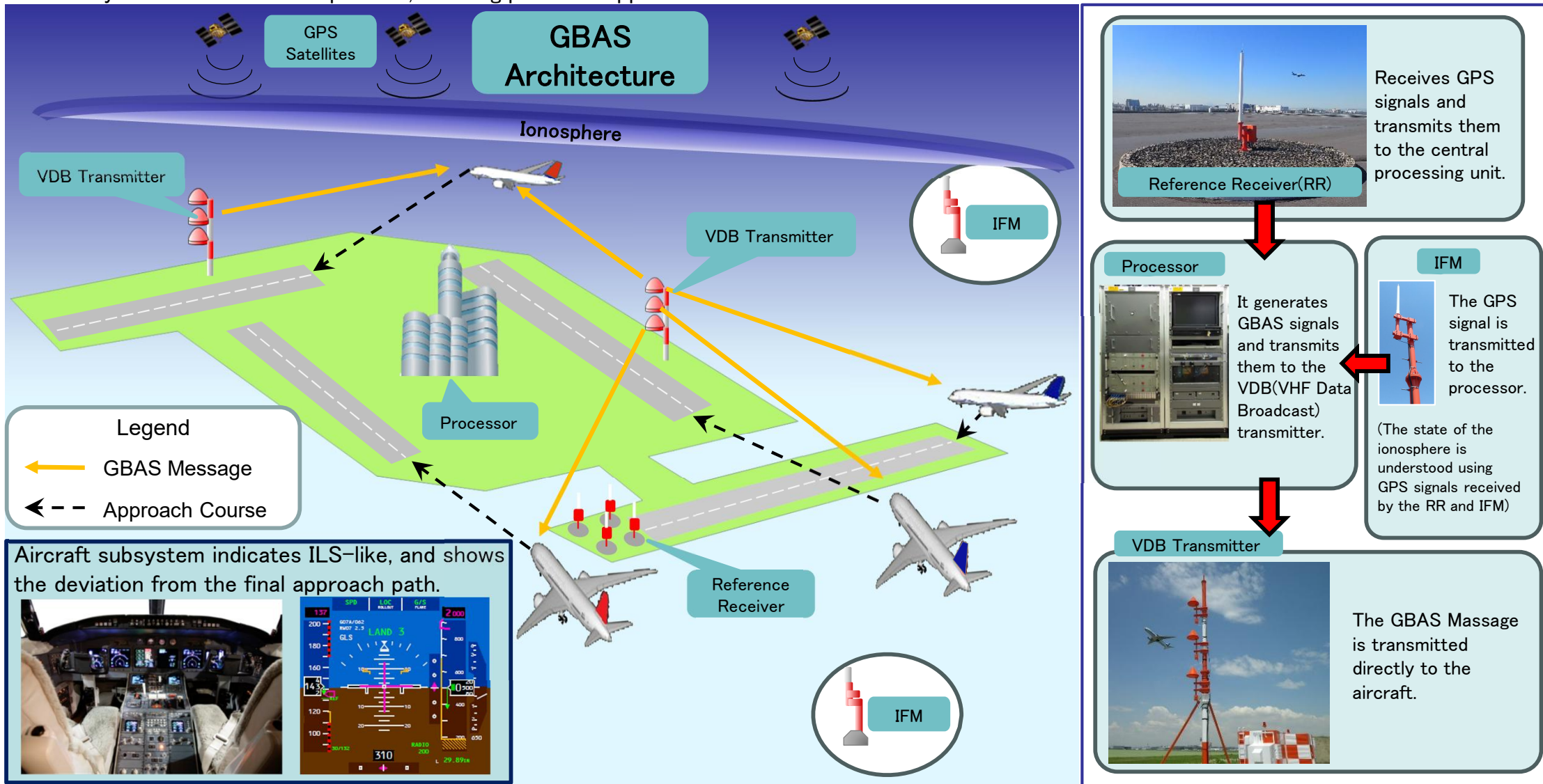
SBAS uses monitoring stations to monitor GPS satellite positioning errors and anomalies, and transmits that information (SBAS signals) to aircraft via geostationary satellites to enhance navigation. Aircraft benefit from improved positioning performance through the SBAS signal, and by using only accurate information, safer navigation using satellite navigation is possible from departure to arrival.



51 GBAS(Ground Based Augmentation System)

GBAS(Ground Based Augmentation System)

GPS satellite signals can experience positioning errors due to the effects of ionospheric conditions and satellite orbit errors. GBAS is a system that monitors GPS satellite positioning errors and anomalies using a reference receiver and IFM(Ionosphere Field Monitor), corrects the positioning errors, and then transmits information about the reliability of the GPS signal, as well as final approach route information(GBAS Message), to aircraft via radio waves from the ground. Aircraft approaching using the GLS system can use the GBAS Message to correct errors in GPS positioning, allowing them to accurately determine their own position, enabling precision approach.



52 Aeronautical Lighting System

Aeronautical lighting systems aid the navigation of aircraft by lighting. They are three types as follows.

(1) Aeronautical beacon (■)

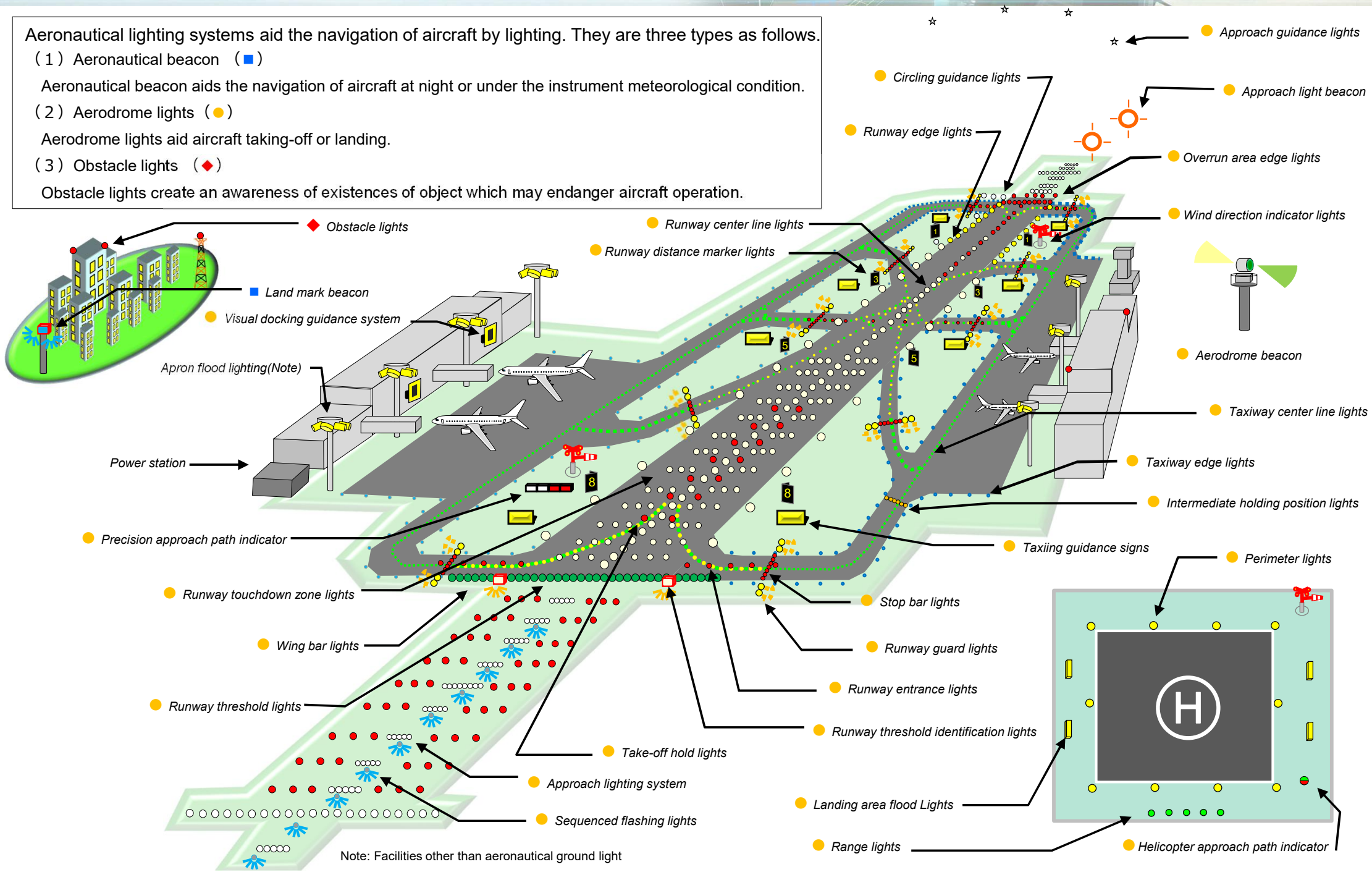
Aeronautical beacon aids the navigation of aircraft at night or under the instrument meteorological condition.

(2) Aerodrome lights (●)

Aerodrome lights aid aircraft taking-off or landing.

(3) Obstacle lights (◆)

Obstacle lights create an awareness of existences of object which may endanger aircraft operation.

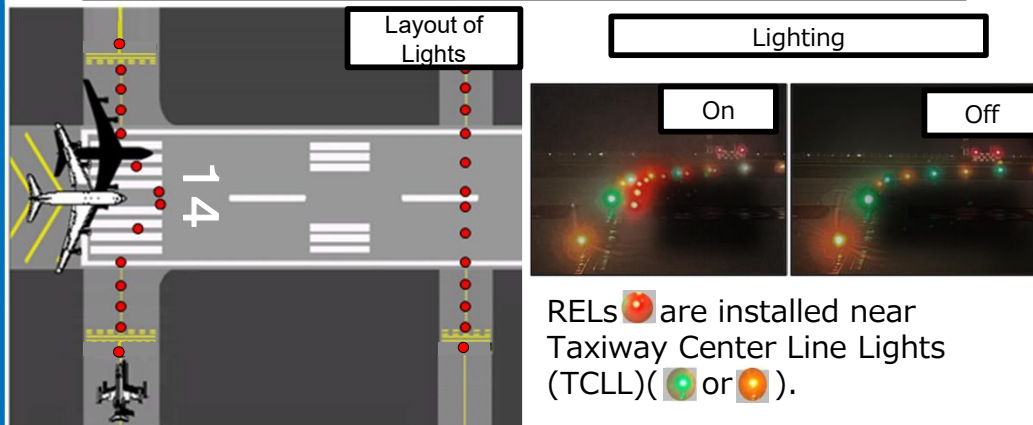


53 Runway Status Lights

【Runway Status Lights (RWSL)】

- ➔ Runway Status Lights (RWSL) is lighting system to warn to aircraft pilots or vehicle drivers who intend to take-off from or cross a runway when the runway is occupied by the other aircraft or vehicles.

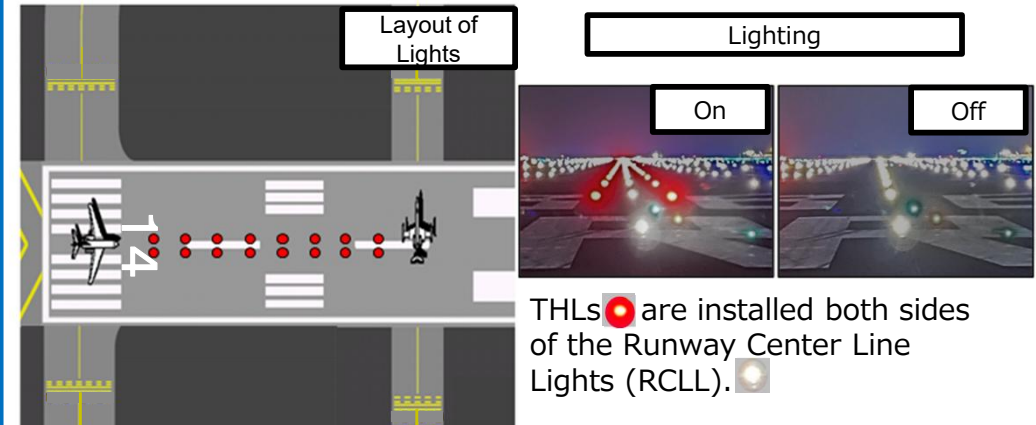
Runway Entrance Lights (REL) Prevention of runway incursions



RELs illuminate to indicate that it is dangerous to enter to aircraft pilots who intend to cross a runway when the runway is occupied by the other aircraft taking-off or landing.

【Installed at New Chitose Airport, Osaka Airport, Fukuoka Airport, Naha Airport】

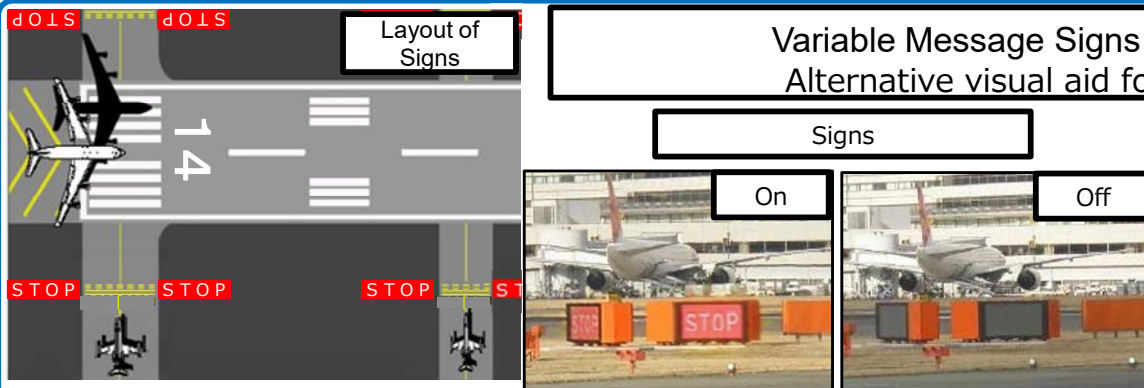
Takeoff Hold Lights (THL) Prevention of accidents during taking-off



THLs illuminate to indicate that it is dangerous to take-off from a runway to an aircraft pilot who intend to do so when the runway is occupied by the other aircraft crossing.

【Installed at New Chitose Airport, Osaka Airport, Fukuoka Airport, Naha Airport】

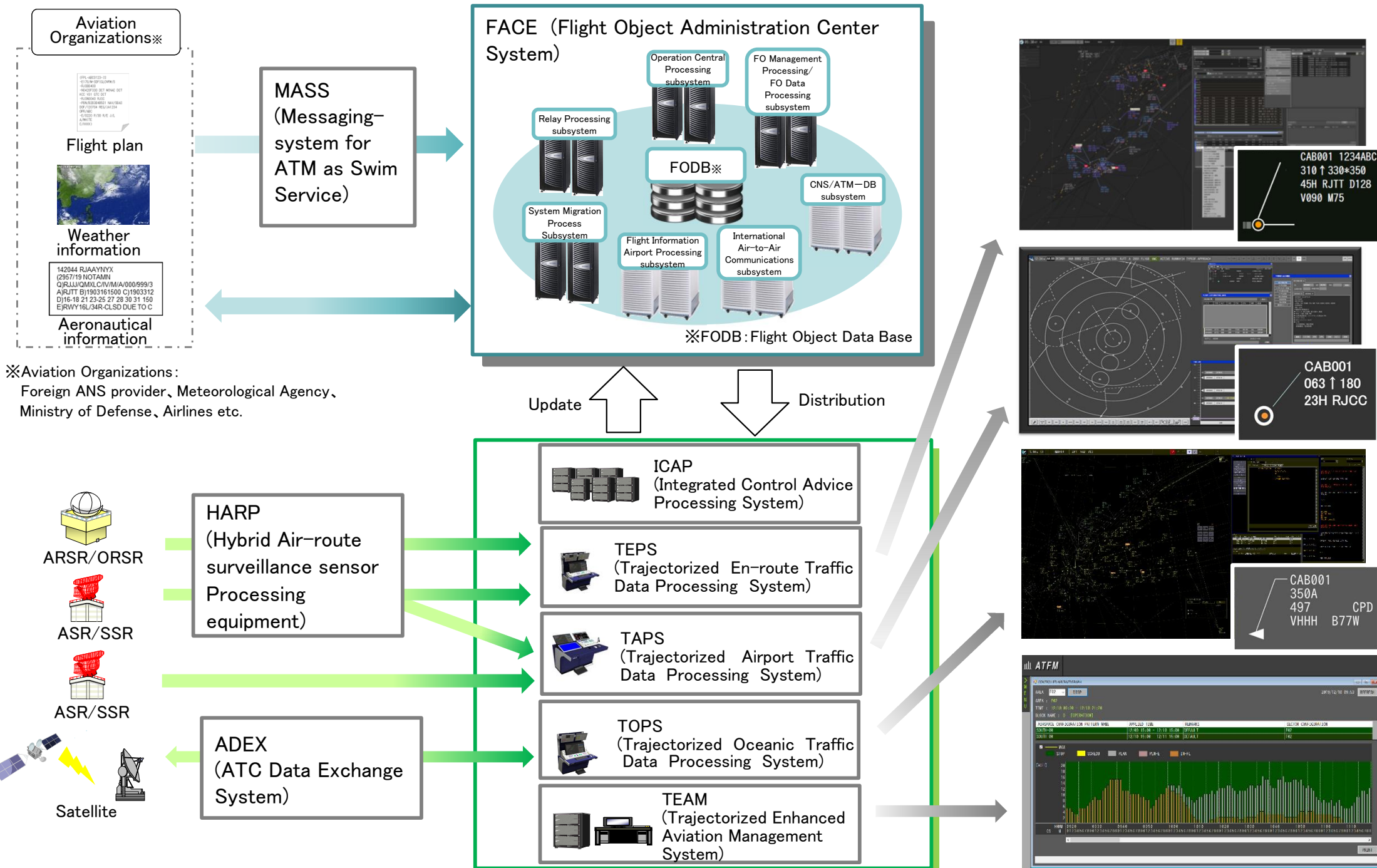
Variable Message Signs (VMS) Alternative visual aid for REL



- At Tokyo International Airport, VMSs are installed in the green area by runway entrances instead of RELs that are inset lights.
- VMSs display "STOP" to indicate that it is dangerous to enter a runway to aircraft pilots who intend to cross the runway when the runway is occupied by the other aircraft taking-off or landing. The objectives are equal to RELs.

【Installed at Tokyo International Airport】

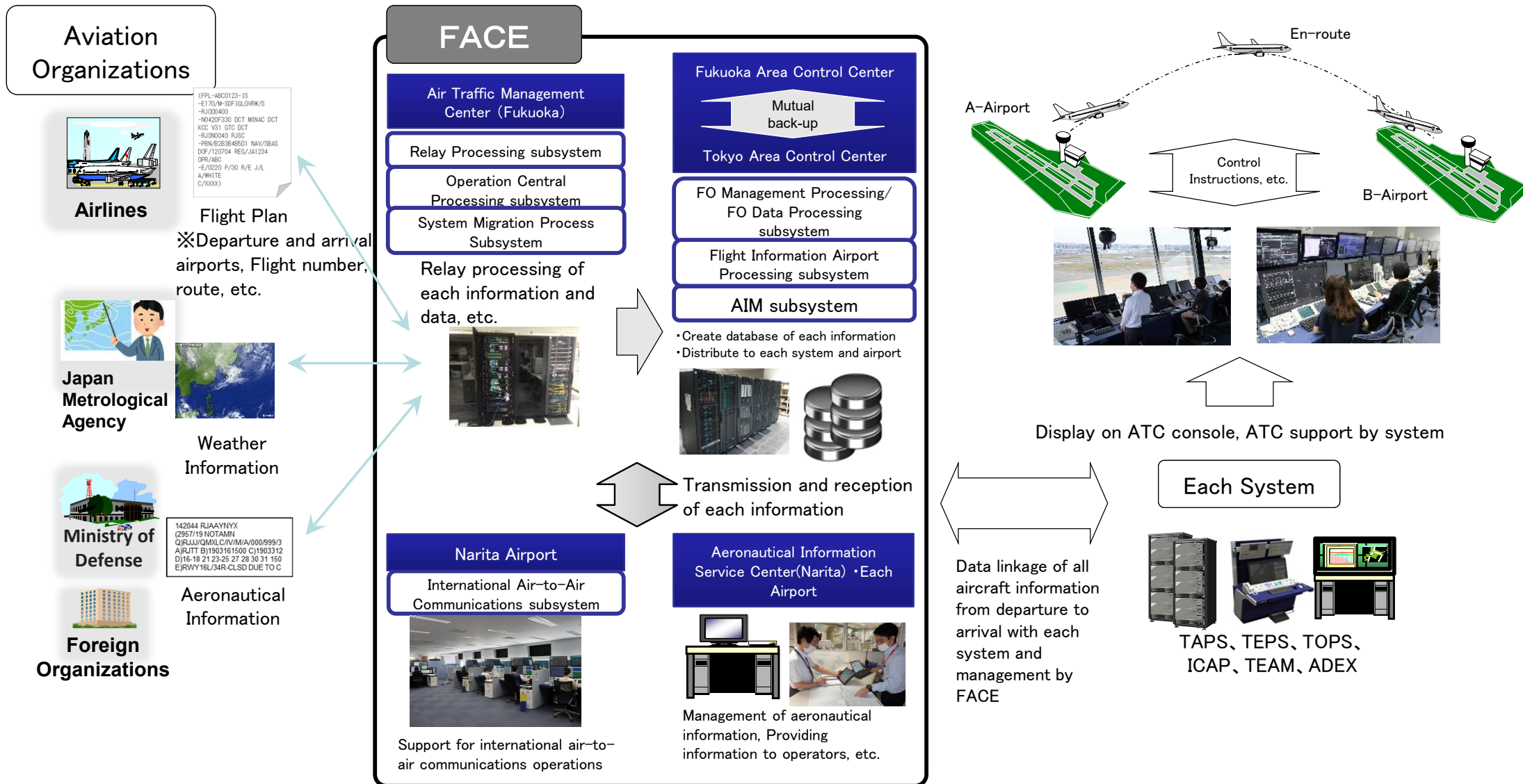
54 ATC Data System Concept Chart



55 FACE (Flight Object Administration Center System)

FACE (Flight Object Administration Center System)

FACE is the central system in the ATC Data that compiles a database of flight plan information (flight numbers, flight routes, etc.) and other information related to flight operations (aeronautical information, weather information, etc.), distributes these information to various systems, and exchanges information with related domestic and foreign organizations.

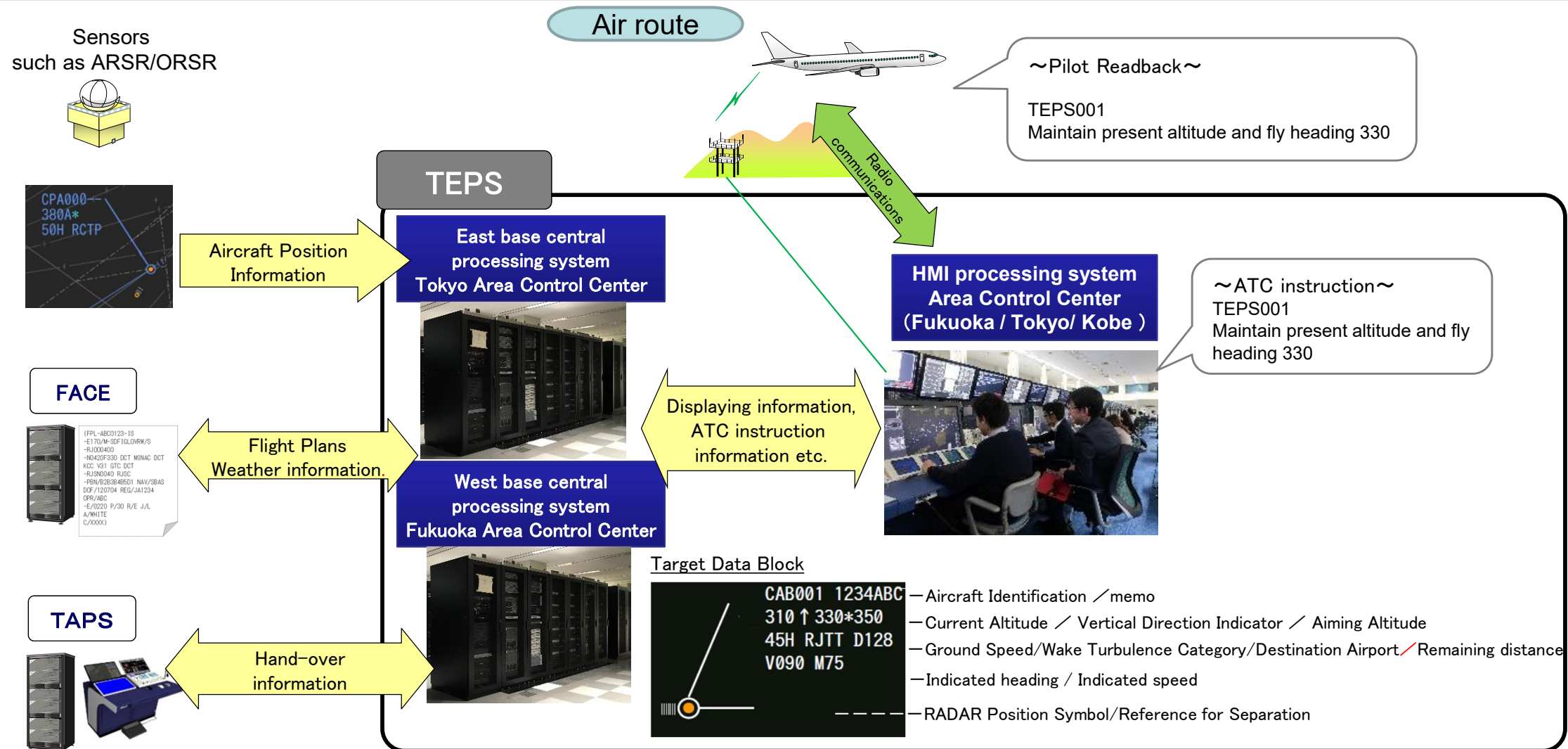


56 TEPS (Trajectorized En-route Traffic Data Processing System)

TEPS (Trajectorized En-route Traffic Data Processing System)

TEPS is a system supports air traffic control for aircraft operating on ATS routes.

TEPS integrates aircraft position information from radars and flight plan information from FACE and presents necessary information for air traffic control operation which is aircraft position and aircraft information, such as flight number, altitude, aircraft type, and predicted position information, on the ATC console displays.

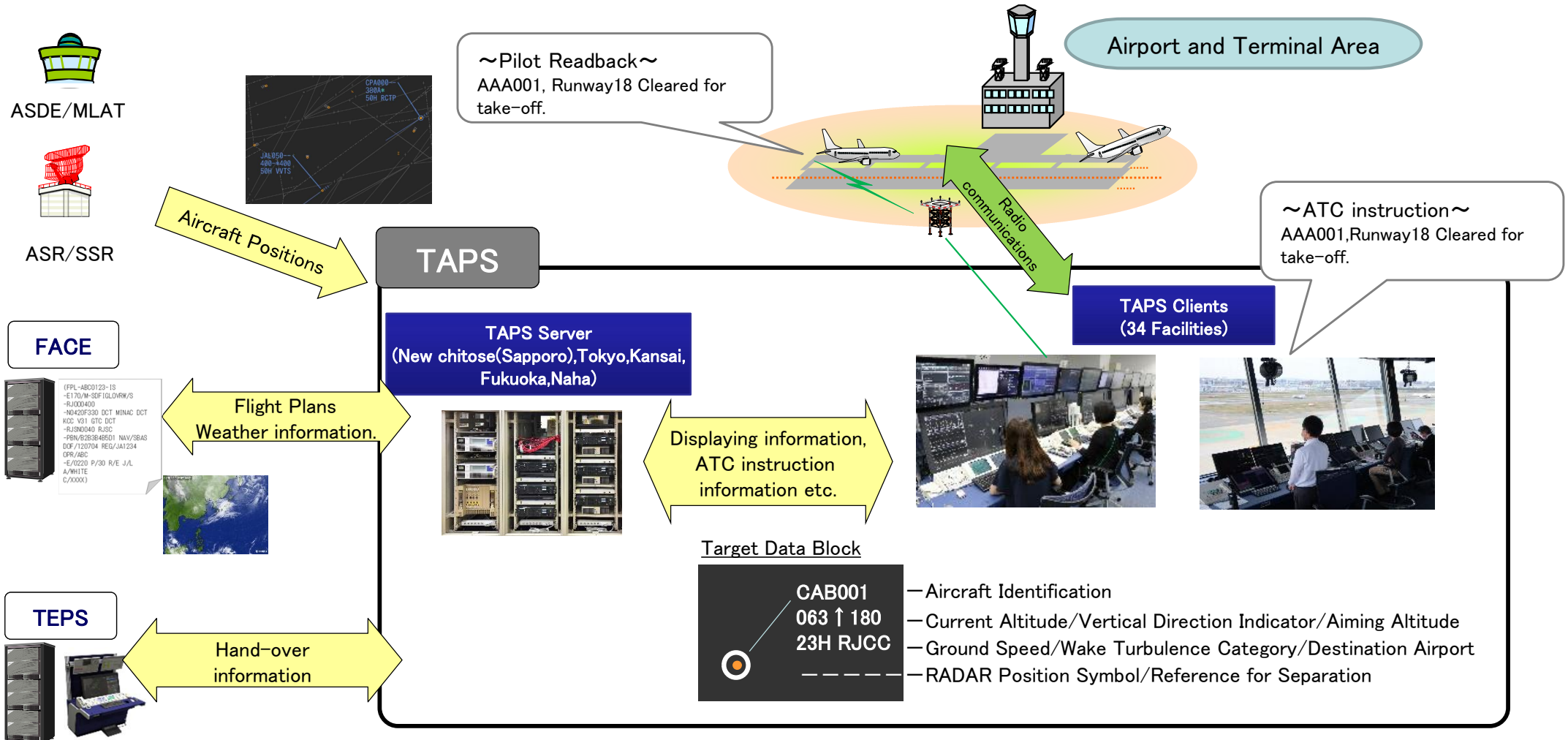


57 TAPS (Trajectorized Airport Traffic Data Processing System)

TAPS (Trajectorized Airport Traffic Data Processing System)

TAPS is a system supports the air traffic control services for aircraft taking off and landing at airports.

TAPS processes information on aircraft operating at airport (flight number, altitude, type of aircraft, predicted position, etc.) by combining aircraft position information from sensors (Radar/MLAT) and flight plan information from FACE, and then display those information on the console.



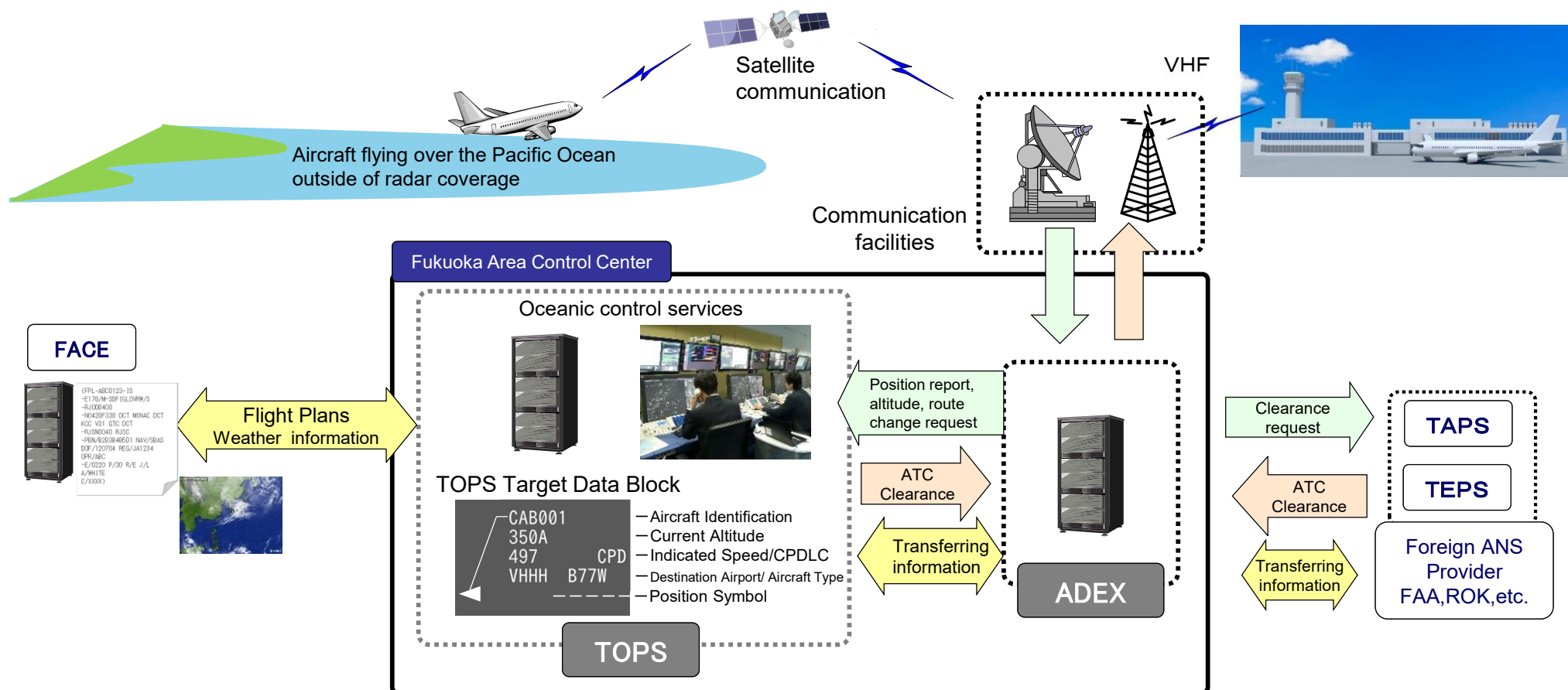
TOPS (Trajectorized Oceanic Traffic Data Processing System)/ ADEX (ATC Data EXchange system)

TOPS (Trajectorized Oceanic Traffic Data Processing System)

TOPS is used to support Oceanic control service. TOPS displays aircraft information (flight number, altitude, type, of aircraft, estimated aircraft position, etc.) and other information on the console display using position information received via satellite communications and flight plan information from FACE from aircraft flying over the Pacific Ocean, where there is no radar coverage.

ADEX (ATC Data EXchange System)

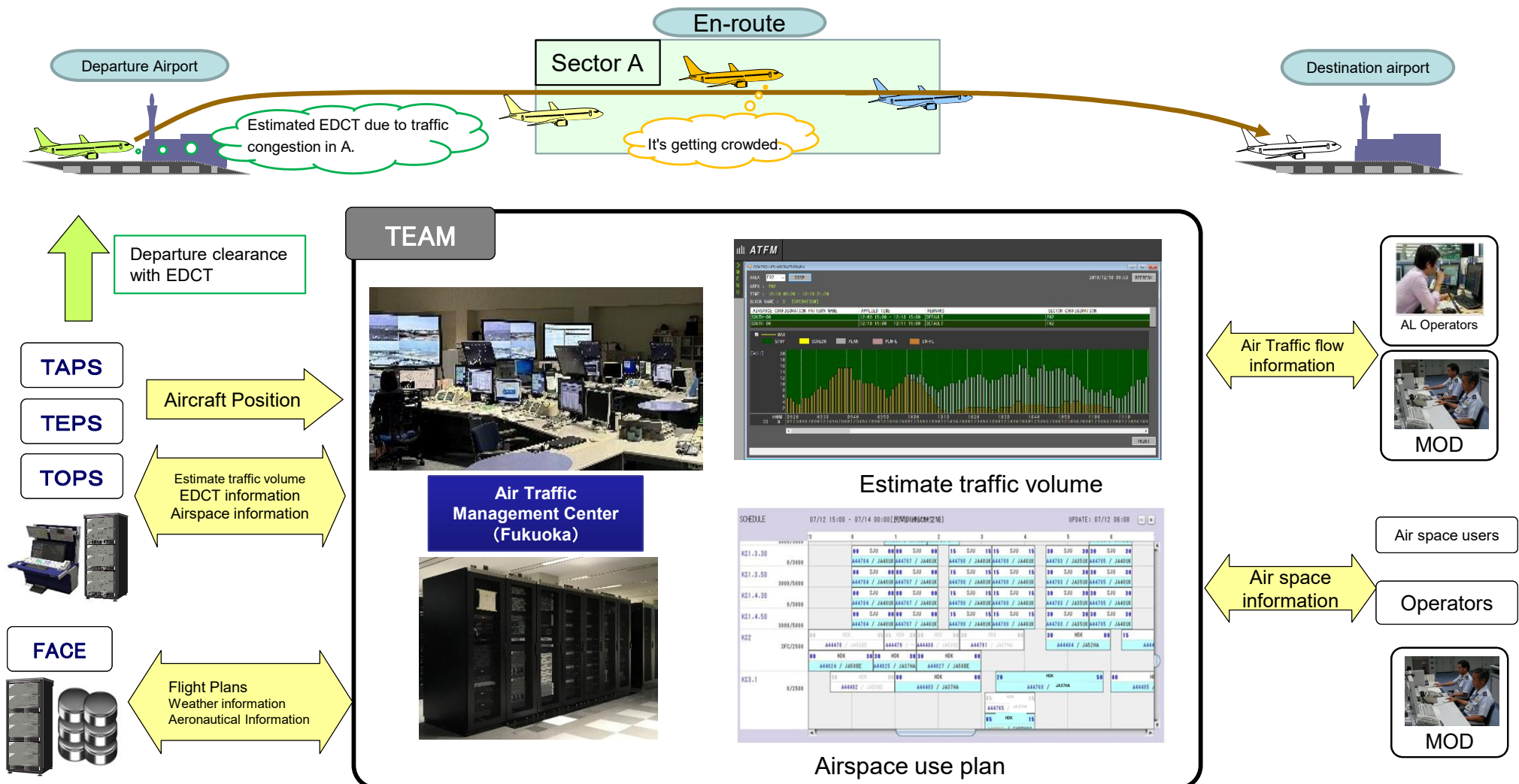
ADEX relays digitalization information on ATC clearance between aircraft and air traffic controllers or on transfer information between Japan and foreign ATC providers and transmits these information to the necessary facilities and systems.



59 TEAM (Trajectorized Enhanced Aviation Management System)

TEAM (Trajectorized Enhanced Aviation Management System)

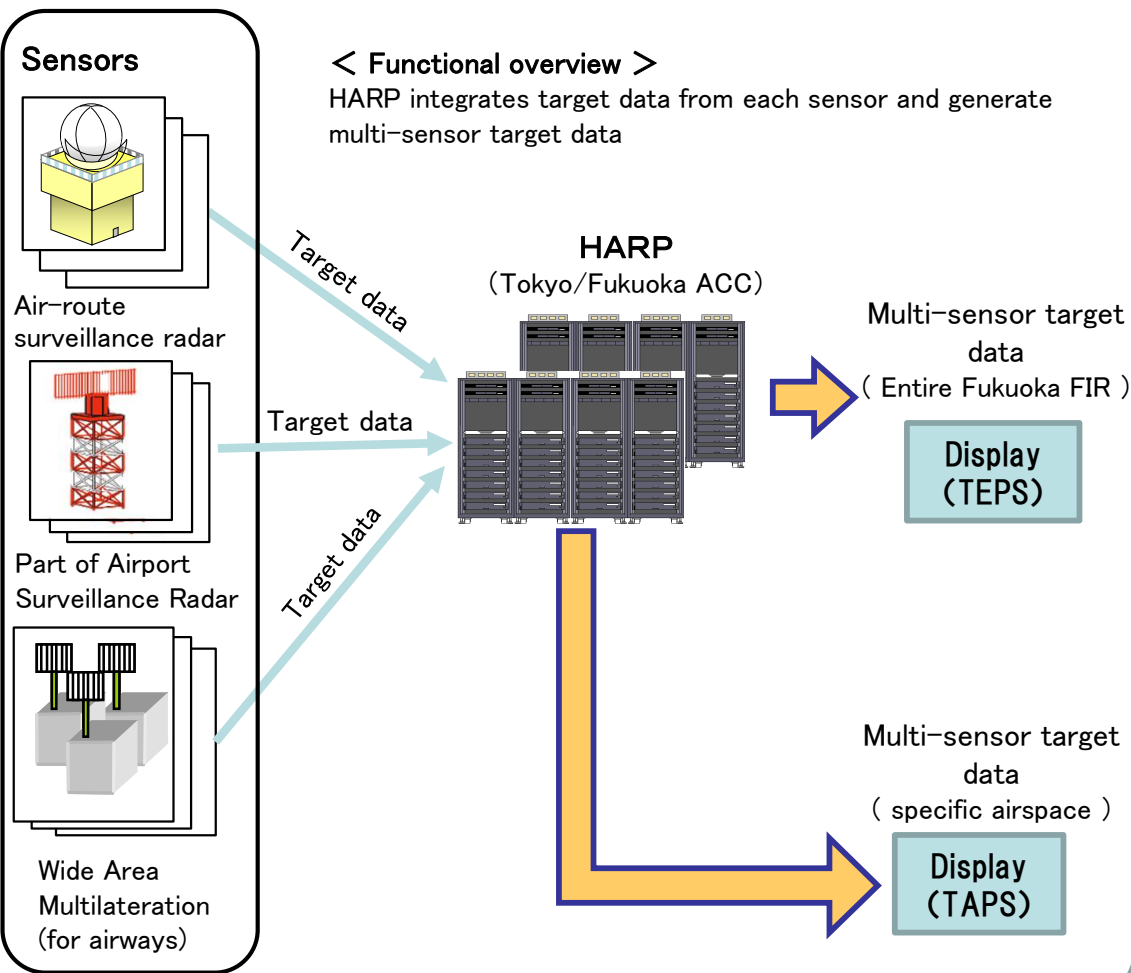
TEAM is a system that supports the management of airspace and air traffic flows to reduce air traffic congestion. In order to avoid the over concentration of aircraft on specific air routes and airports, TEAM predicts traffic volumes based on aircraft position information from TAPS and other systems, flight plans from FACE and airspace information, and displays information for air traffic management.



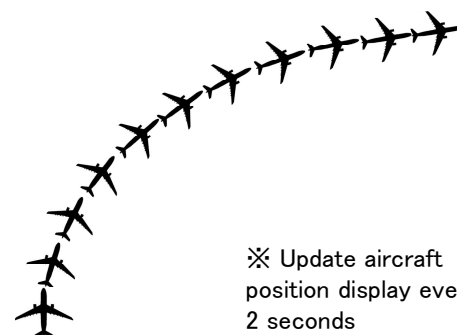
60 HARP (Hybrid Air-route suRveillance sensor Processing equipment)

HARP receives target data from Air-route Surveillance Radars, Airport Surveillance Radars and Wide Area Multilaterations all over Japan, and calculates the aircraft's position by integrated processing. Then it outputs to display (TEPS) for every 2 seconds as multi-sensor target data.

< Schematic >



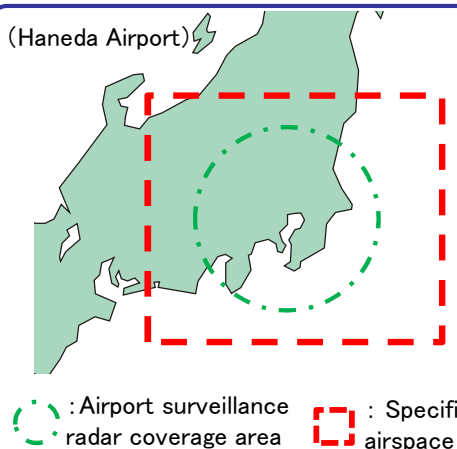
< HARP output (TEPS display) image >



Up until now updated aircraft position detected by the Air Route Surveillance Radar every 10 seconds, but target data from each sensor integrated processing by HARP, updated every 2 seconds. Highly accurate aircraft position detection realized by receiving target data from several sensor.

※ Update aircraft position display every 2 seconds

< HARP output (TEPS display) image >



Up until now can display only aircraft positions within airport surveillance radar coverage, but extracts targets in specific airspace from multi-sensor target data of output from HARP, can display outside airport surveillance radar coverage

○ : Airport surveillance radar coverage area
□ : Specific airspace

61 ICAP (Integrated Control Advice Processing System)

ICAP (Integrated Control Advice Processing System)

ICAP calculates trajectory* of each IFR aircraft within Fukuoka FIR, and predicts and provides position of each aircraft, altitude, and speed to systems, TEAM, TEPS, TAPS, TOPS, utilized for air traffic control. ICAP servers are located at the Fukuoka and Tokyo Area Control Center. In addition, ICAP allocates discrete beacon codes (DBC) to aircraft operates within Fukuoka FIR which is used to match radar information with flight plans.

* Trajectory: a predicted path calculated by adding time information to its geographical coordinates and altitude.

Trajectory calculated by ICAP

Prediction information

ICAP provides the necessary predictive information to each system before the aircraft departs.

- Altitude
- Longitude
- Latitude
- Speed
- Course
- Estimated time of passage

Cruising altitude reaching point

Estimated departure time

Starting point of descent

Estimated land time

Trajectory of each flight

Trajectory

ICAP

Trajectory

TEPS·TAPS·TOPS

TEAM

- Efficient control based on predictive information
- Proximity warning as a safety measure

- Air traffic flow management
- Airspace management
- Proposal of routes to avoid congestion

ICAP provides calculated trajectory of all aircraft fly within Fukuoka FIR used for aiming to predict airspace congestion and aircraft collision threats by each system.

Estimated time for entering Fukuoka FIR

Estimated time for leaving Fukuoka FIR

Trajectory of Fukuoka FIR

62 Airport Electric Power Supply Facilities

Airport power substation obtain commercial power for high-voltage or very high-voltage from electric power company. The substation drops the voltage and supply power to each Air Traffic Service facilities etc. through widely interconnected electricity network. In case of outage of commercial power, the substation steadily continues power supply through airport emergency generator or uninterruptible power supplies.

Normal

From
power
company



Primary Power



Unit Substation

Primary power source is commercial power from electric power company. The voltage of Primary power is dropped at Unit Substation for power supply to each facility.

Airport Office



In case of outage of Commercial power

Secondary Power



Emergency
Generator

Secondary power source is emergency generator. When primary power supply stops, Emergency generator automatically starts up and supplies secondary power to each facility within a maximum of 15seconds. Emergency generator keep to operate for 72 hours without refueling.

Uninterruptible Power



Uninterruptible power
supplies

Uninterruptible Power source is Uninterruptible power supply. Uninterruptible power supplies continue constant and stable power supply through contained batteries during outage of primary power. It is used for radar, communication equipment, computers, etc., which are required to keep to obtain constant and stable power with a momentary power outage.

LOC



GS



VOR/DME

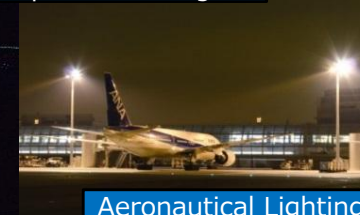


Radio Navigation Aids

PALS



Apron Flood Lights



Aeronautical Lighting

TSR



ASDE



Control Tower



63 Standby Power Supply Equipment

Commercial power supplied from electric power company has various risks such as power outage and instantaneous voltage fluctuations due to the natural disasters such as typhoons, earthquakes, lightning strikes, and snowfall.

In preparation for these risks, we have installed standby power supply equipment to provide stable power supply to air navigation facilities and support the stable operation of radio facilities and air traffic control system.

Emergency power generation equipment

When power outage occurs, diesel engine generator supplies power to air navigation facilities in 10 second.



Transportable power generation equipment

Transportable power generation equipment is installed at airport etc. when maintenance for emergency power generation equipment or when being affected by natural disaster. There are 44 units deployed at major airports and remote islands across the country.



Uninterruptible power supply equipment

Momentary power failures and voltage fluctuations is not acceptable for air traffic control system etc. Uninterruptible power supply equipment supplies stable power to air traffic control system etc.



64 Emergency ATC Towers and Emergency Radar Facilities

Emergency ATC towers and emergency radar facilities

When any airport ATC tower or radar control room suffers devastating damage due to an earthquake, fire or any other disaster, and it is expected to take a long time to restore its functions, an emergency ATC tower or emergency radar facility will be transported to and made available at the scene in the replacement of the damaged facility.

Presently, three emergency ATC towers and three emergency radar facilities are stored separately at three airports (Tokyo International Airport, Osaka International Airport, and Fukuoka Airport).



Emergency ATC tower

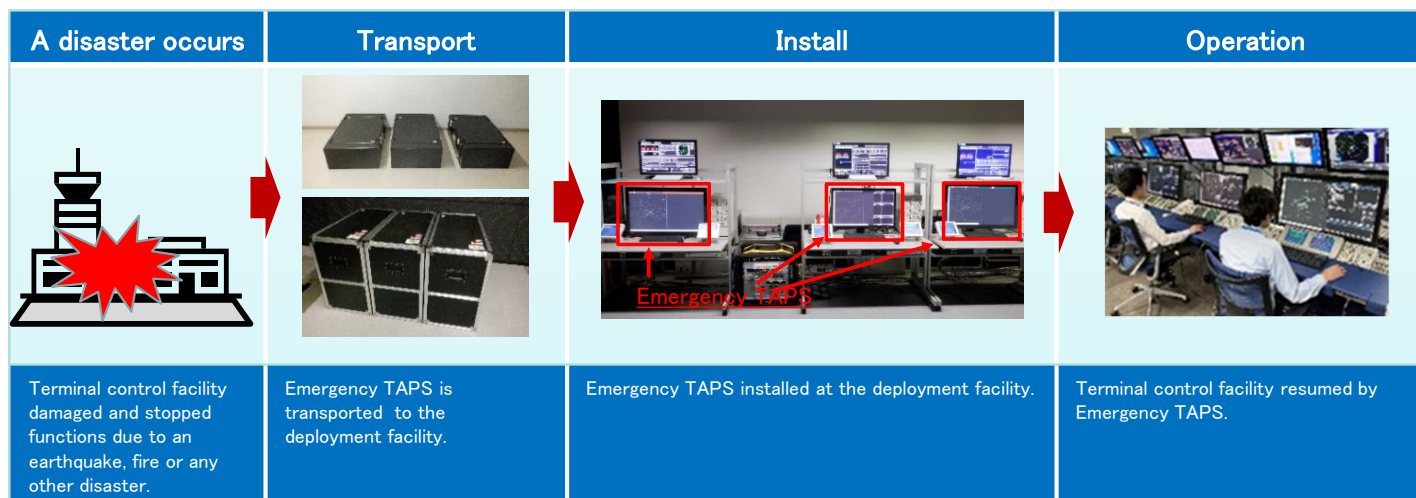
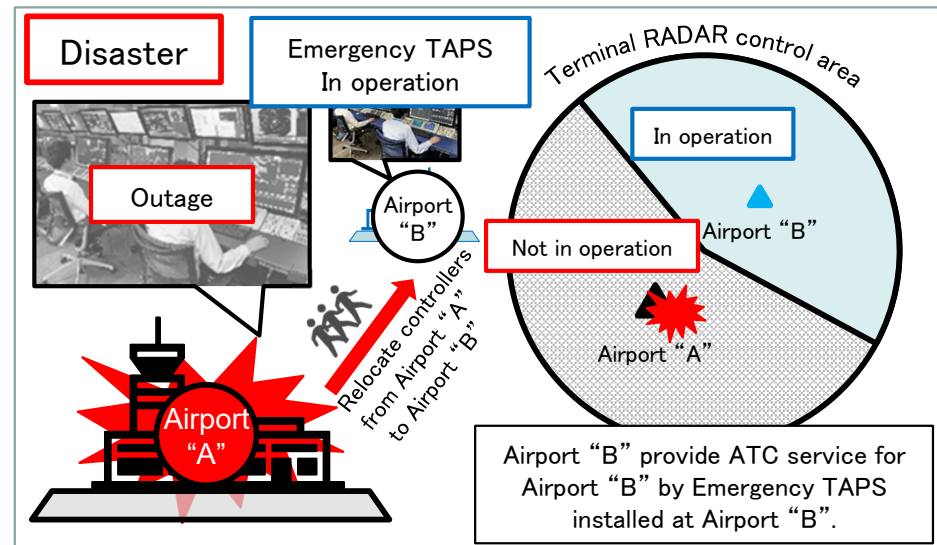
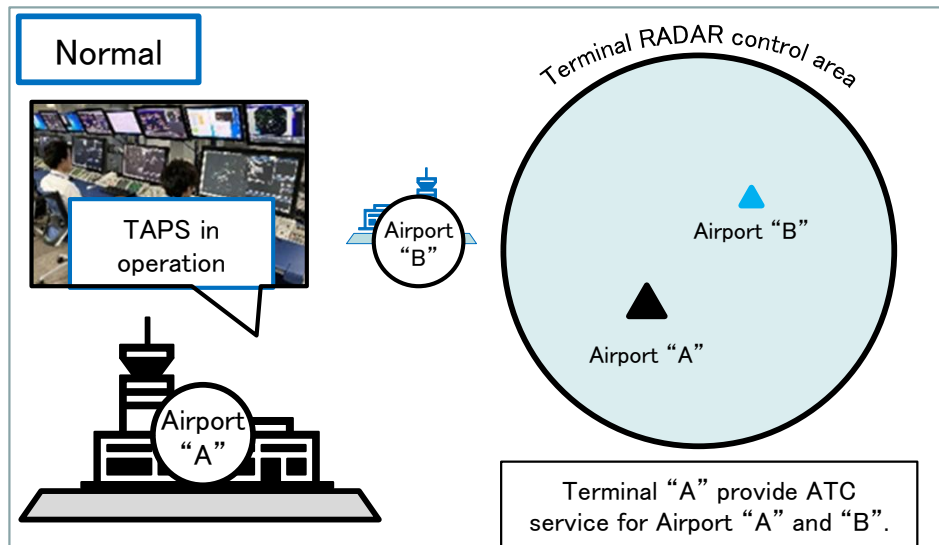


Emergency radar facility



65 Emergency TAPS

Emergency TAPS (Trajectorized Airport Traffic Data Processing System) is the equipment to continue ATC services when terminal control facility that provide ATC for multiple airports has been damaged and stopped functions due to an earthquake, fire or any other disaster.



Affected facility	Deployment facility
New chitose (Sapporo)	Hakodate
Tokyo	Narita
Kansai	Osaka, Kochi, Takamatsu
Kagoshima	Miyazaki
Naha	Ishigaki, Shimojishima

※Storage facility

Always storage	Storage for transport
Narita × 1	Miyazaki × 2 (2025FY)
Osaka × 1	Osaka × 1 (2025FY)

66 Emergency Equipment (Aerodrome Lights and Electrical Facilities)

If aerodrome lights and electric facilities is failure due to disaster or other issues, emergency equipment is tentatively set and used to ensure safe flight operation.

Portable Aerodrome Lights



Runway edge lights

Runway threshold lights

Portable aerodrome lights consist of Portable Runway edge lights and Portable Runway threshold lights.

Portable aerodrome lights are provided when runway edge lights and runway threshold lights which have been installed at aerodrome are failure due to disaster or other issues to ensure safe flight operation for aircraft taking off or landing on a runway at night.

The power source of portable aerodrome lights is dry cell battery.

Portable constant current regulator



Portable constant current regulator (CCR) is tentative power supply and light intensity control equipment for runway edge lights, runway threshold lights and precision approach path indicator. Portable CCRs are provided when CCRs which have been installed at aerodrome are failure due to disaster or other issues. Portable CCRs have been prepared in airports at New Chitose, Tokyo, Osaka, Fukuoka, and Naha.

Portable Substation



Portable Substation is tentative substation optimized for ILS facilities. Portable substations are directly connected to ILS facilities power lines when power supply from aerodrome substation is outage due to disaster or other issues. Portable substations have been prepared in airports at New Chitose, Osaka, Fukuoka, and Naha.

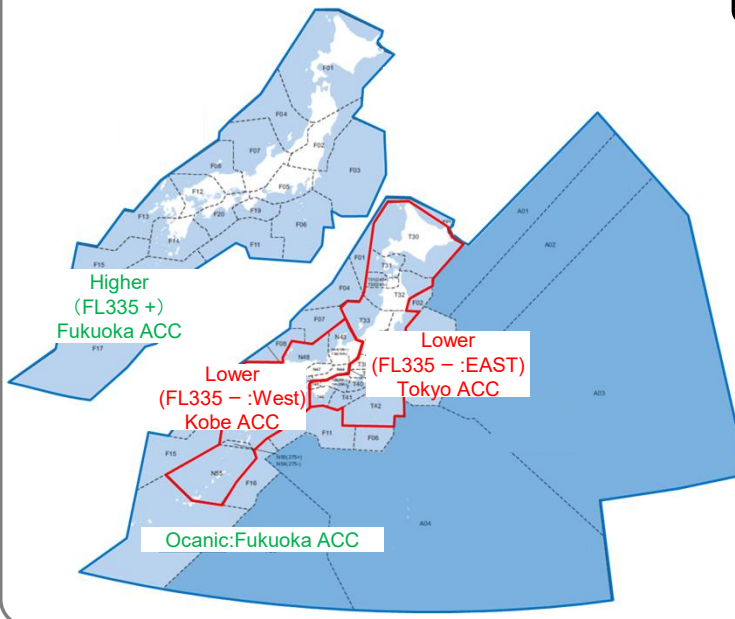
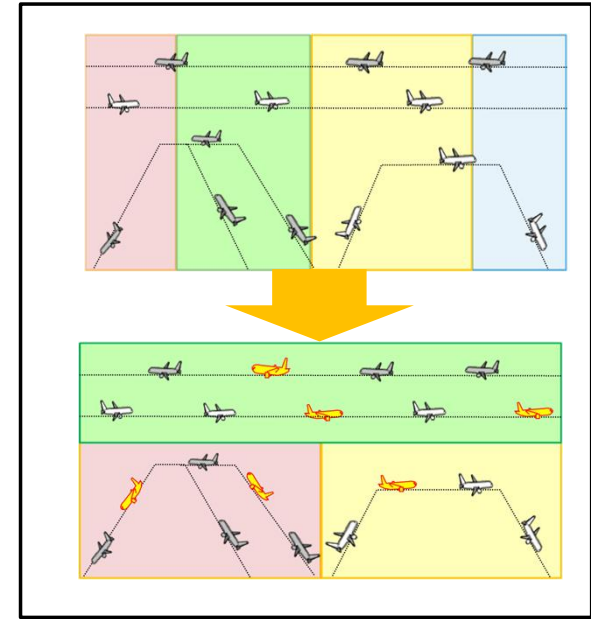
67 Restructure of Domestic Airspace (En-route airspace)

In order to expand air traffic capacity at congested airports and airspace in the Tokyo metropolitan area and other regions, and to accommodate future increases in air traffic, a fundamental reorganization (vertical separation) of domestic air traffic control airspace was implemented in stages and completed in March 2025.

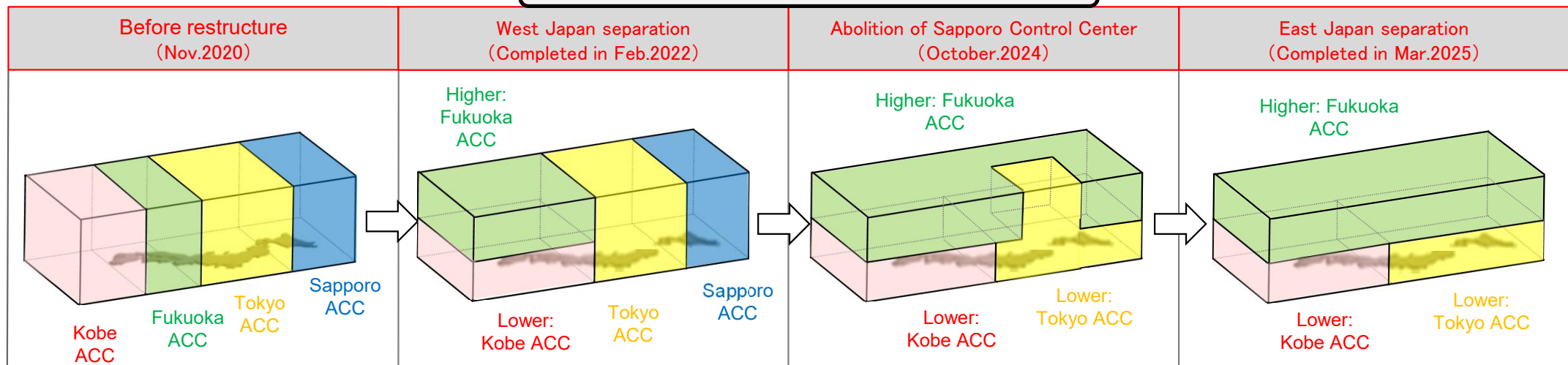
vertical separation of airspace

- ✓ By subdividing sectors and reducing the number of processing aircraft per sector, we have achieved what we have done so far.
- ✓ Further sector subdivision would lead to an increase in handover between sectors and a shortage of space for avoiding bad weather or for sequencing aircraft, which could in turn reduce handling capacity.

- ✓ By separating airspace vertically and clearly dividing the roles of air traffic control, air traffic control processing capacity will be improved.



History of Restructure

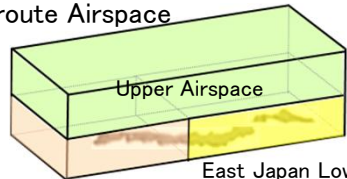


68 Restructure of Domestic Airspace (Terminal Airspace)

In order to provide air traffic control to multiple airports integrally, enhance departure and arrival traffic flow, improve control capacity and improve air traffic convenience, we are planning to expand and consolidate terminal airspace which controls arrival and departure traffic to/from airports within the lower airspace.

Expanding and Consolidating Terminal Airspace

En-route Airspace

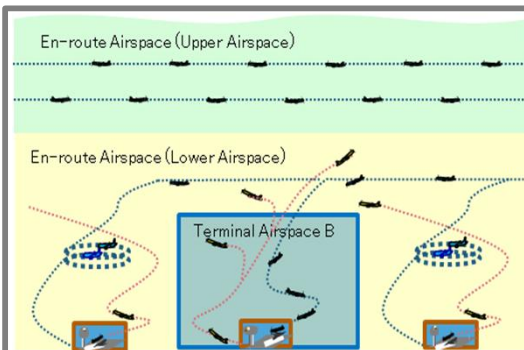


West Japan Lower Airspace

East Japan Lower Airspace

- ✓ Enhanced integration process for radar sensor data.
- ✓ Expand and consolidate multiple adjacent terminal airspace and provide air traffic control integrally.

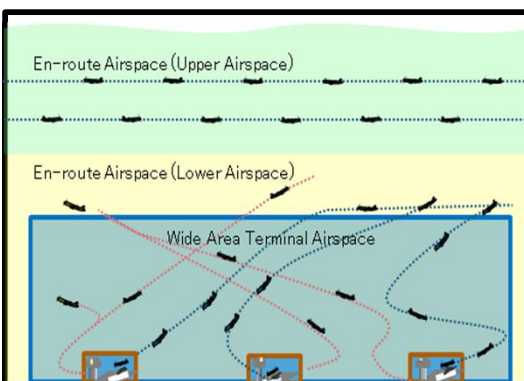
(Before restructure)



Terminal airspace is established at congested airports which has its own airport surveillance radar. Airports without a terminal airspace, departure/arrival delays, airborne holding and detours exist.



(After restructure)



In order to resolve airborne holding and reduce delays significantly, we are planning to provide air traffic control to airports broadly and integrally by expanding and consolidating terminal airspace.

Plans of Expanding and Consolidating Terminal Airspace

South Japan consolidation (Nov. 2021)

Naha Airport Office

Sakishima

Naha

Hidaka

Shirakami

North Kyushu consolidation (Oct. 2026)

(Consolidate Fukuoka, Nagasaki, Kumamoto and Oita)

Fukuoka Airport Office

Fukuoka

North Japan consolidation (Feb. 2025)

New Chitose Airport Office Sapporo Branch

Tokyo

Capital Area consolidation (Mar. 2020)

Tokyo Airport Office

Kagoshima

Kagoshima Airport Office

Kagoshima/Miyazaki consolidation (Nov. 2020)

※The month/year within the figure designates when the project completed.

North Kyushu consolidation

【Planned Schedule】

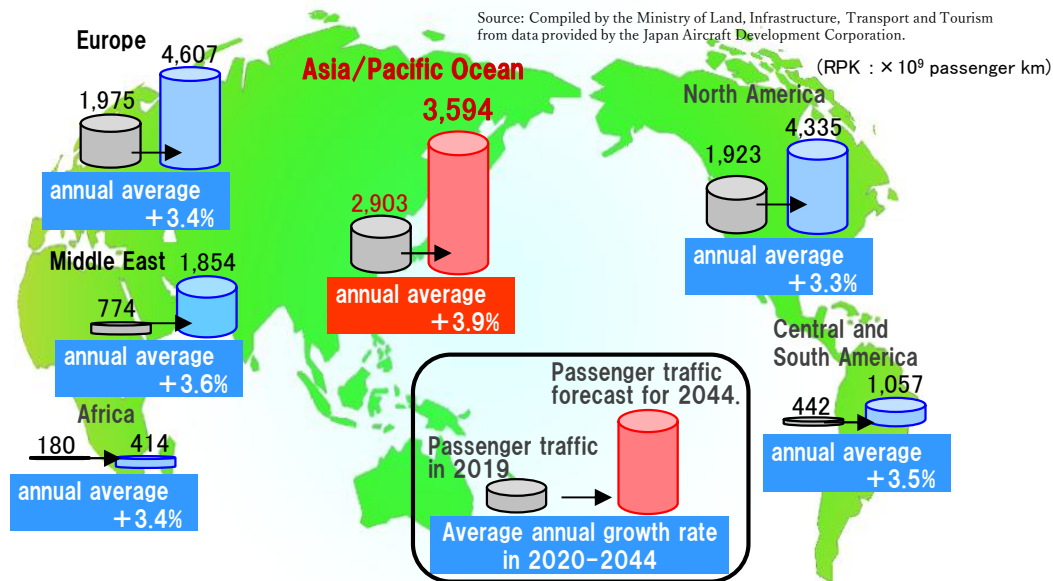
- Dec. 2025, Consolidate Fukuoka, Nagasaki and Kumamoto Airspace.
- Oct. 2026, Consolidate Fukuoka and Oita Airspace

69 Collaborative Actions for Renovation of Air Traffic Systems(CARATS)(1)

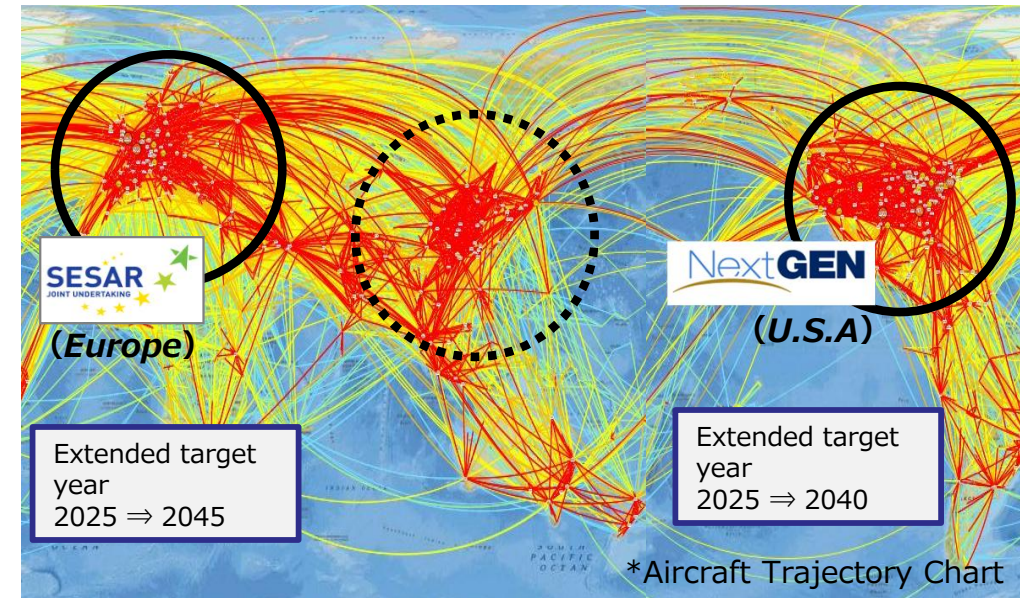
○History of CARATS

- In 2003, ICAO developed the Global ATM Concept of Operations to promote the transformation of the air traffic system with a view to 2025 and beyond.
- In 2009, “Study Group on Future Air Traffic Systems” was established, consisting of representatives from industry, academia and government, with the aim of responding to common global issues such as increasing air traffic, improving punctuality and flight efficiency, and countering global warming.
- In 2010, the Long-term Vision for the Future Air Traffic System “Collaborative Actions for Renovation of Air Traffic Systems (CARATS),” was formulated and published. It aimed at advancing air traffic systems by 2025.
- In 2011, the CARATS Roadmap was formulated to systematically build a future air traffic system.
- In 2019, the target year of the CARATS roadmap was extended from 2025 to 2040 in order to align with the future plans of the International Civil Aviation Organization (ICAO).
- In 2025, the target year of the CARATS was extended from 2025 to 2040, and we published CARATS2040.

○International Trends in International Air Transport



○International Trends in Future Air Traffic Systems



- Air traffic control capacity expansion is indispensable to cope with increased demand, etc.
- Future volume of air passengers will increase mainly in the Asia-Pacific region.
- At the 41st ICAO Assembly (October 2022), a resolution was adopted as follows.
 - the long-term aspirational goal (LTAG) aiming for carbon neutrality by 2050.
 - set 85% of 2019 emissions as Carbon Offsetting and Reduction Scheme for International Aviation(CORSIA)'s baseline until the end of the scheme in 2035.

- Long-term vision for future air traffic systems in the U.S. and Europe (NextGEN, SESAR) in accordance with ICAO's vision. Specific changes are being promoted.
- The 2025 Edition of the European ATM Master Plan which set out the vision of European air traffic management was published on 12 December 2024.
- The U.S. is under consideration for updating future vision.

69 Collaborative Actions for Renovation of Air Traffic Systems(CARATS)(2)

○ Overview of CARATS

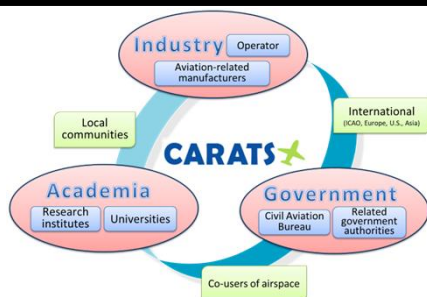
The direction for future efforts	Summary
① Strengthen Safety and Security Measures	• Enhance runway safety through AI-powered human error detection and automatic aircraft guidance
② Realization of Trajectory Based Operations (TBO) for optimal aircraft operations	• Realize optimal and effective aircraft operations controlled from departure to arrival in real time
③ Realization of sustainable air transport	• Reduce environmental impact through improving flight operations and efficient trajectories
④ Effective use of airspace that accommodates the diversification of air mobility	• In the short term, introduce separate airspace operations for each type of air mobility • In the medium and long term, integrate safely new air mobilities into non-segregated airspace alongside existing aircraft
⑤ Strengthening resilience	• Reduce the impact on aircraft operations in the event of natural disasters, system outages, cyber attacks, and other unforeseen events by enhancing the robustness and redundancy of the air traffic system
⑥ Strengthening international cooperation and promoting overseas expansion	• Actively participate in ICAO discussions and guidance development • Overseas development of packaged Japanese technology and operational know-how through ODA, JICA technical cooperation projects, etc.

○ Promotion Structure of CARATS

- The “Committee for Promoting Renovation of the Air Traffic System” was set up to steadily promote CARATS with the cooperation of industry, academia and the government.
- The Committee is continuously conducting PDCA for CARATS goals and roadmaps, and is studying and promoting everything from research and development to the introduction of measures.



CARATS2040
main text



The cooperation of industry, academia
and the government in Committee

Policy objectives	Measure name	Measure ID	Sub-measure name	Sub-measure ID	Block 2						Block 3						Block 4					
					25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	
4D Trajectory Operation integrated management from departure to arrival	Collaborative Trajectory Negotiation	TBO-2	Pre-Departure Collaborative Trajectory Negotiation	TBO-2-1	Pre-Departure Collaborative Trajectory Negotiation						★											
			Trajectory Negotiation in real-time	TBO-2-2									Trajectory Negotiation in real-time						★			

Excerpt from CARATS Roadmap

CARATS HP

<https://www.mlit.go.jp/koku/carats/>



Official CARATS YouTube Channel

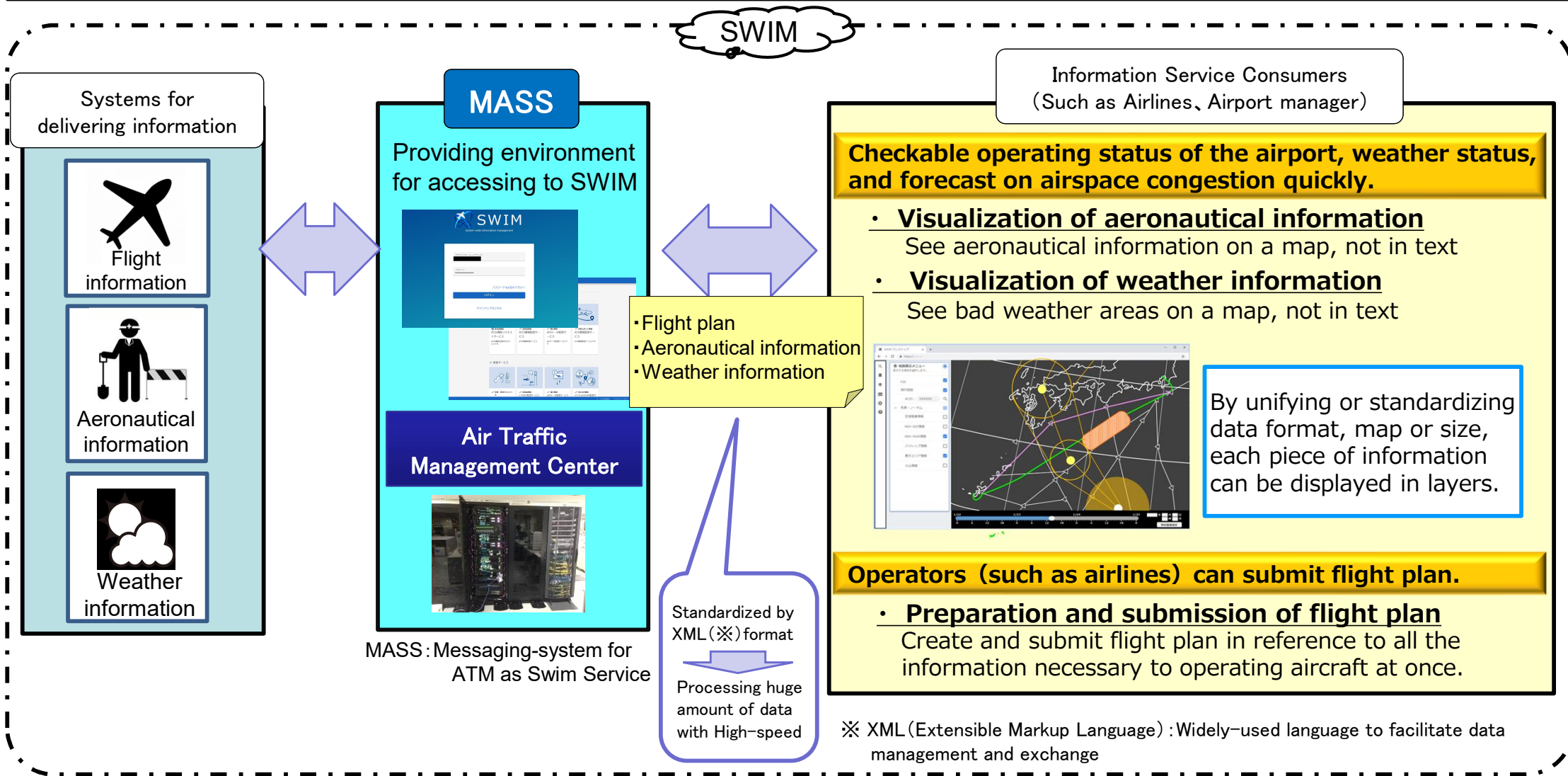
<https://www.youtube.com/channel/UCrvA5VkicinKs8flyrtxSuQ>



70 SWIM (System-Wide Information Management)

SWIM (System-Wide Information Management) is a cross-system “information management framework” that enables aviation professionals to use “reliable information services” in “reliable environment”.

Since more information than ever before needs to be processed for the purpose of coping with the future growth in air traffic, it supports ATM stakeholders in improving their situational awareness and make decision making quickly by digitalize information and facilitate information exchange.



71 TBO (Trajectory Based Operations)

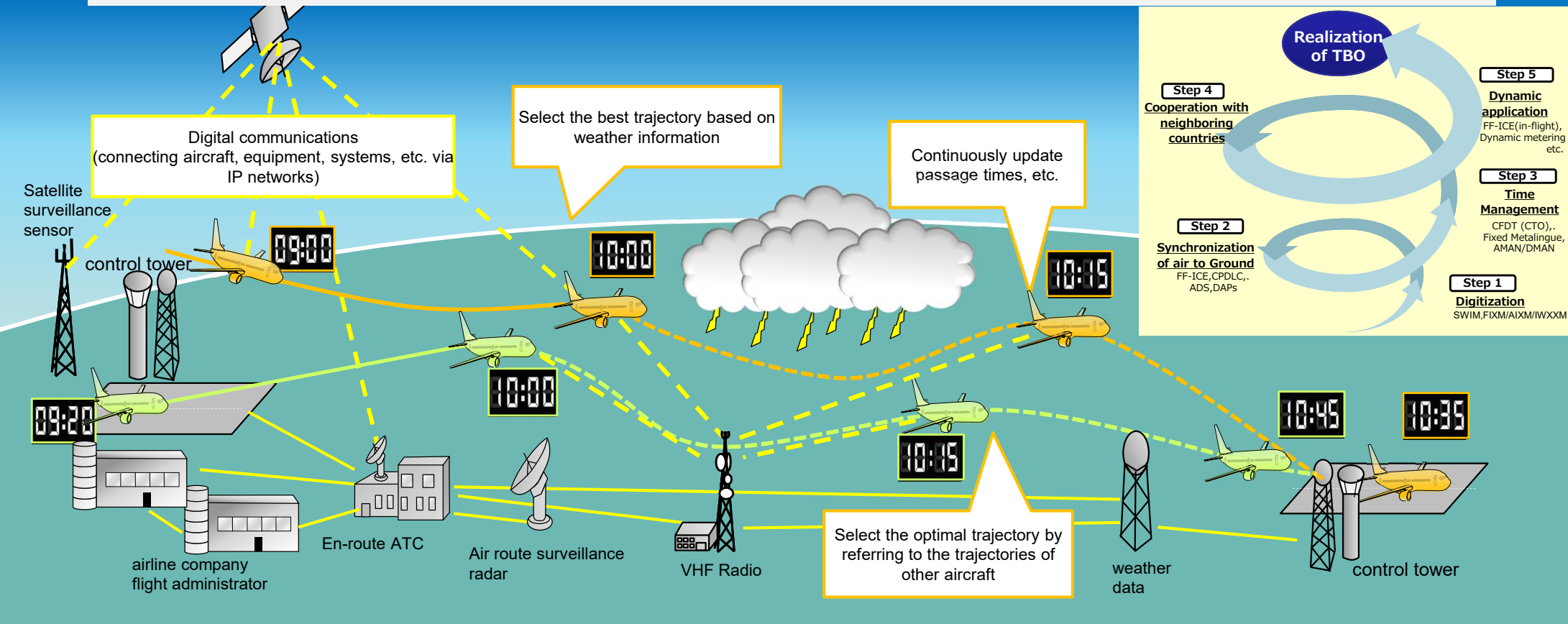
OTBO (Trajectory Based Operations) is a concept whereby aircraft trajectories are shared in real time by digital technology to air traffic control and aviation stakeholders, and this information is used to optimize control operations.

○ The TBO will enable ①safer and more comfortable flights, ②smooth response to sudden weather changes (e.g., cumulonimbus and volcanic eruptions), and ③ contributes to carbon neutrality by reducing fuel consumption

OTBO will be introduced in stages, starting with the digitization and synchronization of information (SWIM, FF-ICE), time management (metering), coordination with neighboring countries (Global SWIM international ATFM), and dynamic application (FF-ICE R2, dynamic metering, dynamic airspace configuration).

※Trajectory is an expected flight route including latitude, longitude, altitude, and time information.

- Fly optimal flight paths coordinated among relevant parties based on advanced weather forecasts, etc.
- Share weather information, etc. in real time and change flight paths to optimal ones
- Manage the flight paths of all aircraft from departure to arrival to improve and alleviate airspace congestion
- Reduce air traffic control instructions for congestion avoidance (diversion, holding above the airspace, ground holding), enabling an increase in the number of aircraft handled and a reduction in fuel consumption through shorter flight distances

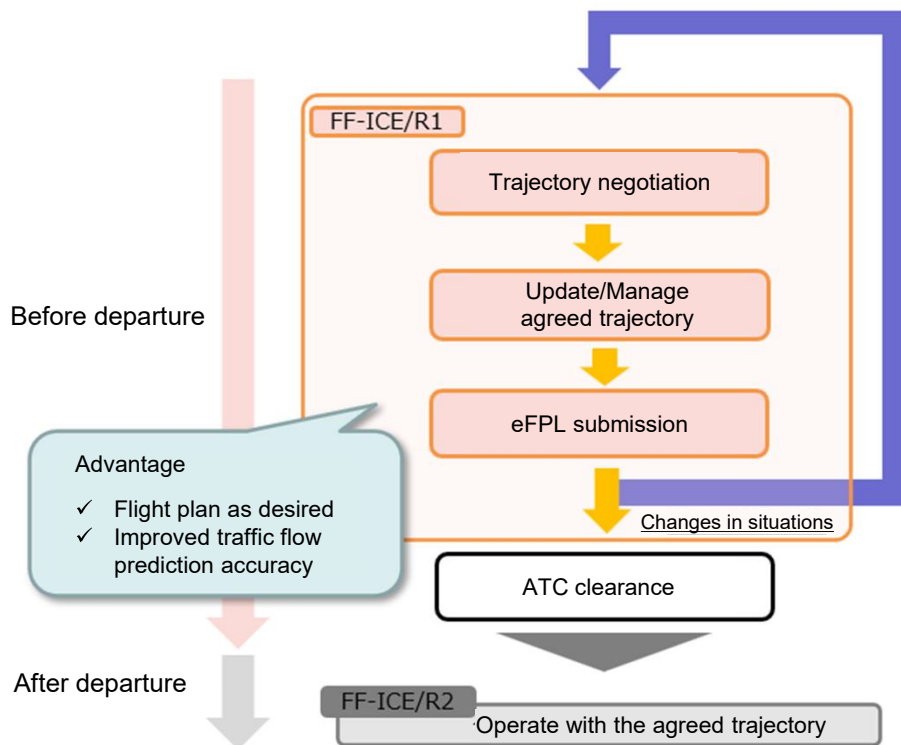


72 Trajectory Negotiations for TBO (FF-ICE R1/R2)

- An operational concept that uses information shared and exchanged in a collaborative environment to realize the ATM of the future.
- Utilizing SWIM*, based on digital flight plans that can include a wide range of flexible information, the company plans to introduce pre-flight trajectory (flight route and altitude) adjustments and gradually transition to in-flight trajectory adjustments. *SWIM: System-Wide Information Management

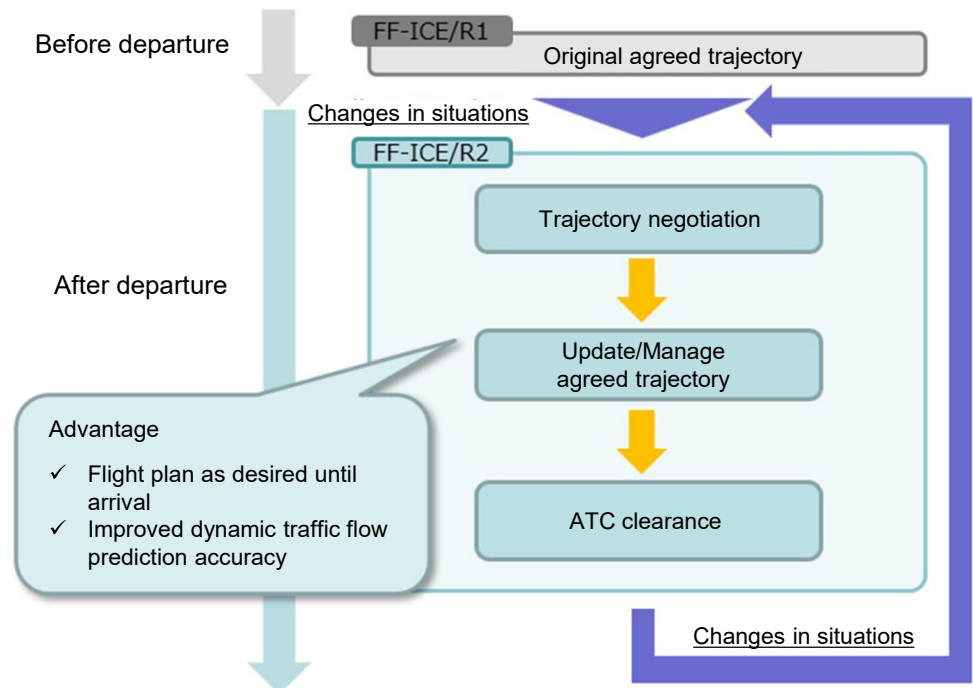
FF-ICE/R1*1: Pre-flight trajectory negotiations

Flight plans submitted by operators, ever-changing aviation information, weather conditions, airspace congestion status, etc. are digitized, and this information is shared among relevant parties using the system prior to departure to adjust and determine the optimal flight route and altitude.



FF-ICE/R2*2: In-flight trajectory negotiations

A system that allows changes to the flight route and altitude (agreed trajectory) that have been coordinated and determined before departure between the operator and the air traffic control unit, even during flight. The agreed trajectory is shared, coordinated, and updated among the parties involved, and instructions are given from the air traffic control unit at the appropriate times.



*1 FF-ICE R1: Flight and Flow Information for a Collaborative Environment Release 1

*2 FF-ICE R2: Flight and Flow Information for a Collaborative Environment Release 2

73 Next Generation of Air Mobility

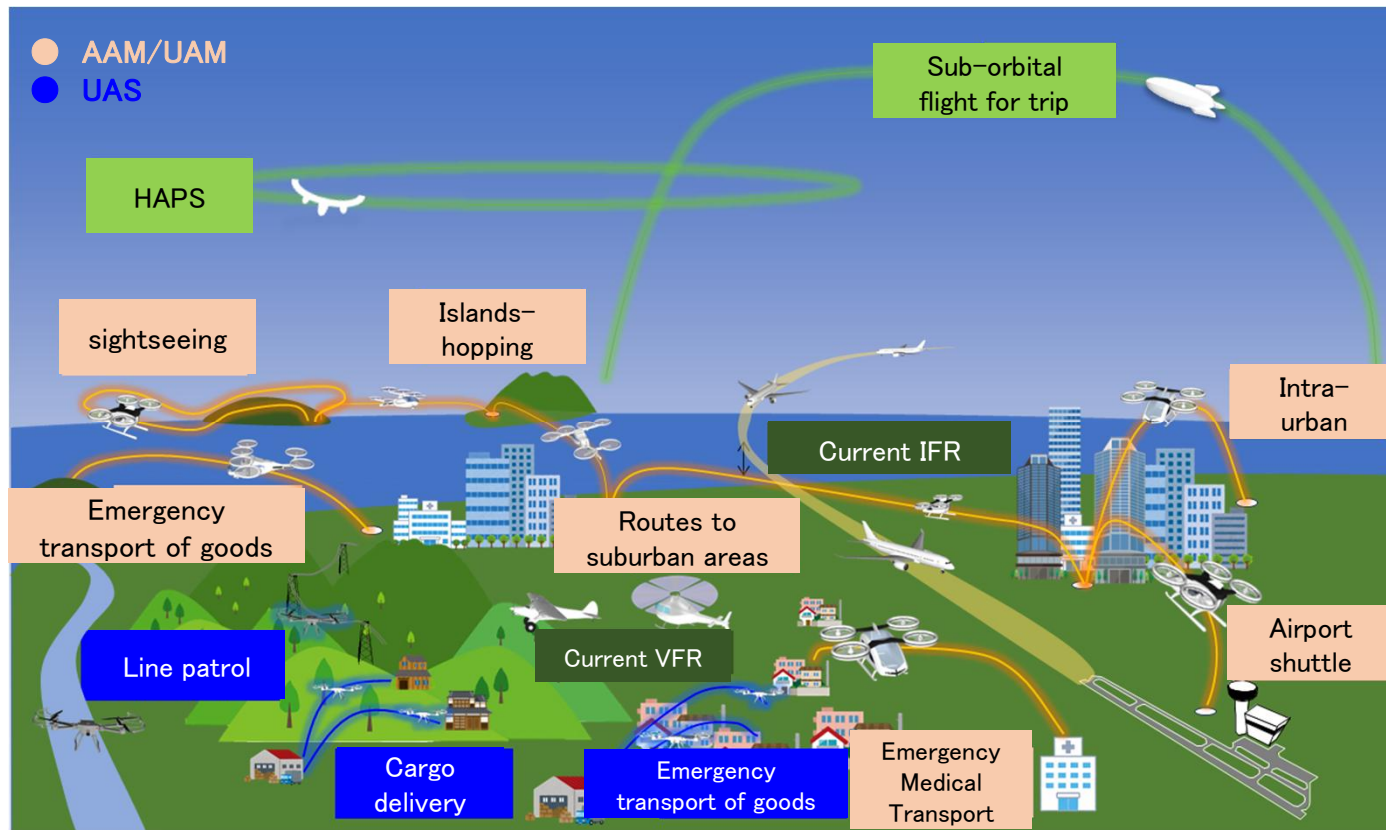
Flexible Air Transportation

AAM and UAS are expected to realize flexible air transportation for both passenger and cargo.

For use in the high altitude airspace above 60,000ft (about 18km), Air Mobility such as RPAS*1, sub-orbital flight for trip, supersonic aircraft, HAPS*2 as a new communication infrastructure are being developed.

* 1 RPAS (Remotely Piloted Aircraft Systems)

* 2 HAPS (High Altitude Platform Station)



The view of future use case of next air mobility in the low and high-level altitude airspace



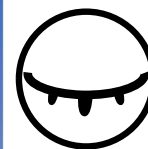
Unmanned Aircraft Systems(UAS)

As a solution for social issues such as declining birthrate and an aging population, labor shortage, depopulated areas. Utilization of logistics, at disaster and infrastructure inspection.



Advanced Air Mobility/Urban Air Mobility (AAM/UAM)

Contribute to reduce exhaust gas and noise. Aim for higher density and automation/autonomy operation as a new urban transportation.



High Altitude Platform Station(HAPS)

As a new communication infrastructure at disaster and in mountainous areas.

Realization of Safe and Efficient Sky

- Traffic management is essential for the harmonization of next generation air mobility and conventional aircraft.
- Established Public-Private Committee/Council to discuss and share issues.
- Developed Concept of Operations and roadmap
- Prepare for new rules and structures for new traffic management and realize the safe and efficient sky.

* 1 『Public-Private Council for Environment Preparation on small unmanned aircraft』
『Public-Private Committee for Advanced Air Mobility』

Main task

- Harmonization of low altitude airspace
- Adjustment at disaster
- Management of remoted, automation and autonomy operation
- Service provision for frequent, highly dense and various operations
- Development of human-less ecosystem
- International cooperation for air mobility in the high airspace

Traffic Management for AAM

AAM runs on battery and motor, and it is expected to contribute to exhaust gas and noise reduction. AAM can make vertical take-off and landing at limited space. Also, in the future, pilotless remoted, automation and autonomy operations will be expected. In some cases, AAM is subject to restriction of holding because of battery remains, the traffic management for AAM needs taking this aspect into consideration.

Based on “Concept of Operations for AAM” , JCAB provided the initial Urban Air Traffic Management (UATM)* service and prepared necessary structure and system for EXPO 2025 Osaka, Kansai, Japan.

* Traffic Management for AAM

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* Traffic Management for AAM

- Initial UATM service

- ・「Notification of Airspace and Routes」

Notice the AAM routes and airspace around the EXPO vertiport in AIP.

- ・「Strategic Deconflict」

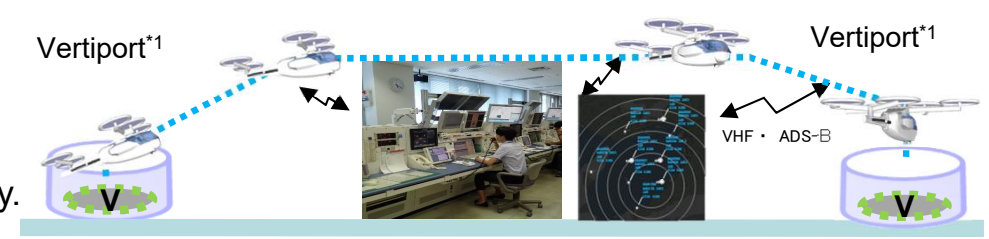
Adjust flight plan before flights to prevent vertiport congestion.

- ・「Conformance Monitoring」

- Monitor AAM using ADS-B to prepare for search and rescue and irregularity.

・「Information Service and Exchange」

- Provide necessary information to improve situational awareness for stakeholders



olders UATM service at EXPO 2025 Osaka, Kansai, Japan

* 1 Operated as off-site take-off and landing area for AAM at EXPO 2025 Osaka, Kansai, Japan.

Vertiport

A “vertiport” is a type of airport dedicated to AAM taking-off/landing. To indicate specifications for the design of vertiports, JCAB published “Vertiport Design Guidelines”. The guidelines include specifications (applicability, location and performance characteristics) of lights installed at vertiports for AAM taking-off/landing at night.

- * 2 FATO (Final Approach and Take-Off area) : A defined area intended for AAM to use for transition from the final approach to touchdown or hovering and from the ground or hovering state to takeoff.
- * 3 TLOF (Touchdown and Lift-Off area) : A defined area intended for AAM to use for transition from the final approach to touchdown or hovering and from the ground or hovering state to takeoff.

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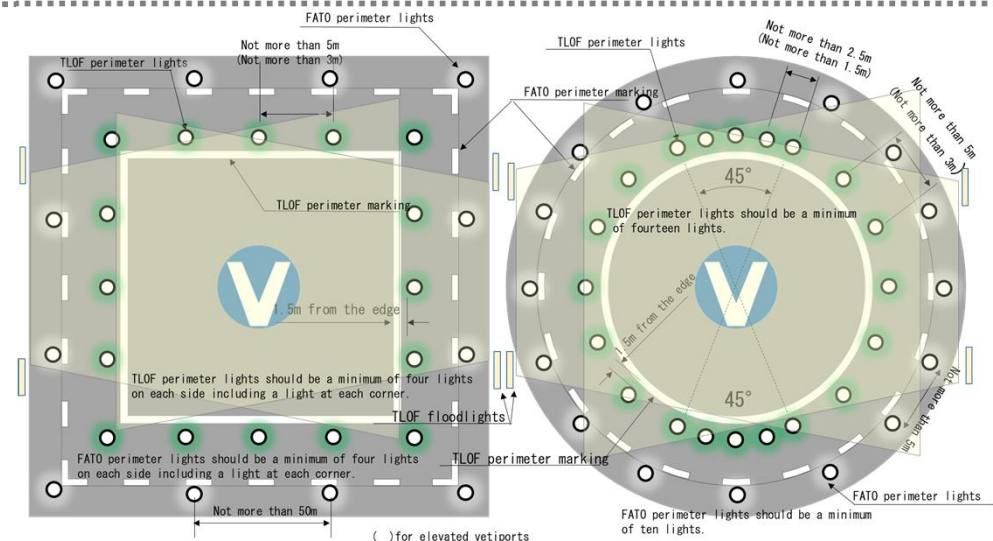
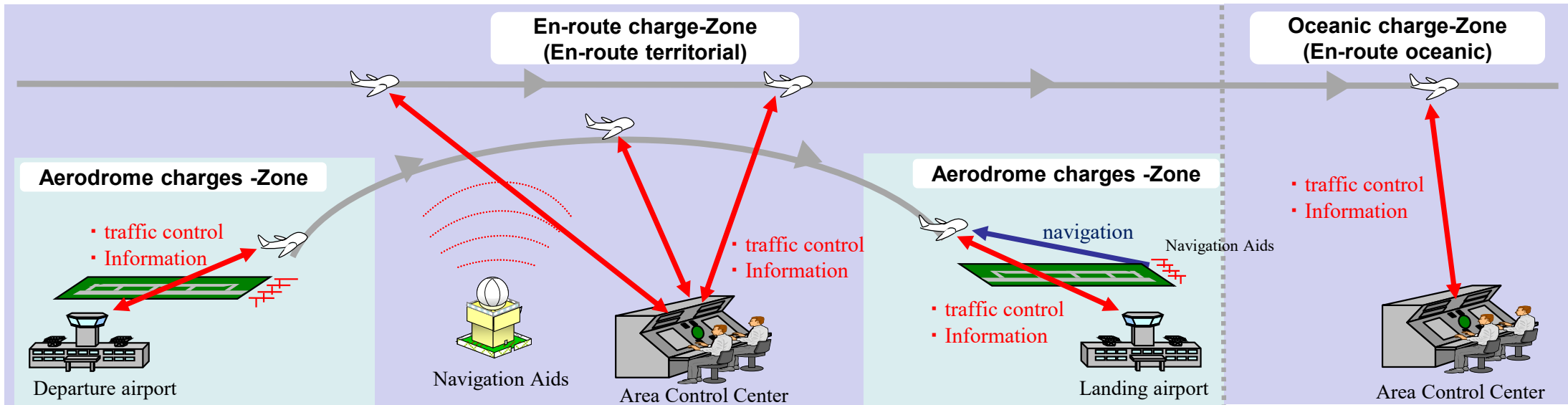


Image of lights installed at vertiports*^{2,3}

75 Air Navigation Service Charges (1)

- Air navigation service charges are collected to cover the costs of installation, operation and maintenance of the facilities for aircraft navigation.
- Aerodrome charges are based on maximum takeoff weight (MTOW).
- En-route charges (En-route territorial) are based on the distance flown and maximum takeoff weight (MTOW).
Oceanic charges (En-route oceanic) are based on Datalink-enabled or Non-Datalink-enabled.



Calculation of Air Navigation Service charges

I. Aircraft weighing over 15 tons (operated by air transport carriers or by international carriers) total charges for a) + b) + c)

a) Aerodrome charges	b) En-route charge (En-route territorial)	c) Oceanic charge (En-route oceanic)
$\text{Airport unit price} \times (\text{MTOW}/50)^{0.7}$ *Maximum MTOW is 250	$\text{JPY } 5,300 \times (\text{distance flown (km)} - A) / 100 \times (\text{MTOW}/50)^{0.5}$ ※Domestic flight A=18.52, International flight A=9.26, upper limit of (distance flown(km) - A) is 1000km *Maximum MTOW is 250	Datalink-enabled aircraft JPY 13,000 Non-Datalink-enabled aircraft JPY 18,000

II. Aircraft other than I JPY 120 per landing

75 Air Navigation Service Charges (2)

Airport unit price for Aerodrome charges

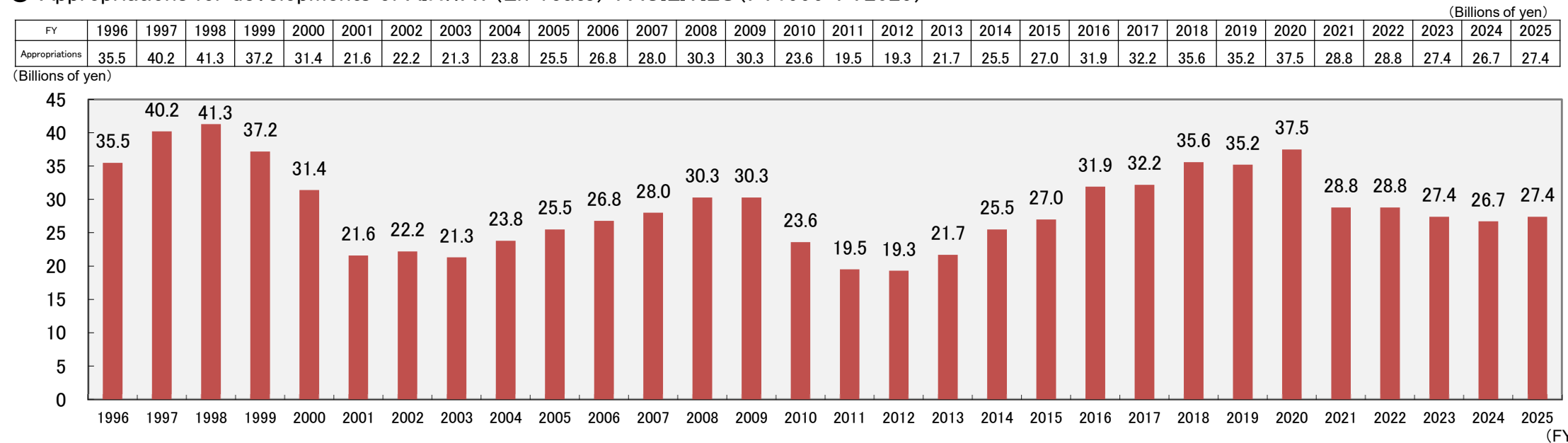
Group	Airport	Aircraft other than those listed on the left	Number of Airports
G1	RJTT	JPY 38,800	1
G2	RJAA, RJGG, RJBB, RJOO, RJFF, ROAH	JPY 17,100	6
G3	RJCC, RJEC, RJCK, RJCB, RJCH, RJSS, RJSK, RJSN, RJOA, RJOT, RJOM, RJOK, RJFR, RJFU, RJFT, RJFO, RJFM, RJFK, RJCM, RJSA, RJNT, RJBE, RJOB, ROMY, ROIG, RJCO, RJNK, RJOS, RJNA	JPY 3,700	29
G4	RJCW, RJSC, RJDC, RJER, RJCR, RJEO, RJCN, RJEB, RJSI, RJSR, RJSY, RJSF, RJTO, RJAN, RJAZ, RJTQ, RJTH, RJSD, RJNW, RJNF, RJAF, RJNS, RJBD, RJOR, RJNO, RJOC, RJOW, RJFS, RJDT, RJDO, RJFE, RJDK, RJDB, RJFG, RJFC, RJKA, RJKI, RJKN, RJKB, RORY, RORA, ROKJ, ROKR, ROMD, RORK, RORE, RORS, RORT, RORH, RORY, RJSM, RJAH, RJOH, RJOI, RJOY, RJBT, RJDA	JPY 470	57

Reductions for Okinawa and remote island routes

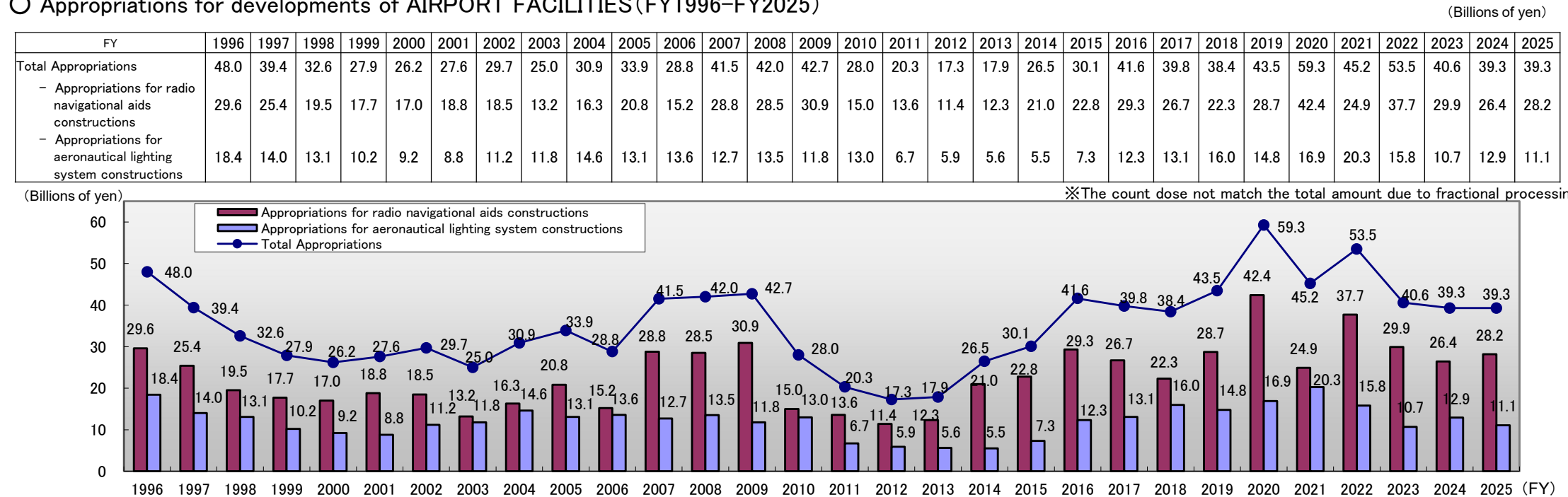
- The Air navigation service charges for routes to/from Okinawa (domestic and international cargo flights) will be reduced to 1/6 to 1/16 depending on the type of aircraft, etc.
- The Air navigation service charges for routes to/from remote islands (domestic flights) will be reduced to 1/6 to 1/16 depending on the type of aircraft, etc.

76 Changes in Appropriations

○ Appropriations for developments of AIRWAY(En-route) FACILITIES(FY1996–FY2025)



○ Appropriations for developments of AIRPORT FACILITIES(FY1996–FY2025)



77 Number of Aircraft under Air Traffic Control and Number of AirNavigation Servicers

(persons)

5,000



■ Air Traffic Control Services

■ Air Traffic Information Services

■ Air Traffic Communication Services

■ Air Traffic Engineering Services

■ Satellite Operation Services

■ Visual Aids and Electrical Systems Services

■ Flight Inspection Services

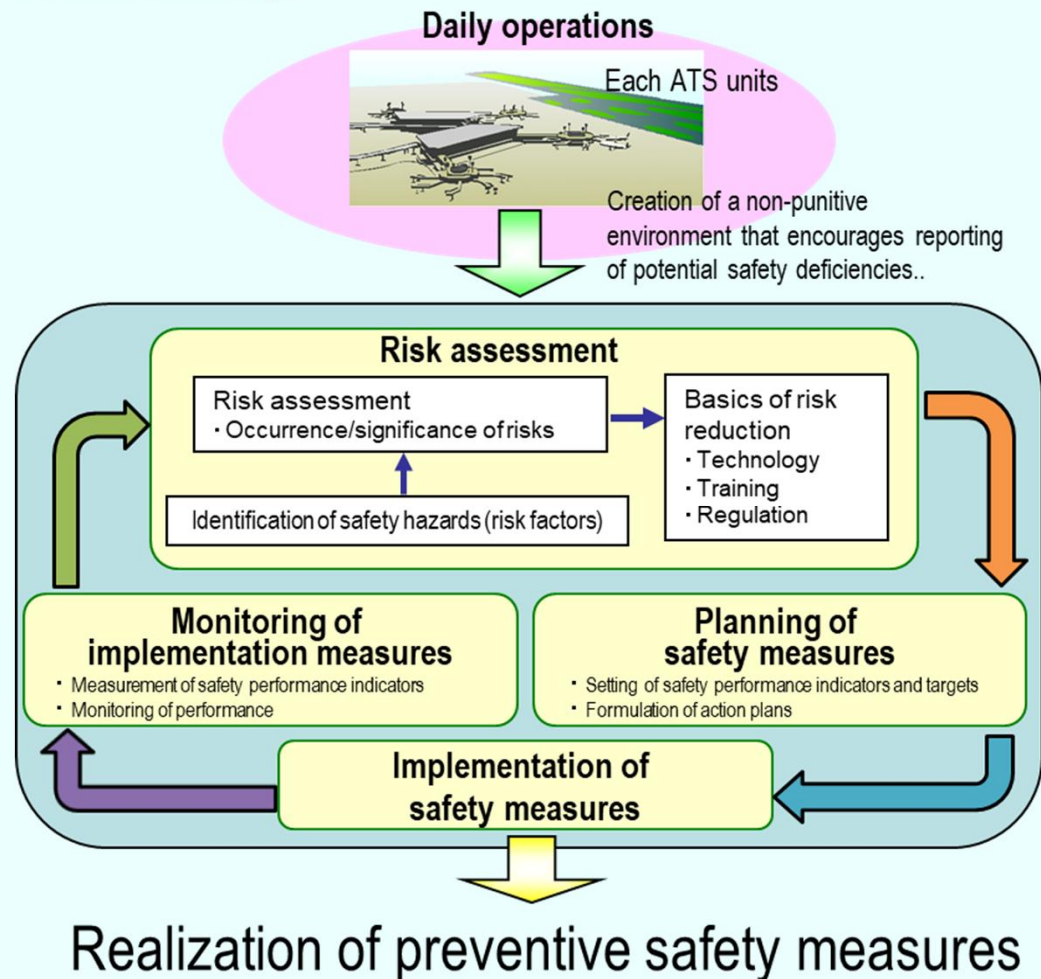
■ Secondary Power Systems Services of Air Navigation Service

■ Development and Evaluation work

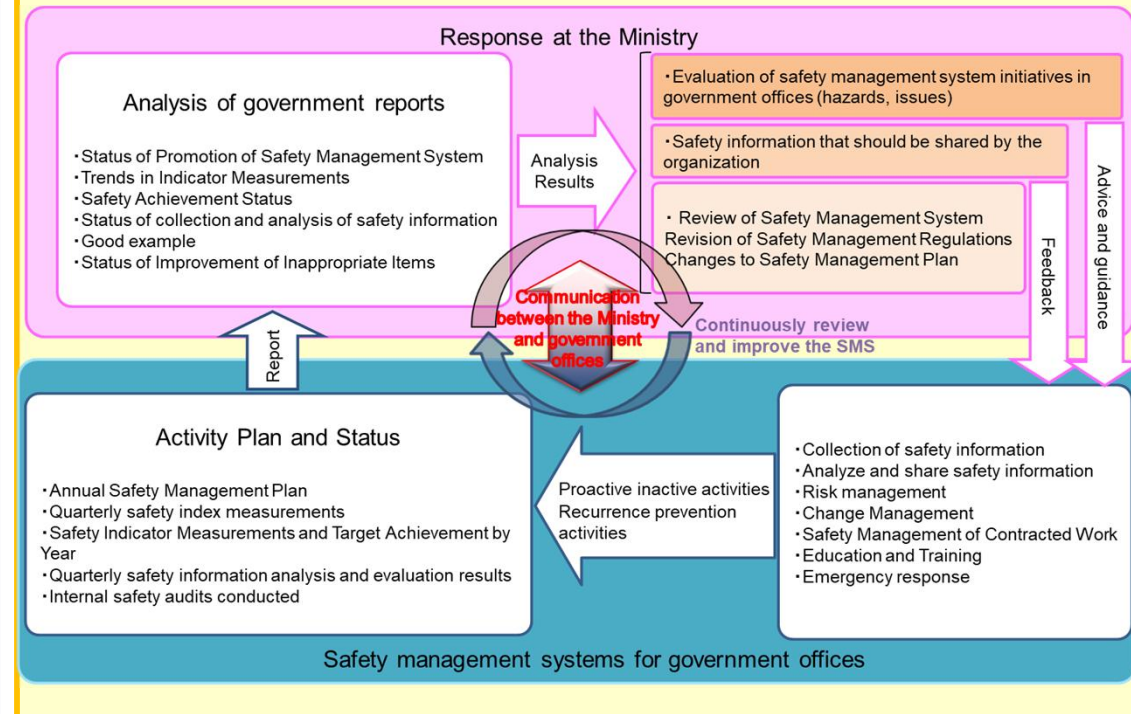
78 ATS Safety Management System(SMS)

- SMS is a comprehensive and systematic approach to **managing safety for crisis prevention** by identifying safety hazards that may cause an accident or trouble, assessing risks, and taking measures to reduce the risks to acceptable level. The policies and objectives for safety are clarified, formulated (Plan), implemented (Do), monitored (Check) and taken (Act) necessary measures.
- Air Navigation Services Department has been implementing SMS in accordance with Annex19 of the Convention on International Civil Aviation since 2014 as a provider of Air traffic control services.

● SMS Concept



● Continuous review and improvement of SMS in the Ministry and at government offices



Safety Promotion Committees are held at the Ministry and at each field office to analyze the causes of accidents and serious incidents ※ resulting from aviation safety operations, considered to prevent recurrence, and confirm the effectiveness of safety measures and their effectiveness.

※ Accidents and serious incidents will be investigated separately by the Transportation Safety Board.

79 Education System for Aeronautical Safety Personnel (1)

• In order to enable specialists to engage in ensuring safety in air traffic, Aeronautical Safety Personnels* must acquire knowledge and skills necessary for their duties. The Aeronautical Safety College provides basic training courses and the IWANUMA Training Center provides specialized training courses.

• The Aeronautical Safety College provides advanced education and training by using training equipment which is essential for actual services. This promotes the application of internationally-standardized training course development approaches, with the aim of upgrading education and training along with the daily progress in aeronautical safety systems.

* Air traffic controllers, ATS flight information officers, Air traffic communications specialists, Air traffic safety electronics personnel, Visual aids and electricity specialists, Facilities Management Officers of secondary power systems, etc.

Aeronautical Safety College (ASC) (near KANSAI International Airport)

< Basic training courses >



- Educational training facility mandated by the Ministry of Land, Infrastructure, Transport and Tourism establishment Act as the only training institution in Japan for Aeronautical Safety Personnel.
- The training period for personnels (Aeronautical Information Course/Aeronautical Electronics Course) is two years. The air traffic controller course is 8 months long and is offered 3 times per year (April, August, December). Personnels in both courses live in dormitories.
- ICAO TRAINAIR PLUS program member (aviation training institution certified by ICAO)



Air Traffic Controller Basic Training Course



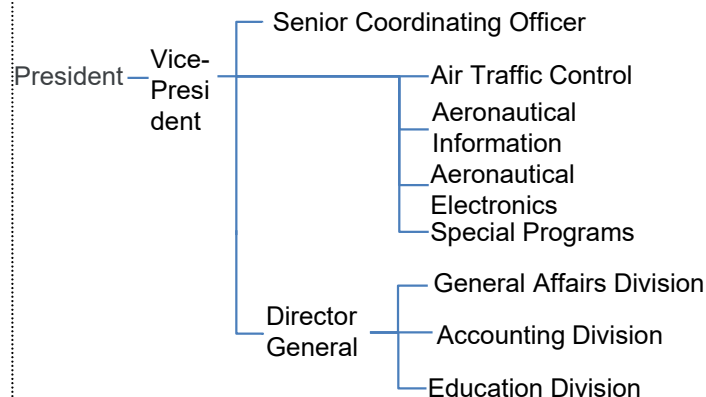
Aeronautical Information Course



Aeronautical Electronics Course

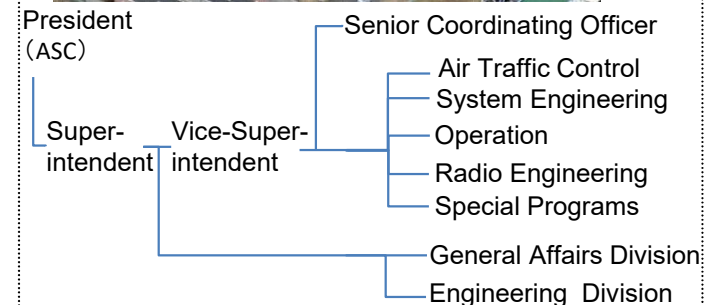


Visual Aids and Electricity Specialist Basic Course



IWANUMA Training Center (next to SENDAI Airport)

< Specialized training courses >

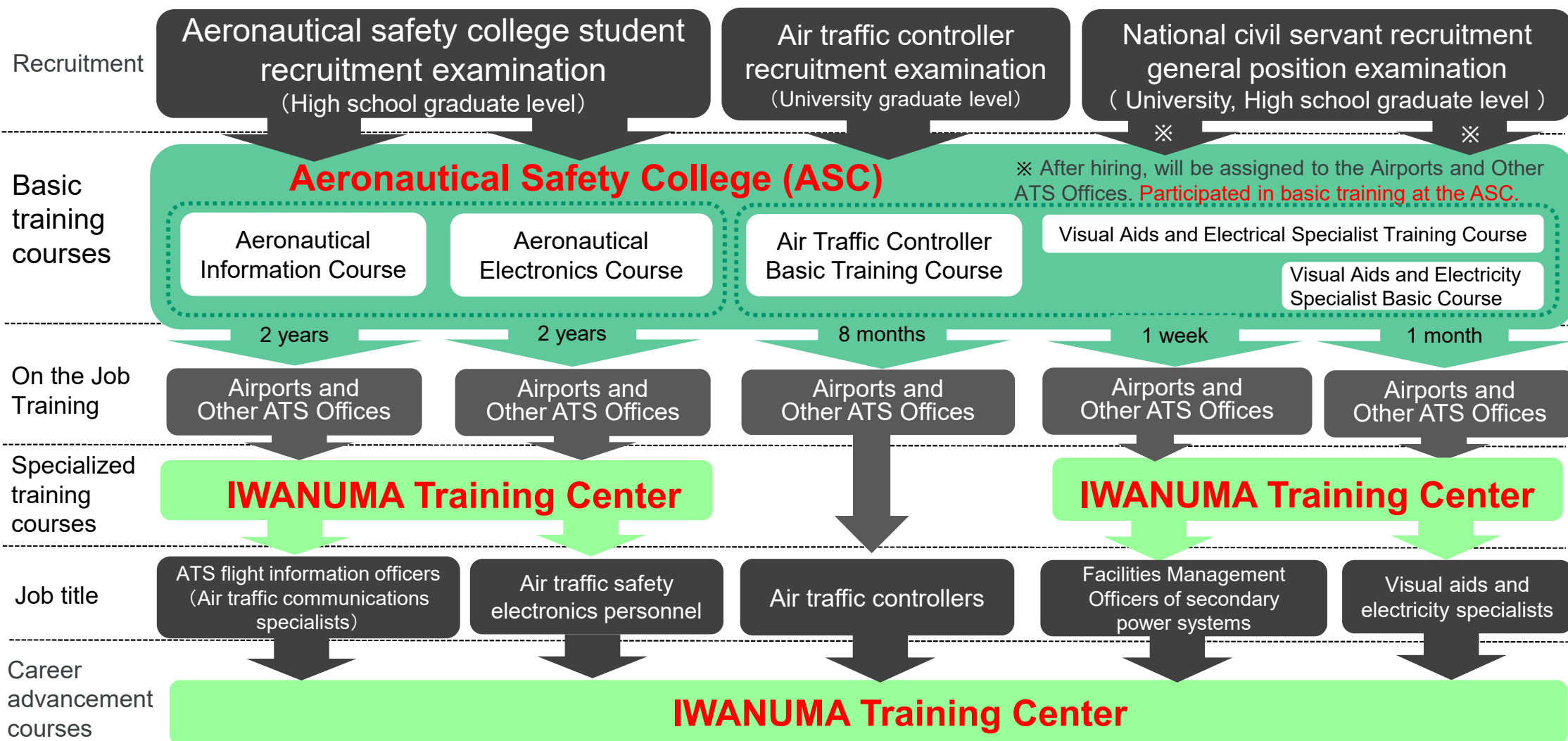


- Training equipment equivalent to the aviation safety radio facilities and air traffic control information processing systems currently in operation at Airports and Other ATS Offices are provided.
- Aeronautical Safety Personnel receive specialized training to develop their career.

79 Education System for Aeronautical Safety Personnel (2)

- In order to become specialists in supporting air traffic safety, Aeronautical Safety Personnel complete basic training at the Aeronautical Safety College(ASC). The purpose of the course is to acquire the necessary knowledge and skills to engage in aviation safety operations.
- Provide specialized training to obtain skill certifications necessary to engage in their daily routine, as well as training to advance their career in each job category.

【 From recruitment to career advancement 】



80 ICAO (International Civil Aviation Organization)

About ICAO

ICAO is one of the specialized agencies of the United Nations established under the International Civil Aviation Convention (Chicago Convention). In addition to various activities related to technical problems and legal problems, with the aim of promoting the safe and orderly development of international civil aviation and the sound and economical operation of international air transportation services, ICAO are conducting activities to audit parties regarding compliance with aviation safety and aviation security standards. The headquarters is in Montreal and 193 states are members as of April 2023. (Japan joined in October 1953).



Annex

Based on the Chicago Convention, ICAO Annexes to the convention are international rules consisting of the following “Standards” and “Recommended Practices” adopted by the Council. There are currently 19 Annexes (see below).

- ① Standards : In order to ensure the safety and regularity of international aviation, Contracting States must conform to uniformly.
 - ② Recommended Practices : For safety, regularity or efficiency of international aviation, Contracting States will endeavor to conform to.
- Note: There are also detailed procedures called PANS (Procedure for Air Navigation Services) that complements the above Standards and Recommended Practices.

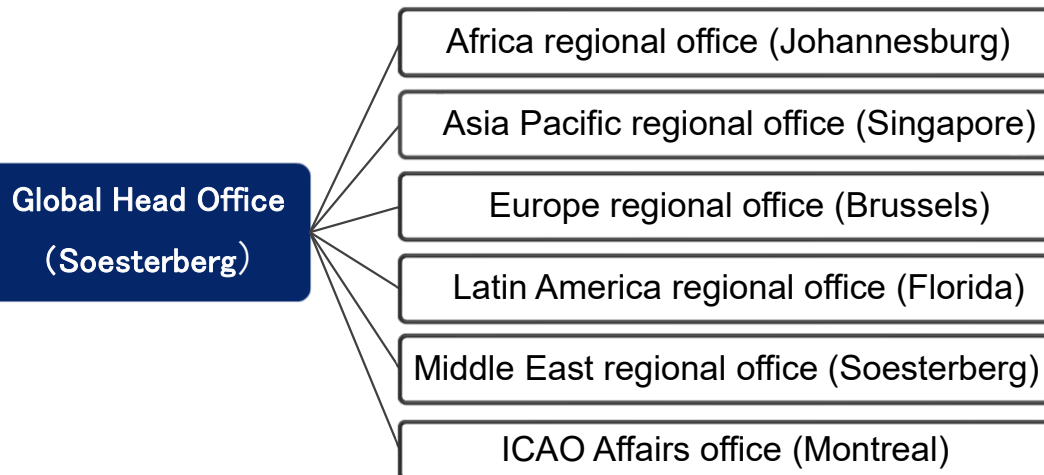
1	Personnel Licensing	Technical certification criteria such as pilots, controllers, etc. and physical examination standards
2	Rules of the Air	Standards for general aviation regulations, VFR and IFR
6	Operation of Aircraft	Standards for flight safety such as fuel, equipment, crew members, maintenance, etc. of aircraft for air transportation business
10	Aeronautical Telecommunications	Standards for radio navigation facilities and communication procedures
11	Air Traffic Services	Standards for air traffic control operations, flight information services, etc.
12	Search and Rescue	Standards for search and rescue organization, cooperation system of related organizations, etc.
14	Aerodromes	Standards for runway, taxiway, obstruction, etc.
15	Aeronautical Information Services	Standards for issue and content of AIP, NOTAM, etc.
19	Safety Management	Standards for Safety Management System



81 CANSO (Civil Air Navigation Services Organization)

About CANSO

CANSO is international organization composed of Air Navigation Service Provider (ANSP) from each state. It provides support capacity building of ANSP and forum for sharing issues and proposing solutions. Its purpose is to represent the opinions and interests of ANSPs and increase their added value. Founded in 1996, CANSO's headquarters are in Soesterberg, the Netherlands. Japan joined in 2013. There are 95 members as of April 2025. (providing air navigation services for approximately 90% of the world's air traffic).



Global

- Establish policies and opinions on behalf of members
- Raise issues of common interest to members
- Organize ATM summits and various seminars

Regional

- Implement policies and initiatives agreed at the global level
- Address common regional issues

CANSO and other organization



ICAO: ICAO is composed of member countries, and it establishes future concepts and various global standards for the development of civil aviation in general, such as ensuring air traffic safety and improving air passenger comfort.

CANSO: CANSO is composed of ANSP from each state and discusses specific measures to improve the safety and efficiency of aviation. After the measures have been coordinated, CANSO recommend to ICAO on behalf of the world's ANSP.

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