JANS
JAPAN AIR NAVIGATION SERVICE

OVERVIEW OF AIR NAVIGATION SERVICES IN JAPAN (2024)

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CONTENTS

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.

②Moving at high speed and inability to increase or decrease speed to an extreme level or stop in mid-air for safety reasons.

③Limited takeoff/landing locations.

④Susceptible 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.

〇Air traffic control services :

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

〇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.

〇Air traffic engineering services :

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

〇Visual aids and electrical systems services :

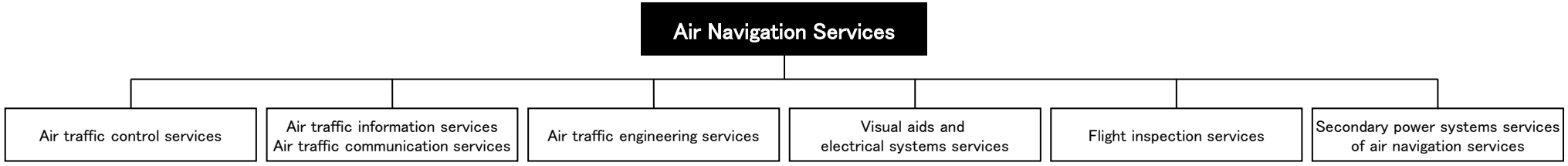
Duties related to installation and maintenance of aeronautical lighting and other electric facilities.

〇Flight inspection services :

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

〇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

Operation of aircraft → Pre-flight → Departure → In-flight → Arrival → Post-flight

Air traffic control services

- Instruction of order of takeoff, routes, altitude, etc. to aircraft taking off the airport.

- Approval and instruction of routes, altitude, etc. to aircraft flying en-route.

- Instruction of order of landing, routes, altitude, etc. to aircraft landing at the airport.

Air traffic information/ Air traffic communication services

- Examination of flight plans. Provision of aeronautical information.

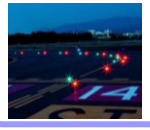
- Provision of aeronautical information to aircraft during the flight. Coordination of search and rescue for distressed aircraft.

- Coordination of search and rescue for distressed aircraft.

Flight inspection services

- Inspection of air navigation facilities.

Visual aids and electrical systems services



- Installation and maintenance of aeronautical lighting and other electric facilities.

Air traffic engineering services

- Development and maintenance of radar and radio navigation aids etc.

Visual aids and electrical systems services

- Installation and maintenance of aeronautical lighting and other electric facilities.

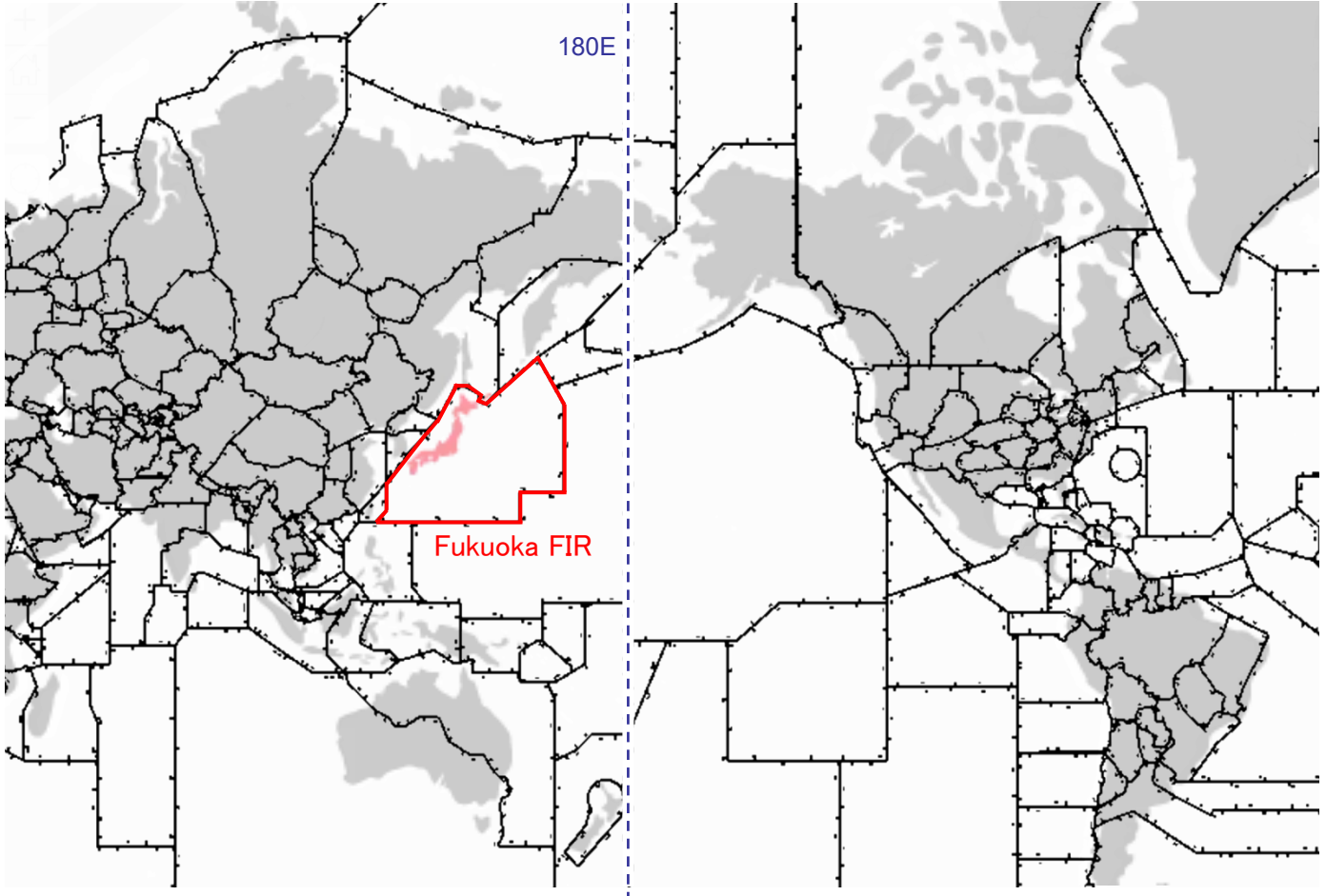
Secondary power systems services of air navigation service

- Development and maintenance standby power supply equipment to secure power supply to air navigation facilities.

3 World FIR (Flight Information Region)

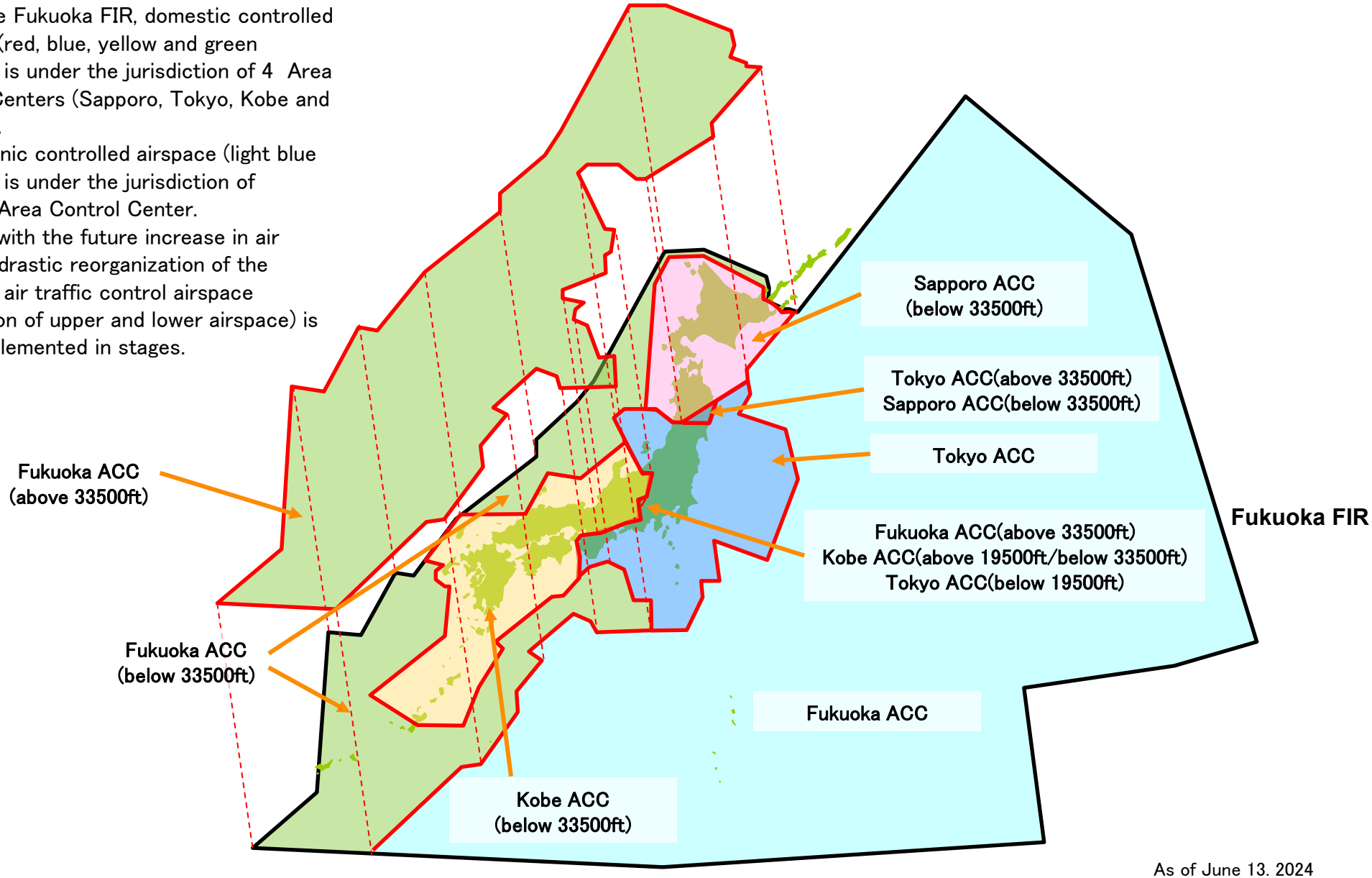
FIR (Flight Information Region)

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 (red, blue, yellow and green airspace) is under the jurisdiction of 4 Area Control Centers (Sapporo, Tokyo, Kobe and Fukuoka).
The oceanic controlled airspace (light blue airspace) is under the jurisdiction of Fukuoka Area Control Center.
To cope with the future increase in air traffic, a drastic reorganization of the domestic air traffic control airspace (separation of upper and lower airspace) is being implemented in stages.



As of June 13. 2024

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 ····· Among controlled areas, airspace in which aircraft climb following the take-off and descend prior to landing within the control zone
  - Positive Controlled Airspace ···Airspace in which congestion of air traffic exists
  - Oceanic Control Area ···Airspace within Flight Information Region（FIR）and 1700 meters or more above water

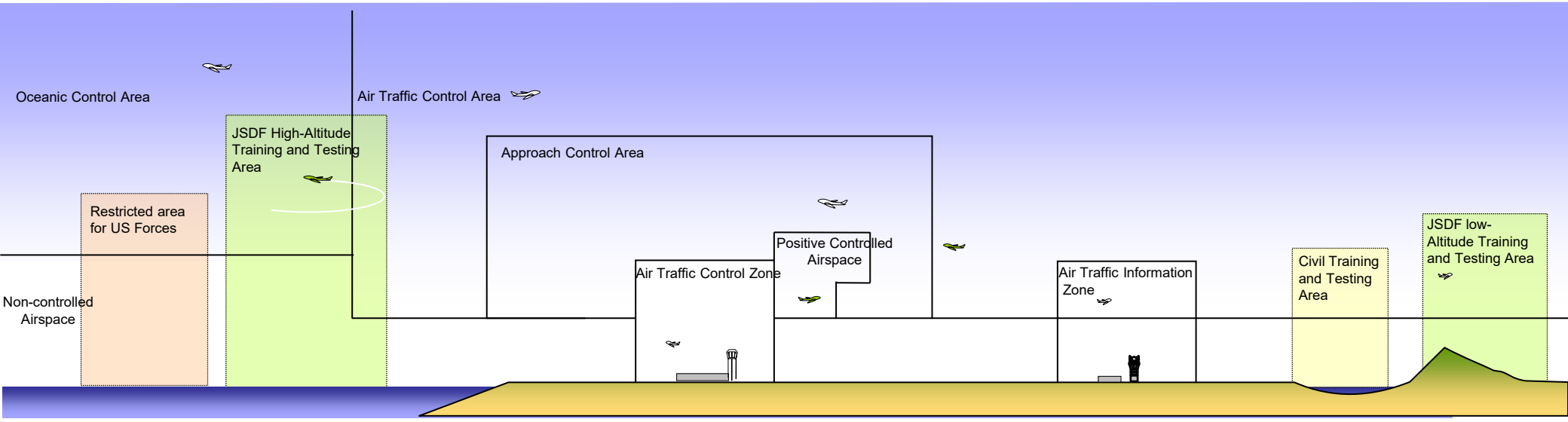
※Other than the above, there is Civil Training and Testing Area which is specifically used for flight training.

- 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

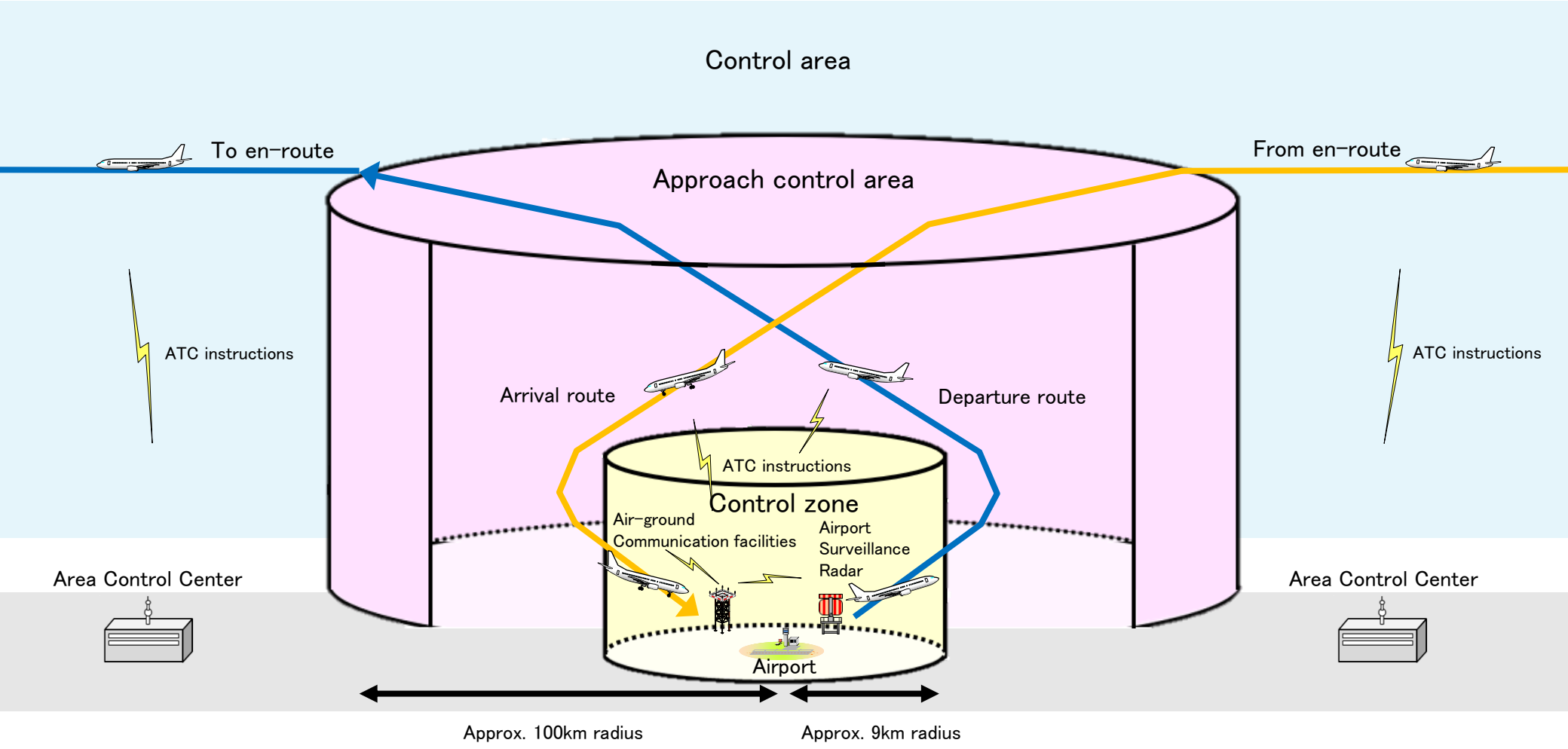
JSDF ····· Air Traffic Control Zone/Approach Control Area of JSDF-controlled airports (Matsushima. Hamamatsu, etc.) and joint use airports (Chitose, Sapporo, Misawa, Hyakuri, Komatsu, Miho, Tokushima), as well as JSDF Training and testing Areas etc.

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



6 Control Areas

Image of air traffic control airspace



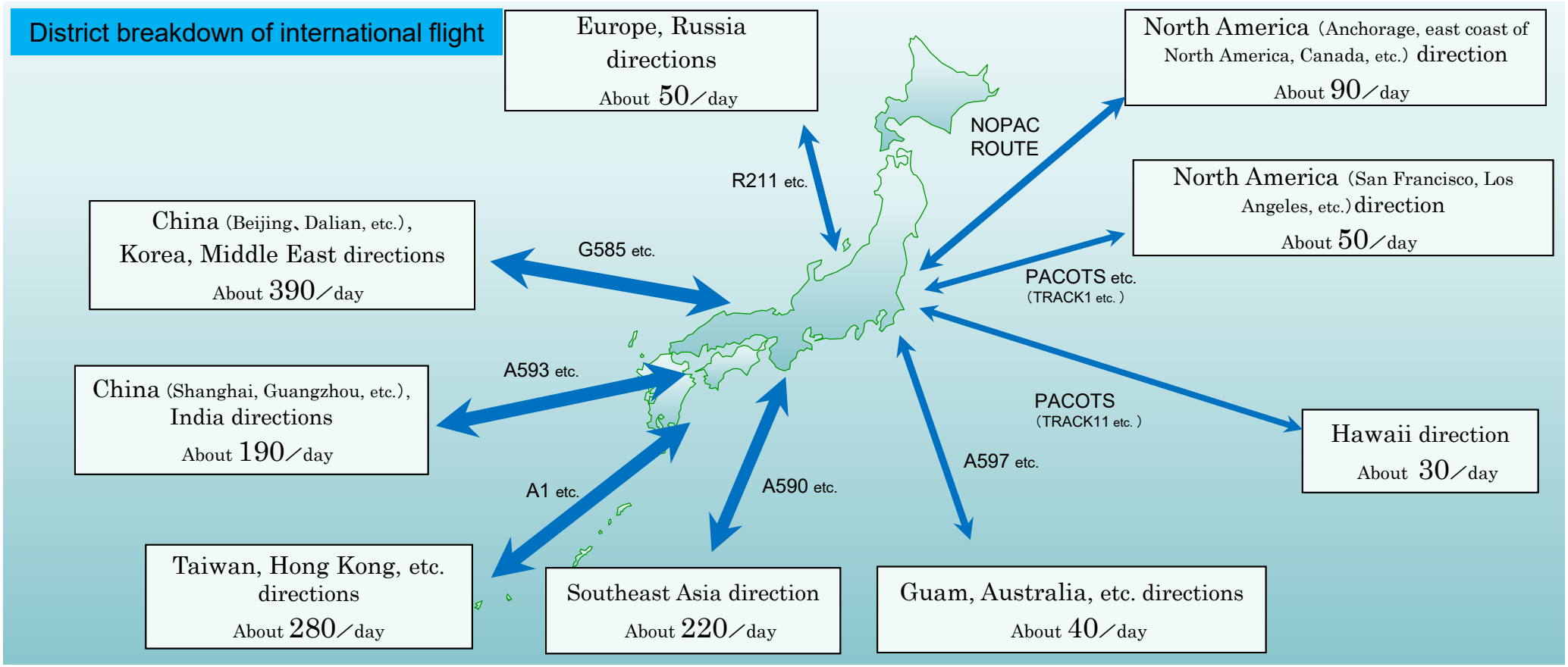
A control zone is an airspace with a radius of approximately 9 km from an airport.
An approach control area is generally an airspace of about 100 km around an airport. Some approach control areas are more extensive, such as Tokyo Approach Control Area surrounding Tokyo International Airport.

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 2,400	About 1,340	About 710

Number of aircraft to fly in VFR (Number of aircraft／day)	
Number of aircraft／day	About 730

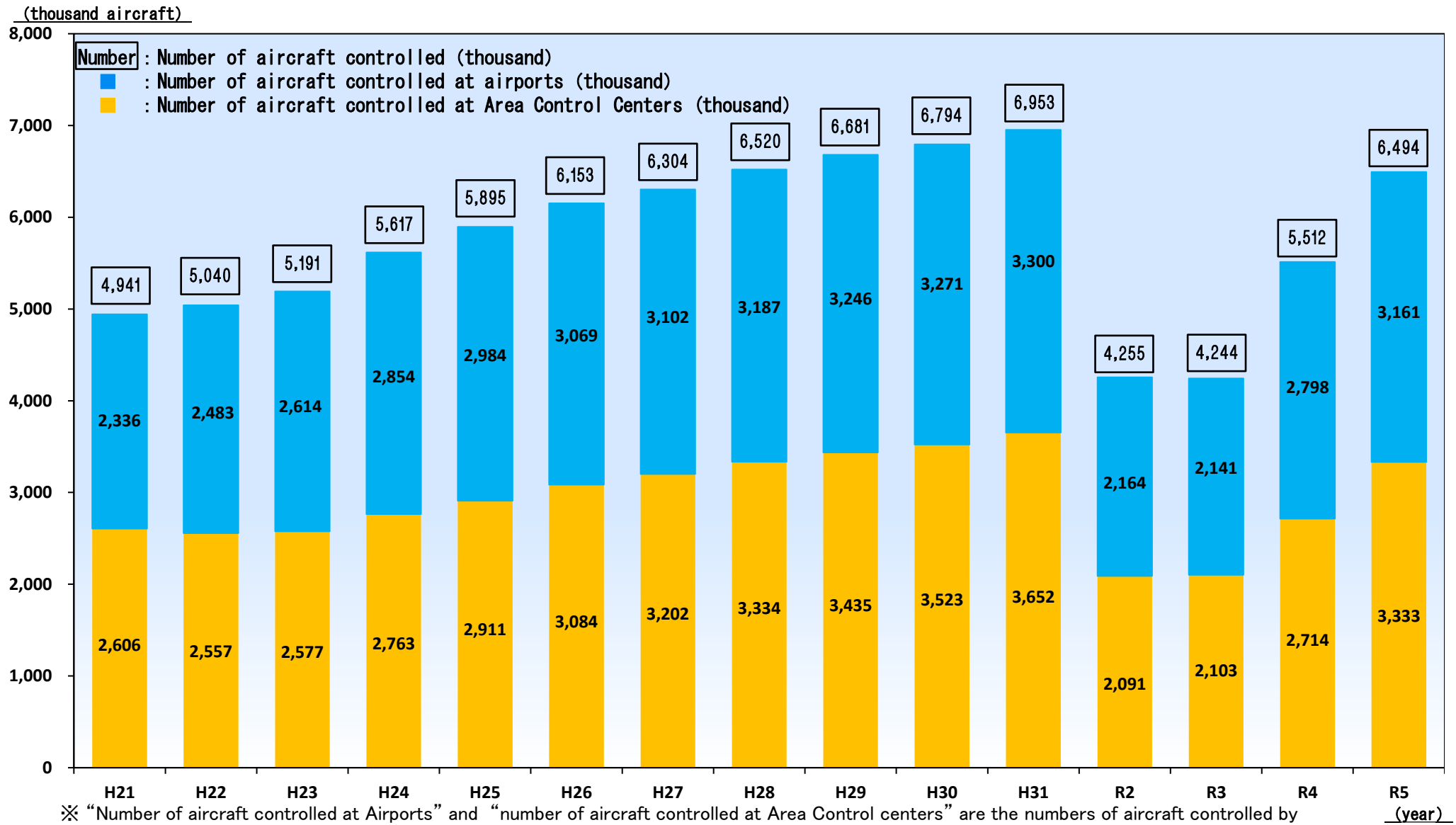
District breakdown of international flight



※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 : Calculated from the flight plan for one month of August 2023.
The figures are the only commercial aircraft, not 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

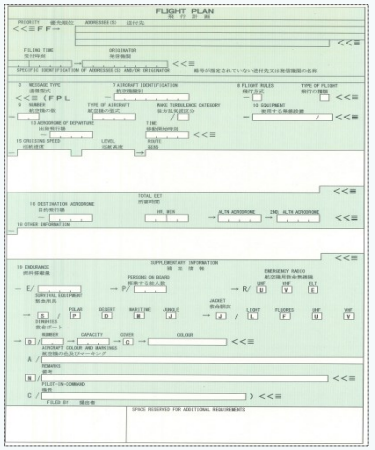
・In order to properly carry out search and rescue services in case of an aircraft accident or emergency state occurs, the flight plan shall be submitted to the Minister of Land, Infrastructure, Transport and Tourism.
・When flying under IFR(※), the flight plan shall be submitted with including the details 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＞



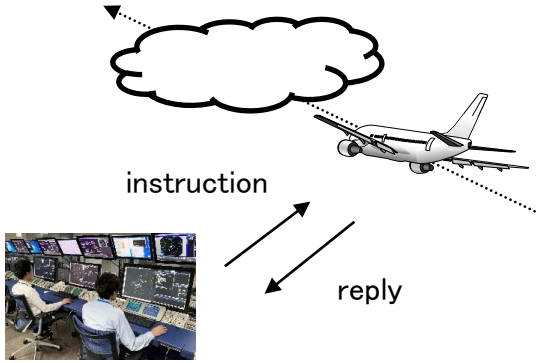
【Flow after submission of Flight plan (When flying under IFR)】

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.)



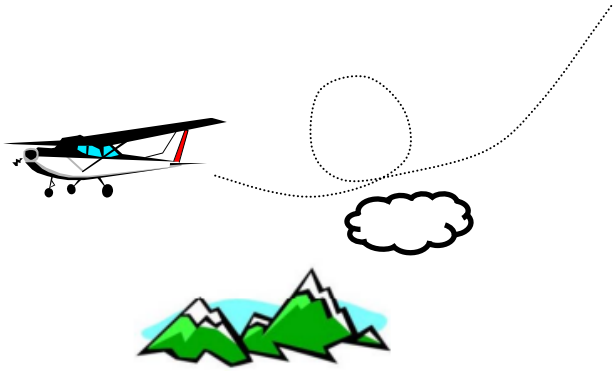
Aircraft flying under IFR may fly during instrument meteorological conditions* under the direction of ATCs.

*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

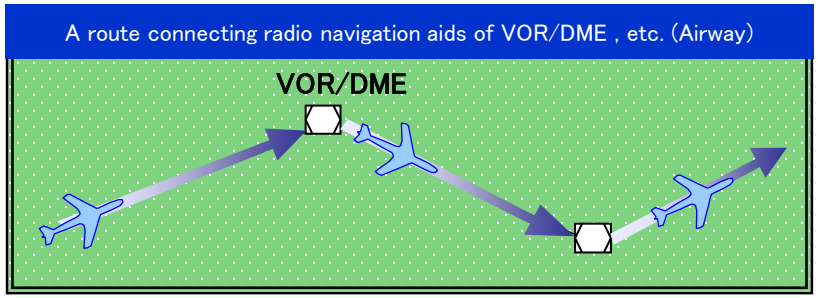
- Airways are the route connecting radio navigation aids. Aircraft fly guided by the information (distance, direction, etc.) obtained from the radio navigation aids.
- Most aircraft by instrument flight rules fly a defined route.

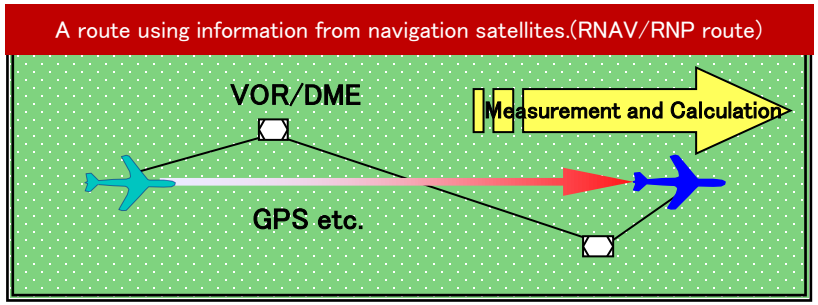
RNAV (Area Navigation)

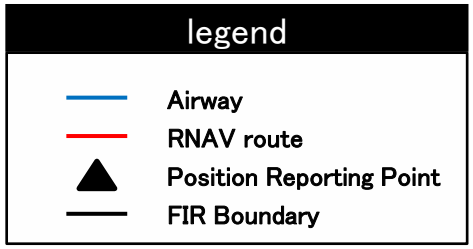
- RNAV(Area Navigation) :It is a method of navigation that uses latitude and longitude information mainly from navigation satellites to calculate the aircraft's position and fly along a desired route using the aircraft's onboard FMS (flight management system) and other equipment. In addition to the mandatory radar monitoring by air traffic controllers, there are other requirements such as on-board equipment and permission.
- There are two navigational specifications:**RNAV specification** and **RNP specification**.

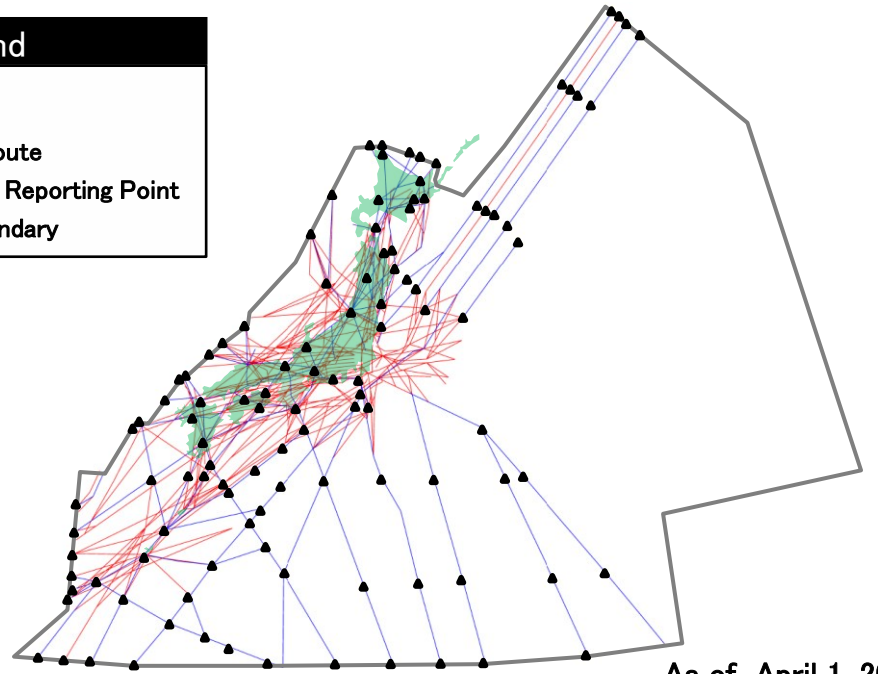
  RNAV specification: A navigational specification that do not include requirements for onboard performance monitoring equipment and warning functions to monitor route deviations and that require radar monitoring.

  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.





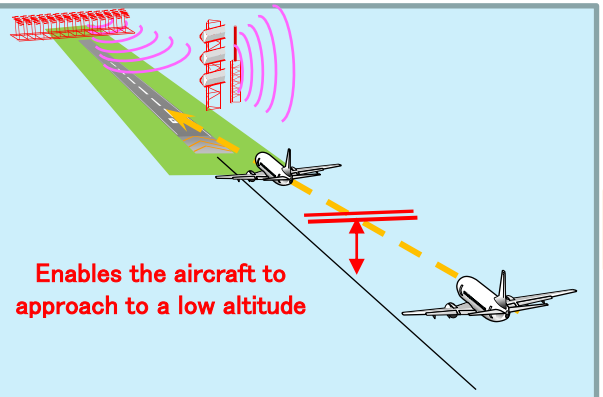




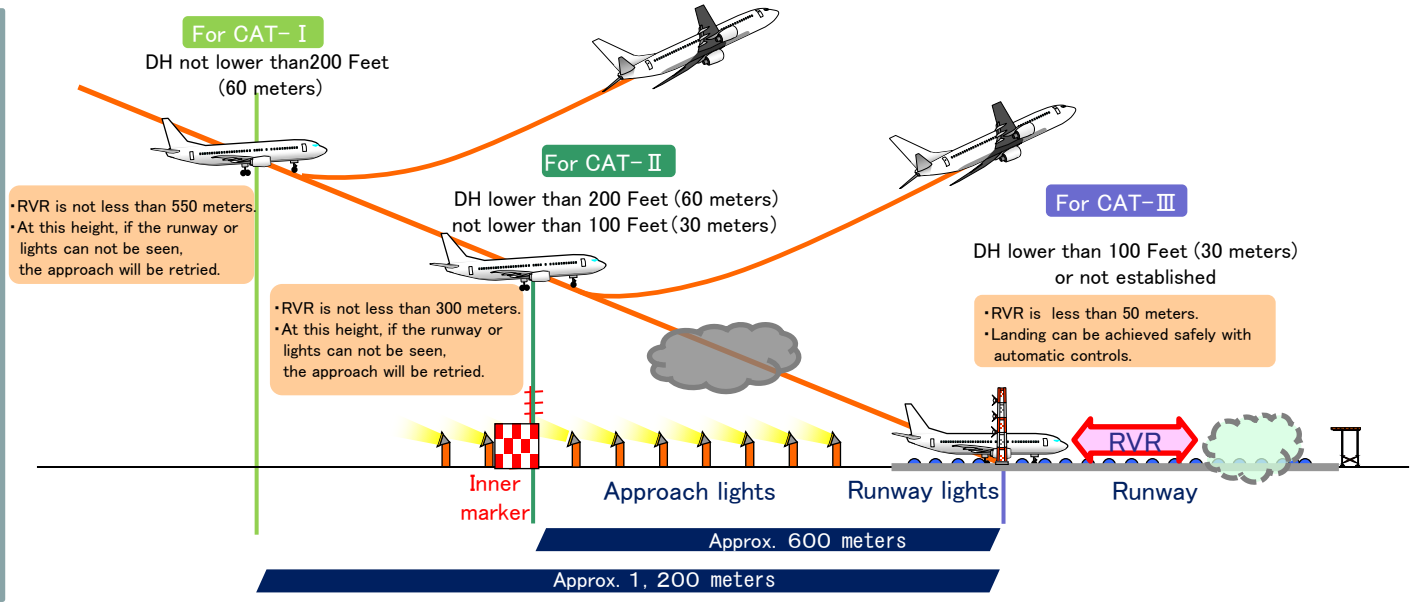
As of April 1, 2024

12 ILS Approach

The flight procedures that connect the airway/RNAV/RNP route to the airport and defines the route, altitude, etc. required for landing is called instrument approach procedures. Each airport has multiple instrument approach procedures based on weather characteristics and surrounding terrain, which can be used according to weather conditions and other factors.
ILS approach is 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.



By receiving guided radio waves indicating the direction and angle of approach from ground facilities, the aircraft can approach to an altitude corresponding to its category.



Classification	Introduction Airport
LOC/T-DME	Rishiri、Shonai、Hachijojima、Oshima、Toyama、Tajima、Izumo、Oki、Tsushima、Fukue、Tokunoshima、Nanki-Shirahama、Kumejima、Yonaguni
CAT- I	Wakkanai、Monbetsu、Memanbetsu、Asahikawa、Nakashibetsu、Kushiro、New Chitose、Obihiro、Hakodate、Aomori、Odate、 Akita、Hanamaki、Yamagata、Sendai、Niigata、Shonai、Fukushima、Hyakuri、Narita、Tokyo、Shizuoka、Chubu、Nagoya、Noto、Komatsu、Kansai、Osaka、Kobe、Hiroshima、Okayama、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

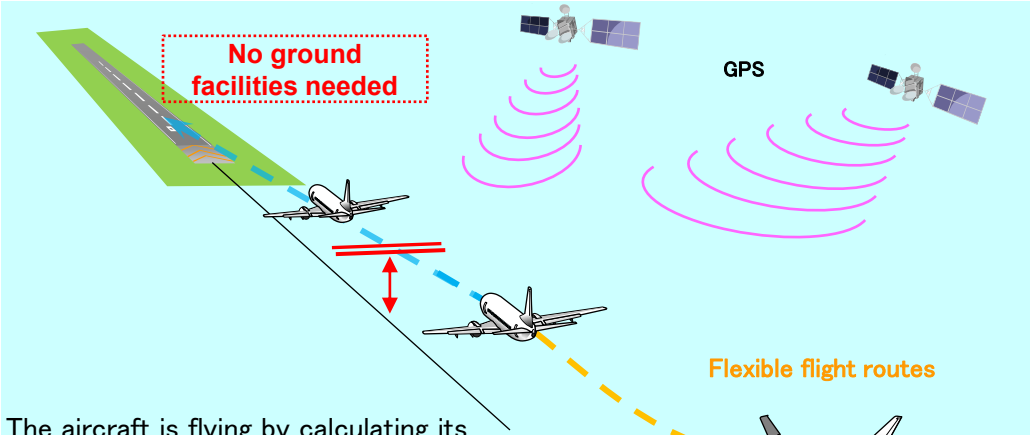
As of April 1, 2024

【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.

13 RNP Approach

The flight procedures that connect the airway/RNAV/RNP route to the airport and defines the route, altitude, etc. required for landing is called instrument approach procedures. Each airport has multiple instrument approach procedures based on weather characteristics and surrounding terrain, which can be used according to weather conditions and other factors.
RNP approach procedure is a landing procedure 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. To carry out an RNP approach, there are requirements such as onboard equipment on the aircraft and navigation permission.

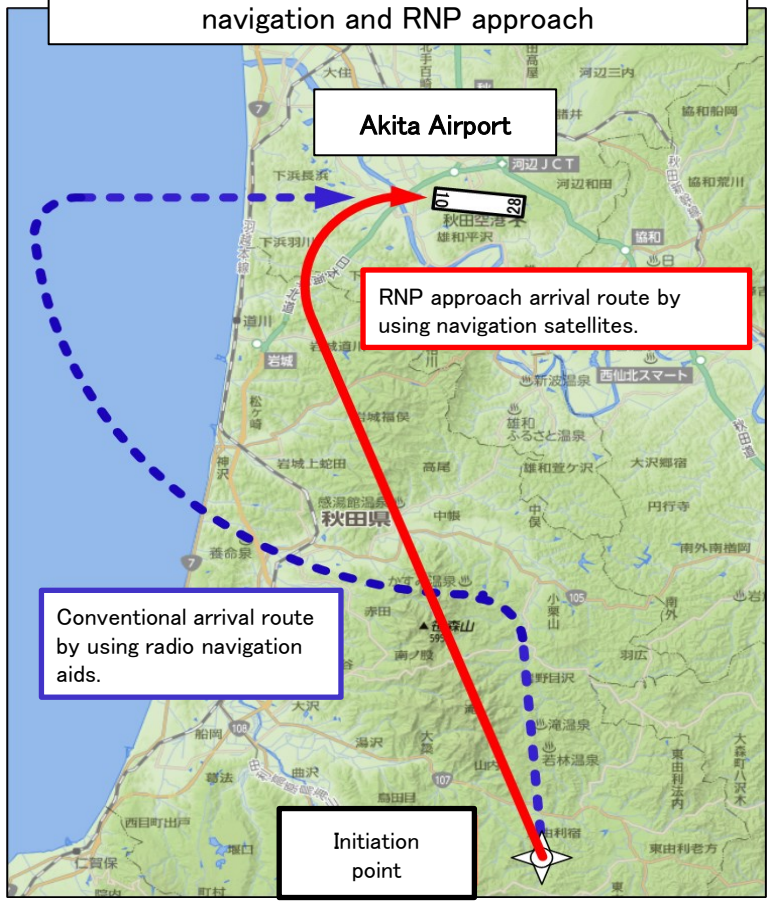


The aircraft is flying by calculating its own position based on information from navigation satellites.
Depending on the terrain around the airport, the aircraft can approach up to 75 meters above the ground.

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

As of April 1, 2024

Examples of arrival routes by conventional navigation and RNP approach



14 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 4
◆ Air traffic management center 1

★ Other airport

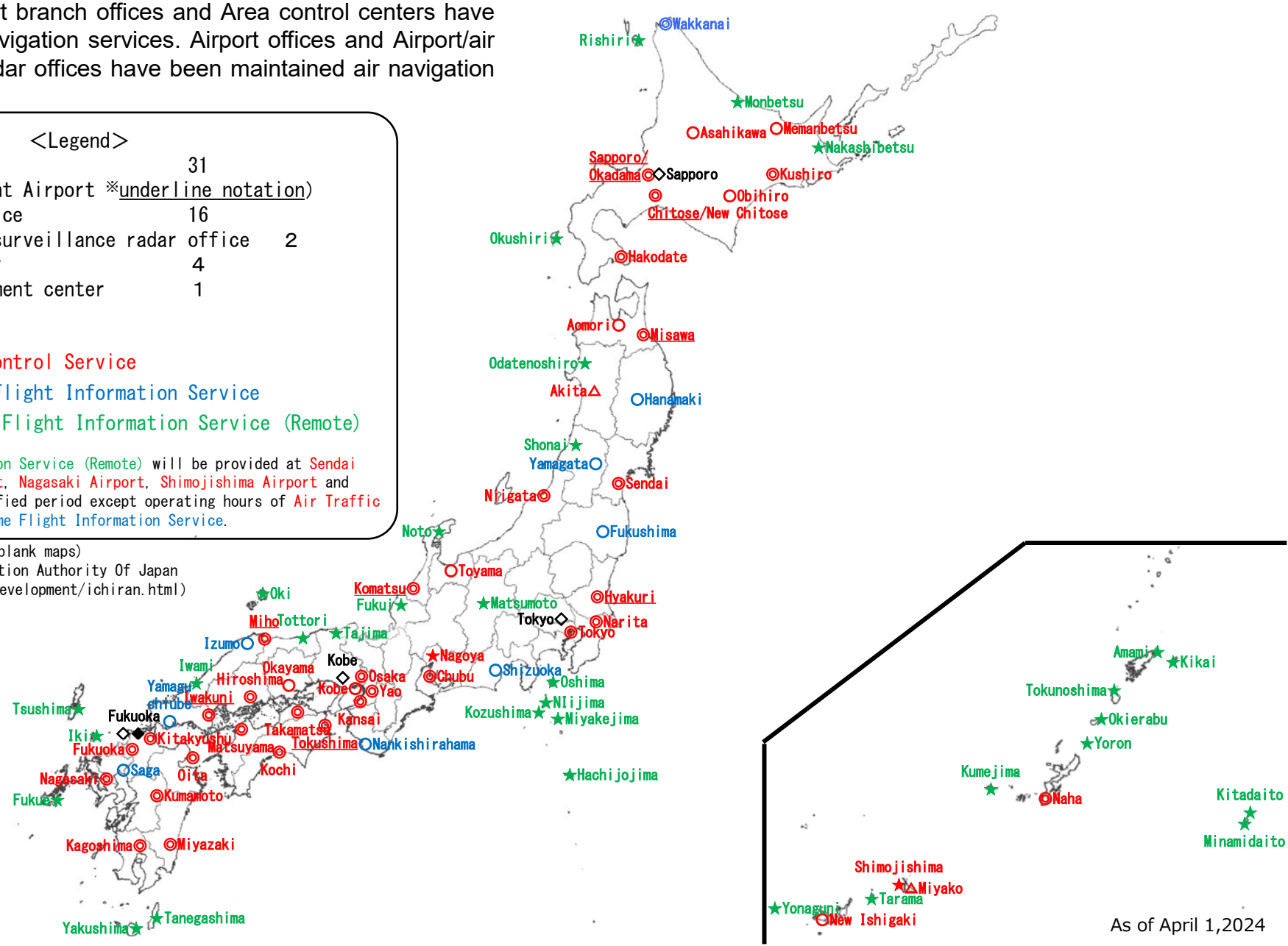
Red text : Aerodrome Control Service

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, Shimojishima Airport and Saga Airport for the specified period except operating hours of Air Traffic Control Service or Aerodrome Flight Information Service.

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



As of April 1,2024

15 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	
Shimofusa	○ (JSDF)	–	
Tateyama	○ (JSDF)	–	
Kisarazu	○ (JSDF)	–	
Chubu Centrair international	○	–	Chubu airport office
Nagoya	○ (JSDF)	–	
Gifu	○ (JSDF)	–	
Kansai international	○	–	Kansai airport office
Osaka international	○	–	
Takamatsu	○	–	
Kochi	○	–	
Kobe	○	–	
Okayama	○	–	
Yao	○	–	
Fukuoka	○	–	Fukuoka airport office
Saga	–	○ Fukuoka airport office (the specified period)	
Iki	–	Fukuoka airport office	
Ashiya	○ (JSDF)	–	
Nagasaki	○	Fukuoka airport office (the specified period)	Nagasaki airport office
Omura	○ (JSDF)	Fukuoka airport office (the specified period)	
Kumamoto	○	–	Kumamoto airport office
Amakusa	–	–	
Kagoshima	○	–	Kagoshima airport office
Miyazaki	○	–	
Nyutabaru	○ (JSDF)	–	
Naha	○ (※2)	–	Naha airport office
Amami	–	Naha airport office	
Kikai	–	Kagoshima airport office	
Tokunoshima	–	Kagoshima airport office	
Okierabu	–	Kagoshima airport office	
Yoron	–	Kagoshima airport office	
Kumejima	–	Naha airport office	
Miyako	○	–	
Shimojishima	○	Naha airport office (the specified period)	
Tarama	–	Naha airport office	
New Ishigaki	○	–	

	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	
Memanbetsu	○	–	
Aomori	○	–	
Akita	○		
Hanamaki	–	○	
Odate-noshiro	–	New Chitose airport office	
Hakodate	○	–	Hakodate airport office
Sendai	○	New Chitose airport office (the specified period)	Sendai airport office
Niigata	○	–	Niigata airport office
Hiroshima	○	–	Hiroshima airport office
Oita	○	–	Oita airport office
Toyama	○	–	–
Sapporo	○ (JSDF)	–	○ (JSDF)
Chitose	○ (JSDF)	–	○ (JSDF)
New Chitose	○ (JSDF)	–	
Misawa	○ (JSDF)	–	○ (JSDF)
Hyakuri	○ (JSDF)	–	○ (JSDF)
Komatsu	○ (JSDF)	–	○ (JSDF)
Fukui	–	Osaka airport office	
Miho	○ (JSDF)	–	○ (JSDF)
Izumo	–	○	
Iwakuni	○ (US Military)	–	○ (US Military)
Matsuyama	○	–	
Tokushima	○ (JSDF)	–	○ (JSDF)
Tsuiki	○ (JSDF)	–	○ (JSDF)
Kitakyushu	○	Fukuoka airport office (the specified period)	
Yamaguchi Ube	–	○	
Wakkanai	–	○	–
Yamagata	–	○	–
Fukushima	–	○	–
Shizuoka	–	○	–
Nanki-shirahama	–	○	–

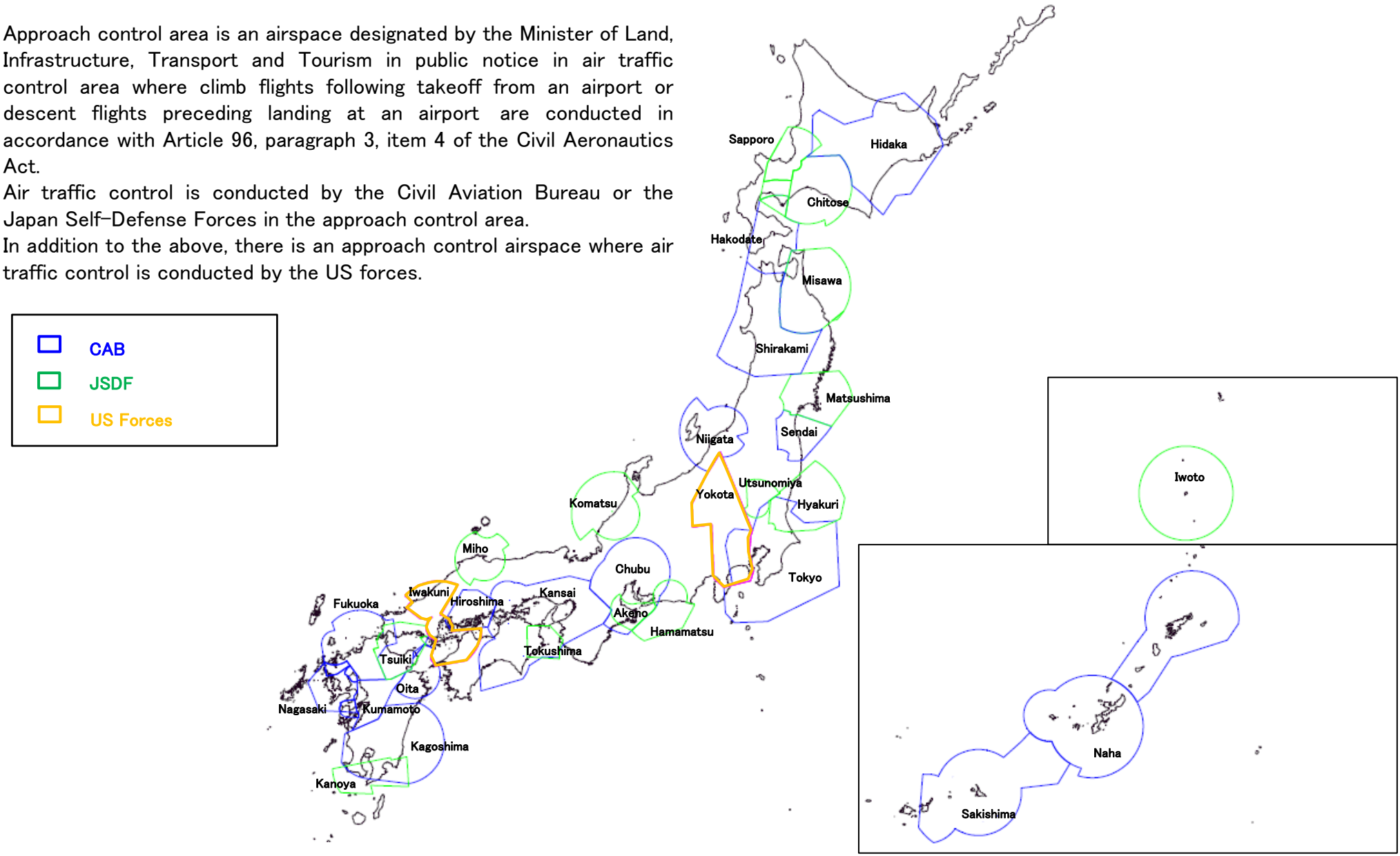
	Aerodrome Flight Information Service（※1）
Rishiri	New Chitose airport office
Okushiri	
Monbetsu	
Shonai	
Matsumoto	
Niijima	
Kozushima	
Miyakejima	
Hachijojima	
Noto	Osaka airport office
Tottori	
Oki	
Iwami	
Tajima	
Tsushima	Fukuoka airport office
Fukue	
Tanegashima	Kagoshima airport office
Yakushima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

As of April 18,2024

16 Approach Control Area

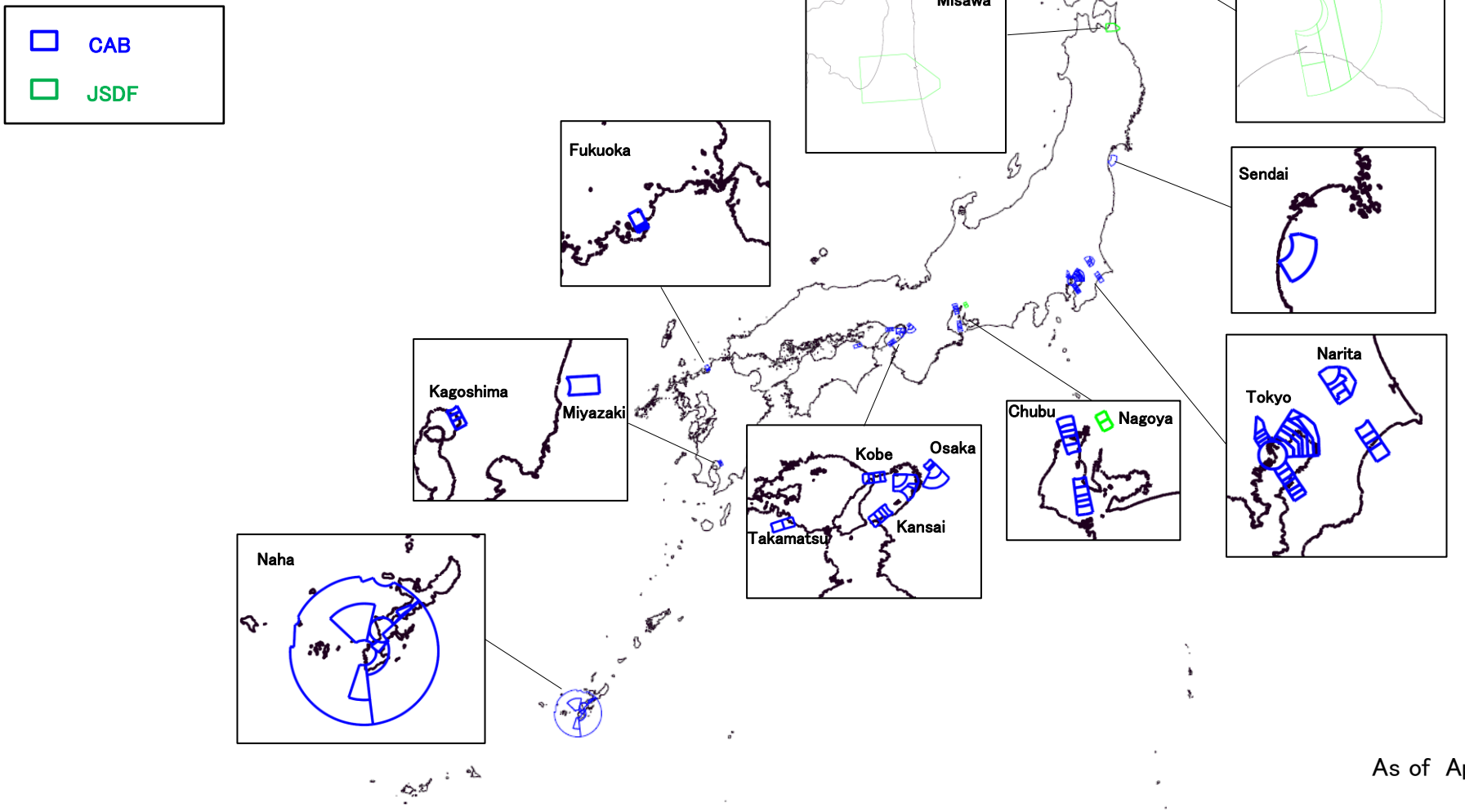
- Approach control area is an airspace designated by the Minister of Land, Infrastructure, Transport and Tourism in public notice in air traffic control area where climb flights following takeoff from an airport or descent flights preceding landing at an airport are conducted in accordance with Article 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.



As of April 18, 2024

17 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.



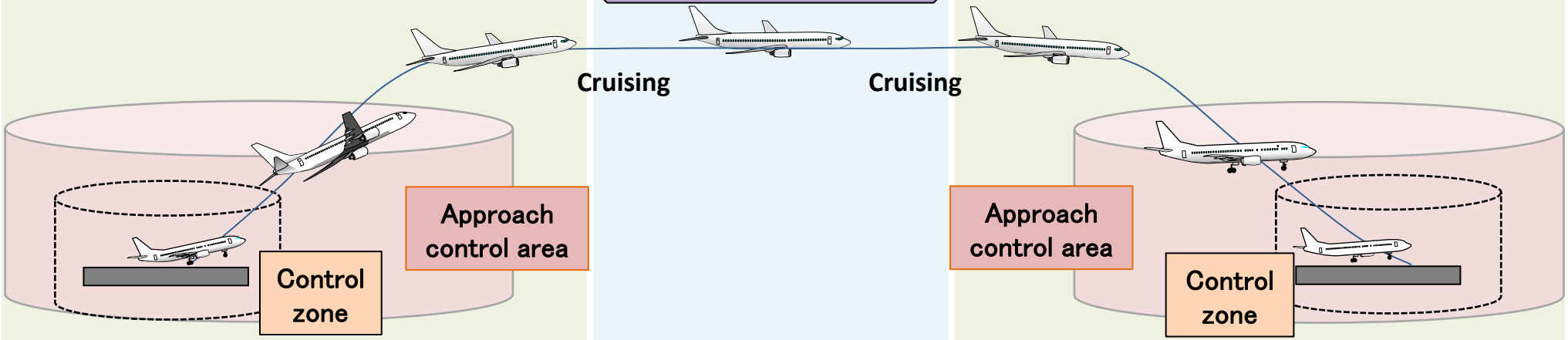
As of April 1, 2024

18 Air Traffic Control Services

Takeoff・Climbing

En-route

Descending・Landing



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

Control zone (Takeoff)

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

Approach control area

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

En-route

〈 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 area

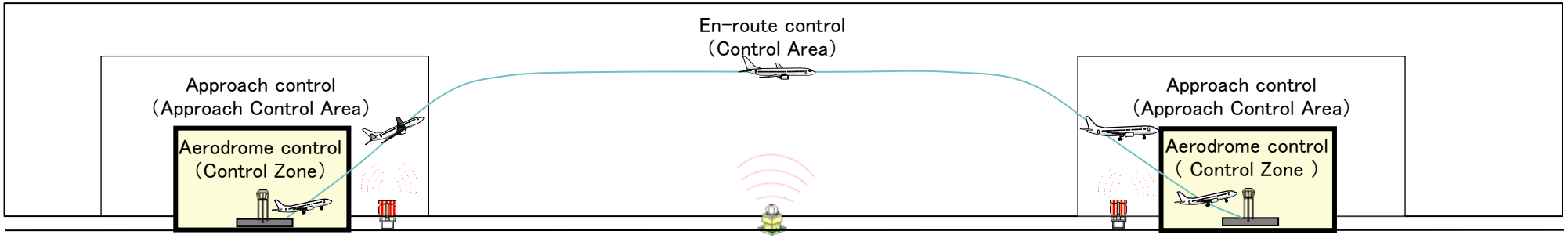
〈 Approach control service 〉
- Recognizes positions of aircraft by airport surveillance radar
- Provides radar vectors from airways to airport
- Sets separation among aircraft

Control zone (Landing)

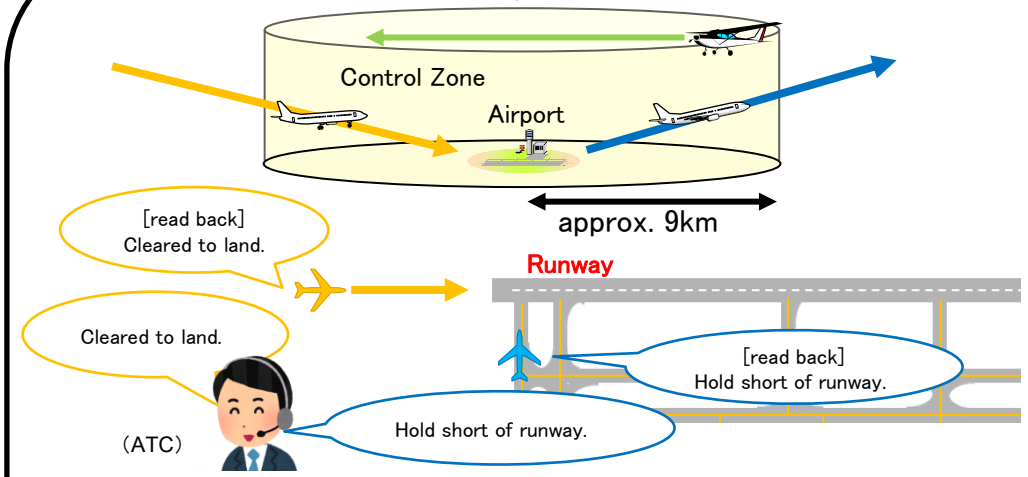
〈 Aerodrome control service 〉
- Recognizes positions of aircraft visually
- Gives landing clearance
- Gives taxi instructions to terminal building

19 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.



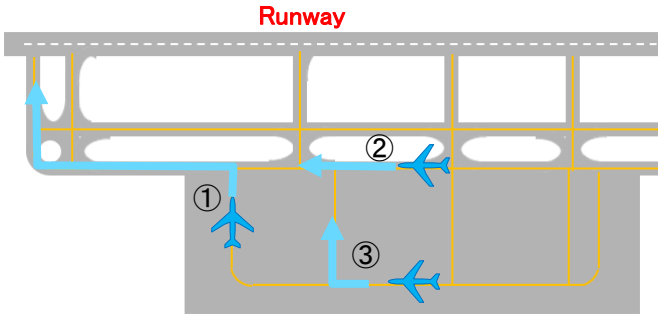
Traffic control around the airport and on the runway



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)

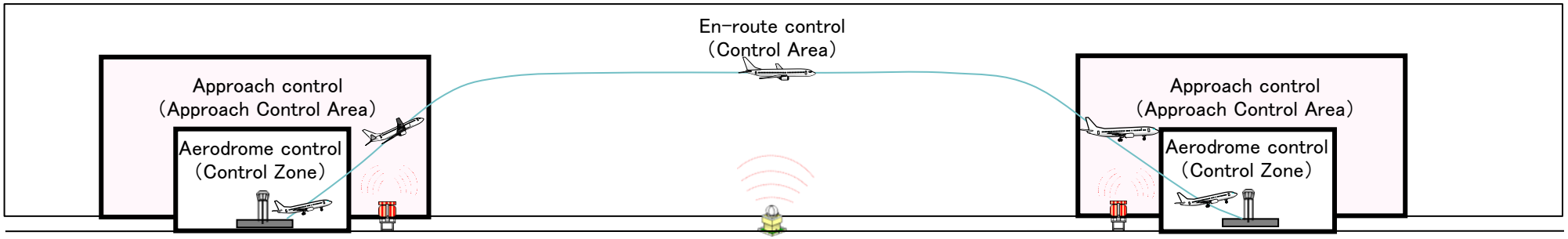
Traffic control on the ground



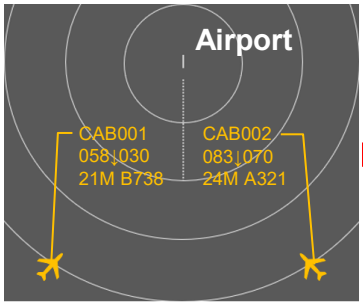
ATCs provide instructions on route for taxiing to aircraft and vehicles. ATCs decide the order of ground traffic and provides instructions to stop or detour.

20 Approach Control

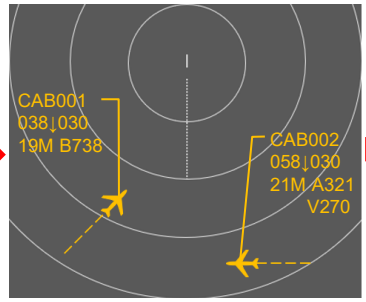
Approach control is a service which ATCs decide the sequence for arriving and departure aircraft flying in approach control area*, and provide instructions on direction, altitude and speed of flight and on holding. ATCs provide this service by observing aircraft on radar.
*In general, an airspace within radius of approximately 100km from an airport.



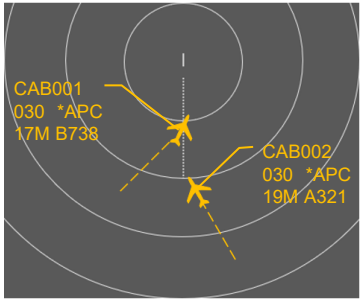
Arr.



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.



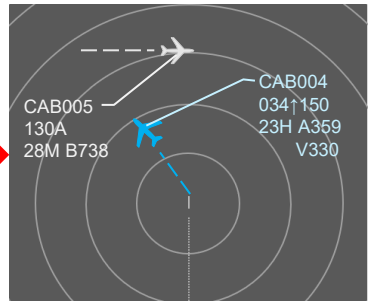
Set a safe separation between them and let them fly toward the runway by giving approach clearance.

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)

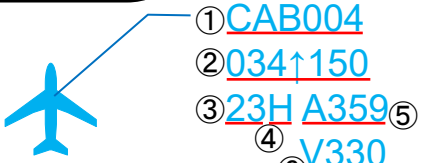
Dep.

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.

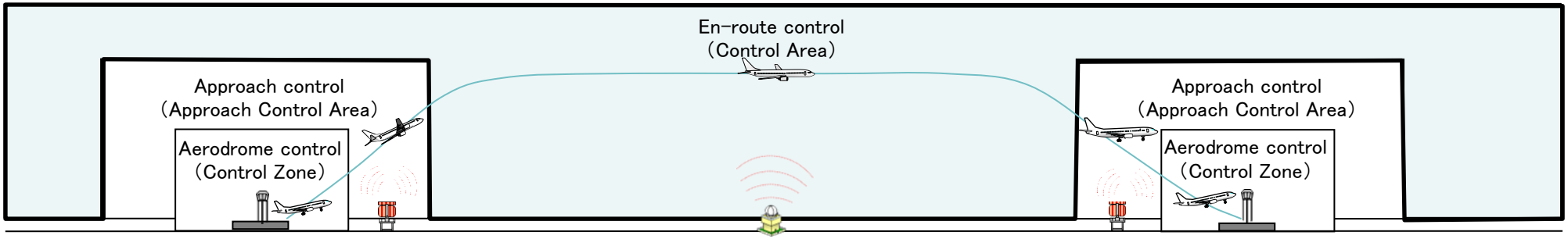
ATCs instruct departure aircraft, which have taken off from an airport, to climb to cruising altitude, while setting a safe separation between others flying around, then hand them over to the area control center.



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

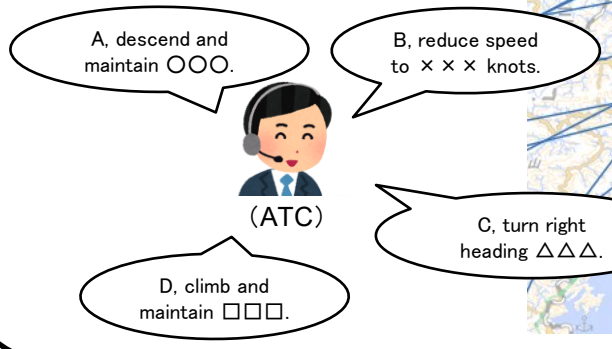
21 En-route Control

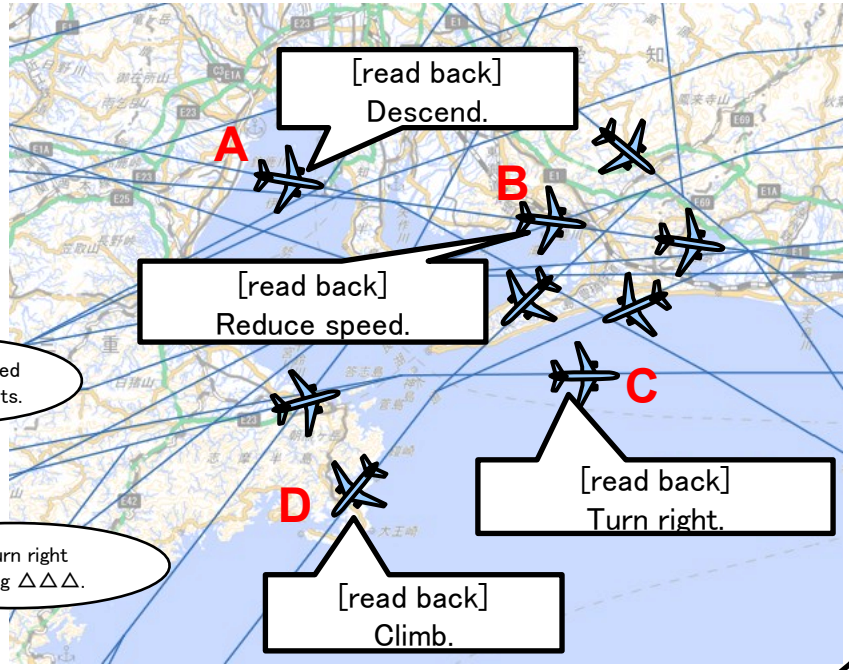
En-route control is a service which ATCs provide instructions regarding flight direction, altitude, speed, etc., to aircraft flying in a control area. ATCs detects positions of aircraft flying in the control area on radar.

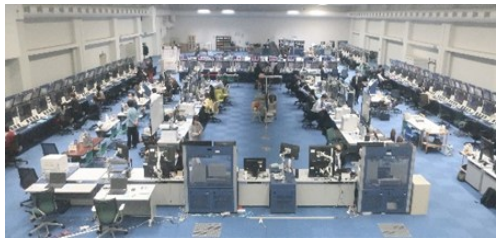


Traffic control on en-route

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)

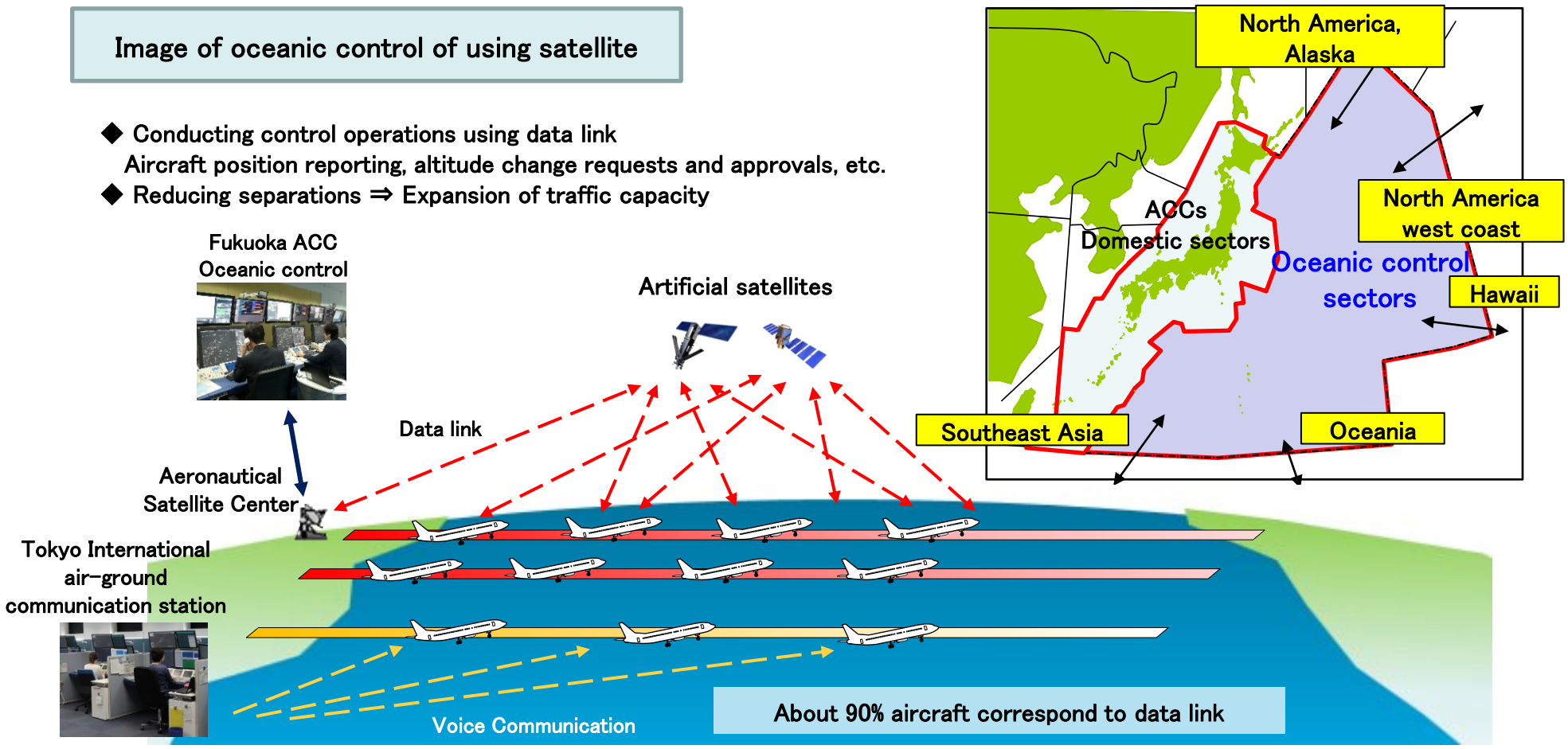
Today, control area is divided into 4 areas. Area control centers, located in Sapporo, Tokyo, Kobe and Fukuoka, provide air traffic control service in control area.

22 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.
・Oceanic control has been transferred from Air Traffic Management Center (ATMC) to Fukuoka ACC since June 13, 2024.
・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.

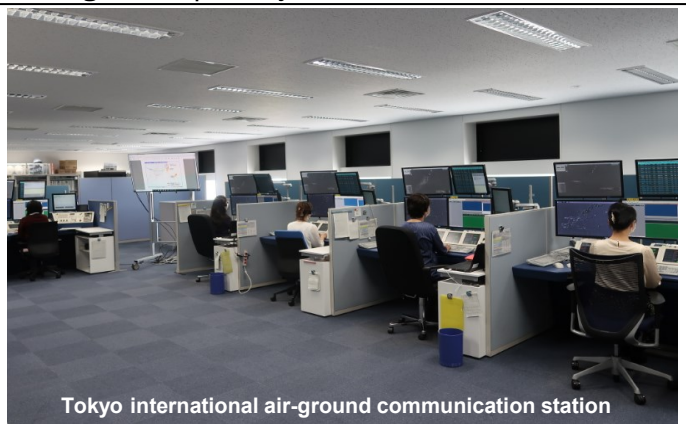
Image of oceanic control of using satellite

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



23 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

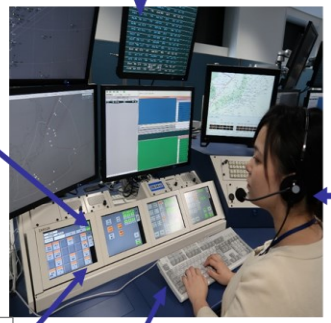
◆The Tokyo international air-ground communication station is one of the communications bureaus of the worldwide organized communications network, responsible for the North Pacific(NP) and Central West Pacific(CWP) areas, and performs the following operations for aircraft flying over the ocean airways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

【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.

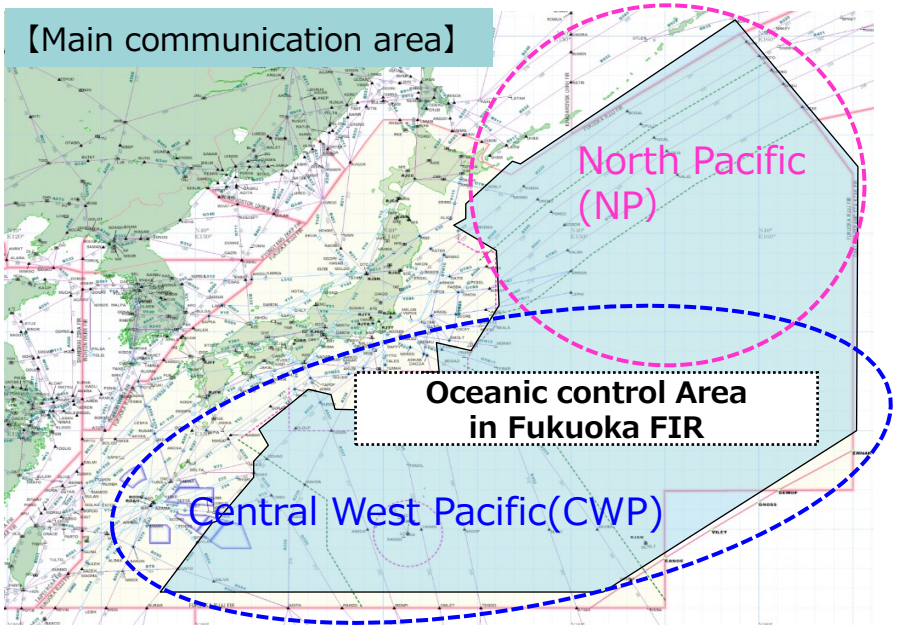


Distinguishing Voice
Since multiple frequencies are operated at the same time, it is possible to distinguish which aircraft is transmitting.
In addition, it is possible to distinguish the voice from the one accompanied by the static and fading characteristic of HF.

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

Communication details typing
Typing its contents at the same time as the communication in order to send it to air traffic control, airline companies, and other concerned parties.

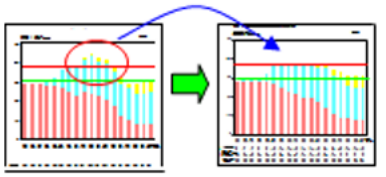
【Main communication area】



24 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 planed routes to form an orderly traffic flow and implements coordination such as route changes to avoid congestion and bad weather.

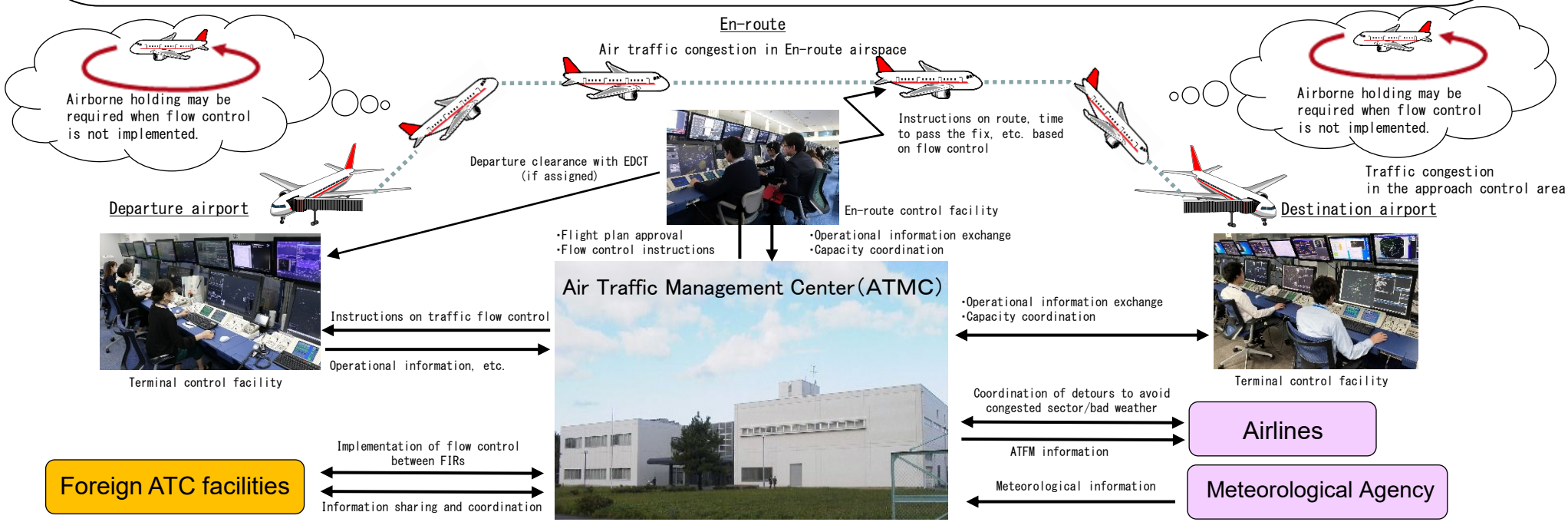


○ ATC clearance
Monitors the ATC capacity of each airspace (sector) and airport and traffic volume, and issue clearance to aircraft to fly on IFR through the ATC facilities.

○ 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 have been established in major ATC facilities, and traffic management units (TMUs) are managing air traffic flow.
- 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.



25 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

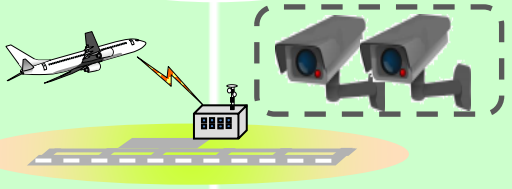
- Air traffic information around the airport
- Meteorological Information
- Significant runway surface conditions
- Relay an ATC clearance

Information is provided From Tower at the airport

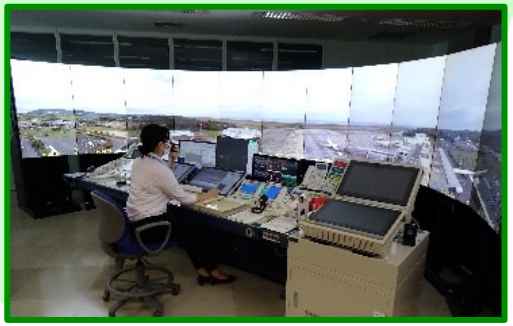
Airport（Aerodrome Control **Service is not provided**）

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 item15.

26 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

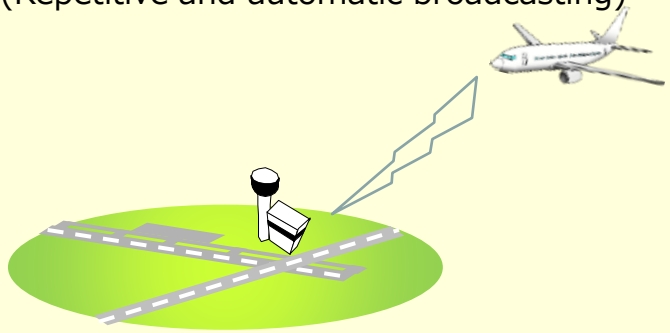
ATIS RJAA T
①Narita airport ②Identify with A～Z
M0800 ③0800UTC(17:00JST)
(APCH)ILS Y RWY16R/ILS Y RWY16L
④Type of approach
LDG RWY 16R/16L ⑤Landing runway
DEP RWY 16R ⑤Departure runway
PARL APCHS INPR. DEP FREQ 124.2.
⑦Parallel approach in progress. Departure frequency for terminal air traffic control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

【Airports providing ATIS 】 TOTAL 22 Airport as of April 1st ,2024

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

【How to provide ATIS】

① Voice Broadcasting
(Repetitive and automatic broadcasting)



② VHF data link
(Data communication by onboard equipment)

Onboard equipment

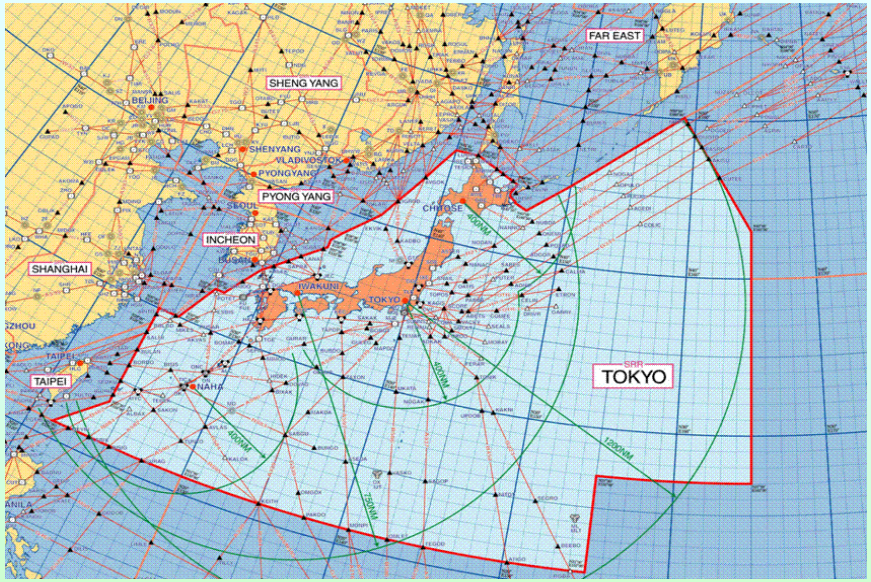
27 Search and Rescue (SAR) Service

・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

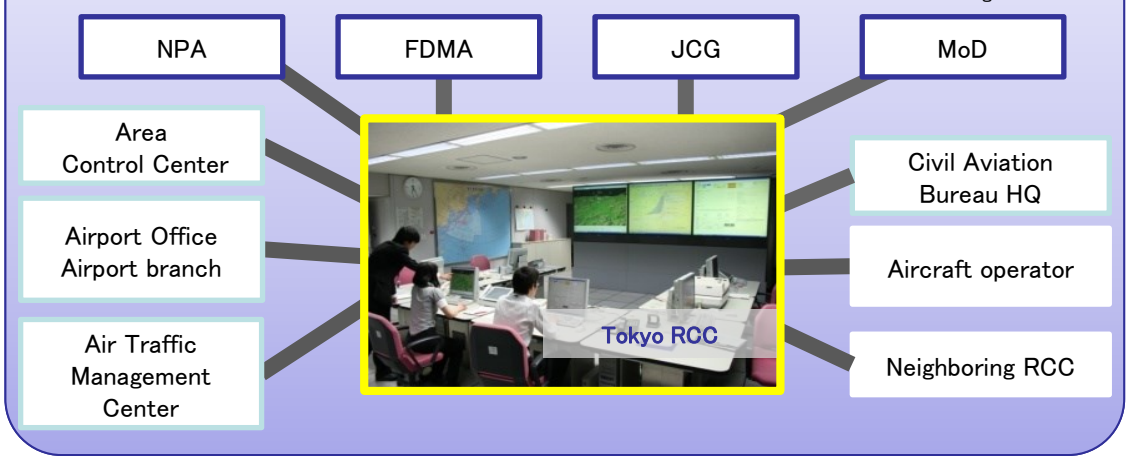
Tokyo Search and Rescue Region (Tokyo SRR)

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.

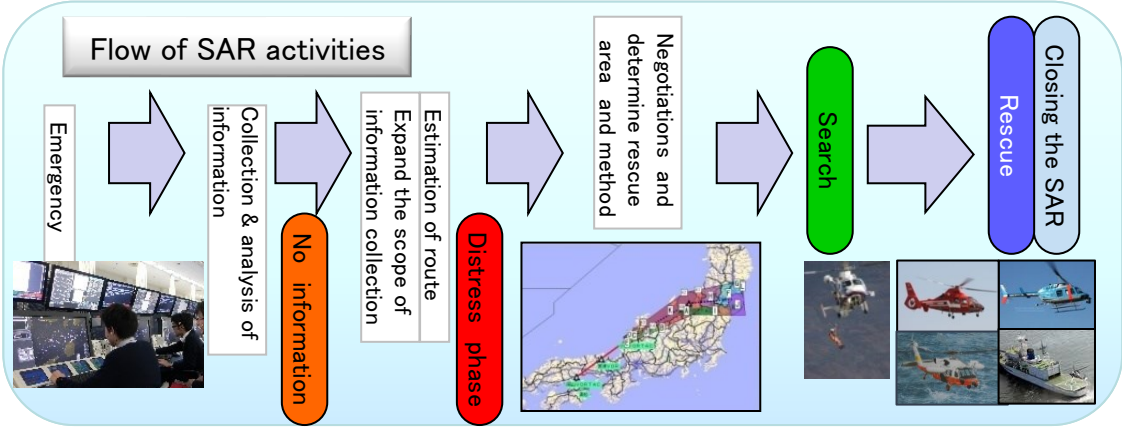


Framework of SAR activities in Japan

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



Flow of SAR activities

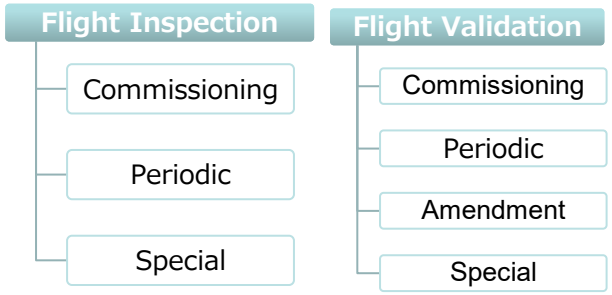


28 Flight Inspection

■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 Hanger

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.

29 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

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

ATM information officers

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

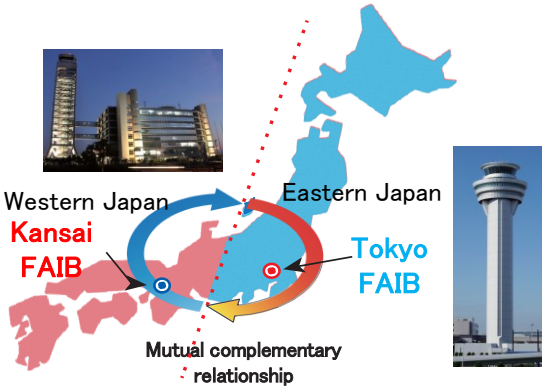
ATM engineering specialists

- CNS※operations coordination

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

30 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.



Before flight	In flight	After flight
Coordination of securing airport slot Ramp Inspection Permission(Civil Aeronautics ACT) Operation support	Flight watch	Ramp inspection Slot monitoring

Slot/Spot Allocation Support Service

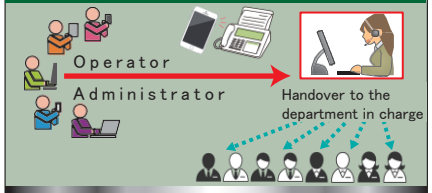
Improvement of convenience ➡ Reducing Flight Delay

Provide a one-stop service for coordination of congested airport use. (SLOT,SPOT etc.)

Operation support

Supporting SAFETY Flight ➡Reducing Accidents

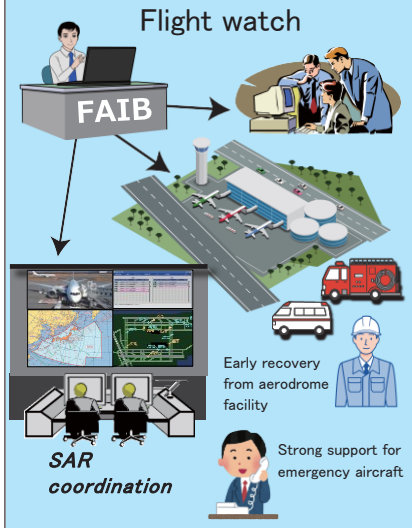
Contact FAIB if you have question



- Acceptance of submission of a flight plan.
- Providing weather information, aeronautical information, etc
- Responding to inquiries regarding operation of aircraft or domestic airports from operators and AD administrators(HELP DESK)

Emergency flight support management

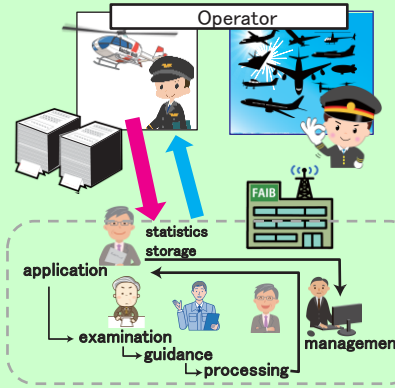
Early recovery from incident/emergency situation



- Monitoring aircraft operation from departure to arrival.
- Coordination for SAR service
- Support emergency aircraft

Ramp Inspection Permission(Civil Aeronautics ACT)

More flexibility in procedures



Service improvement

- ☐ Application time:24H a day
- ☐ Decrease in the number of applicants
- ☐ Unification of application form contents
- ☐ Respond to disasters and other emergencies by making applications more flexible.

- Standardization of permitting procedure
- Sharing safety information
- Ramp Inspection

31 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.

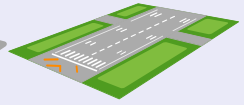
AIS Aeronautical Information Service

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

- Contains permanent information essential for aircraft operations
- Update on a 28-day cycle

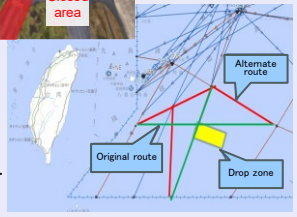
- Temporary change of facilities and services
- Issued 110,000 annually, average 300 per day

Transit to digital data

- By the end of FY2024, 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

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

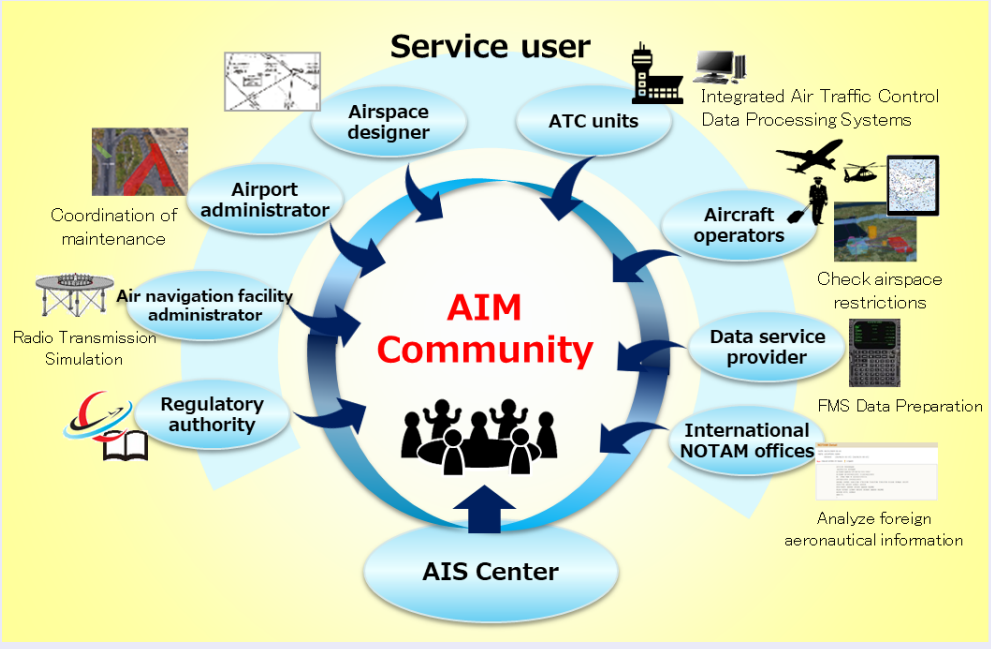
Draw shapes on electronic chart, and display in layer.



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



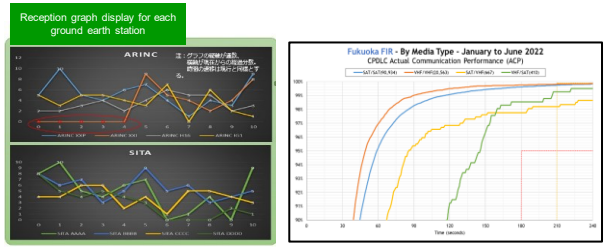
32 NPAC (Network Performance Assessment Center)

Network Performance Assessment Center （NPAC： Located Hitachiota City, Ibaraki 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】

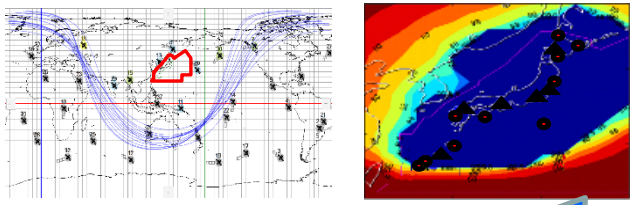
Communication

- 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.



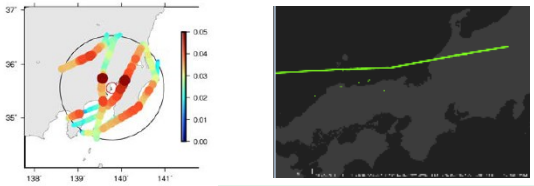
Navigation

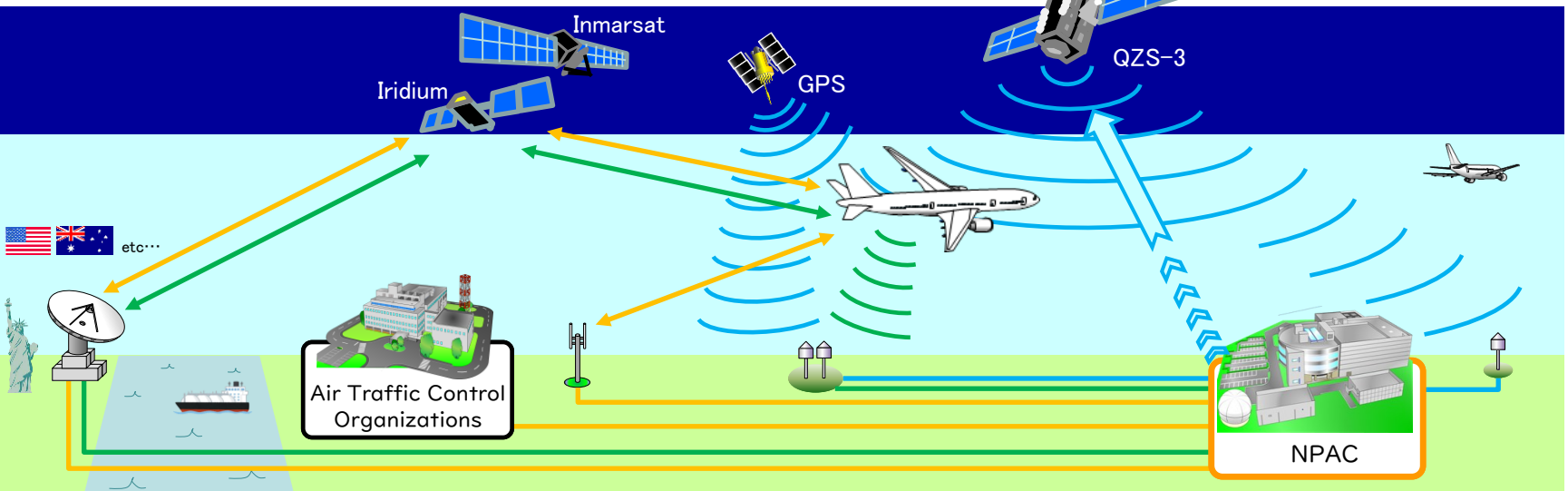
- Generation and monitoring of augmentation signals (SBAS signals) necessary to use GPS for aircraft operations.
- Prediction of GPS availability for aircraft
- Monitoring of GPS signal degradation, interference.

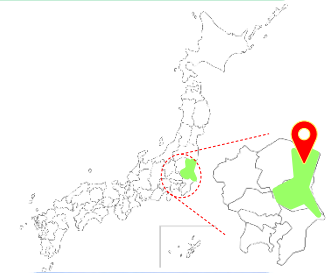


Surveillance

- 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)





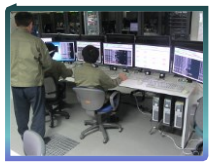


NPAC

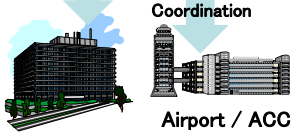
Hitachiota City, Ibaraki Pref.

33 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.



Coordination Trouble report
Coordination



Airport / ACC

JCAB Headquarters

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.

The cycle aiming at a better ATC system

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

Software evaluation

System total evaluation

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

etc.

Exchange opinions and collaborate with the stakeholders

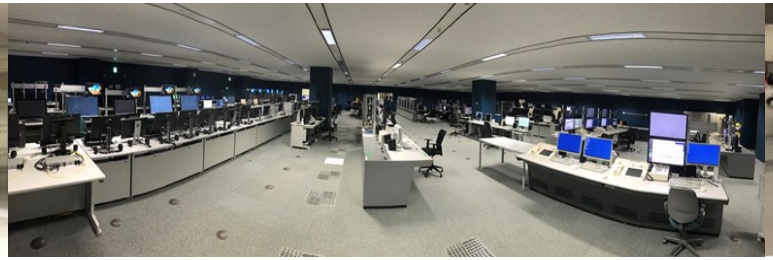
JCAB Headquarters

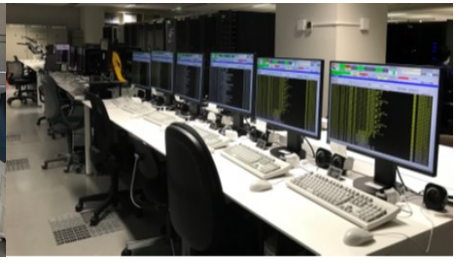
Ministry of Defense

Airport / Airlines

Foreign Facilities

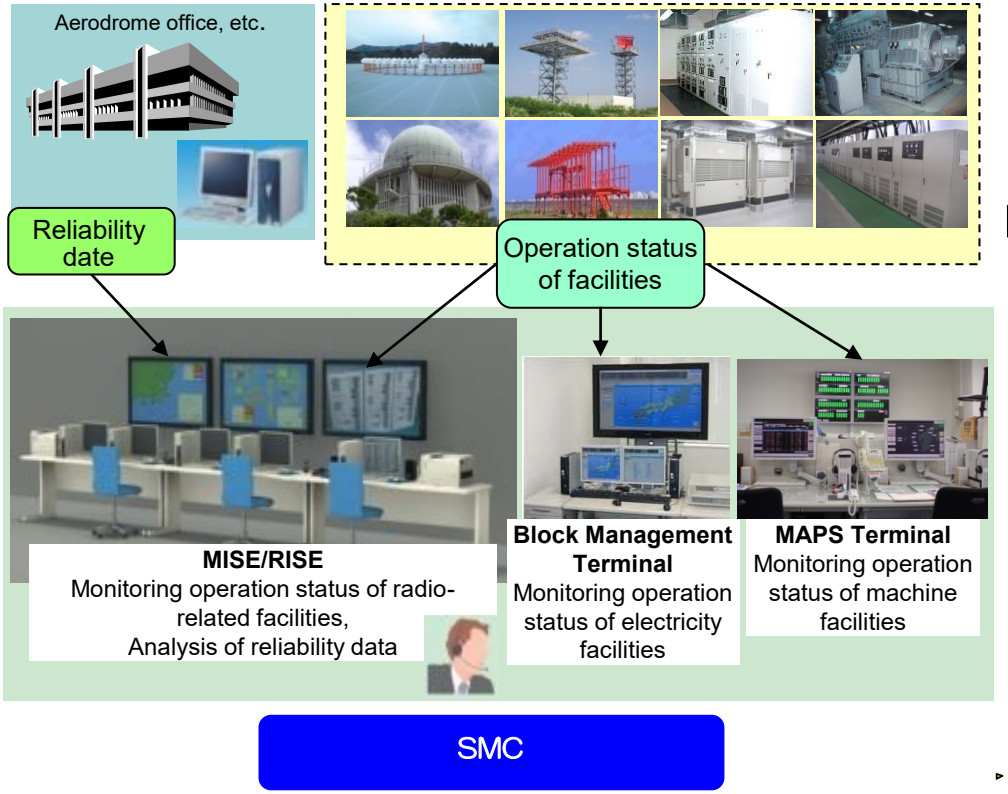
Software Developers

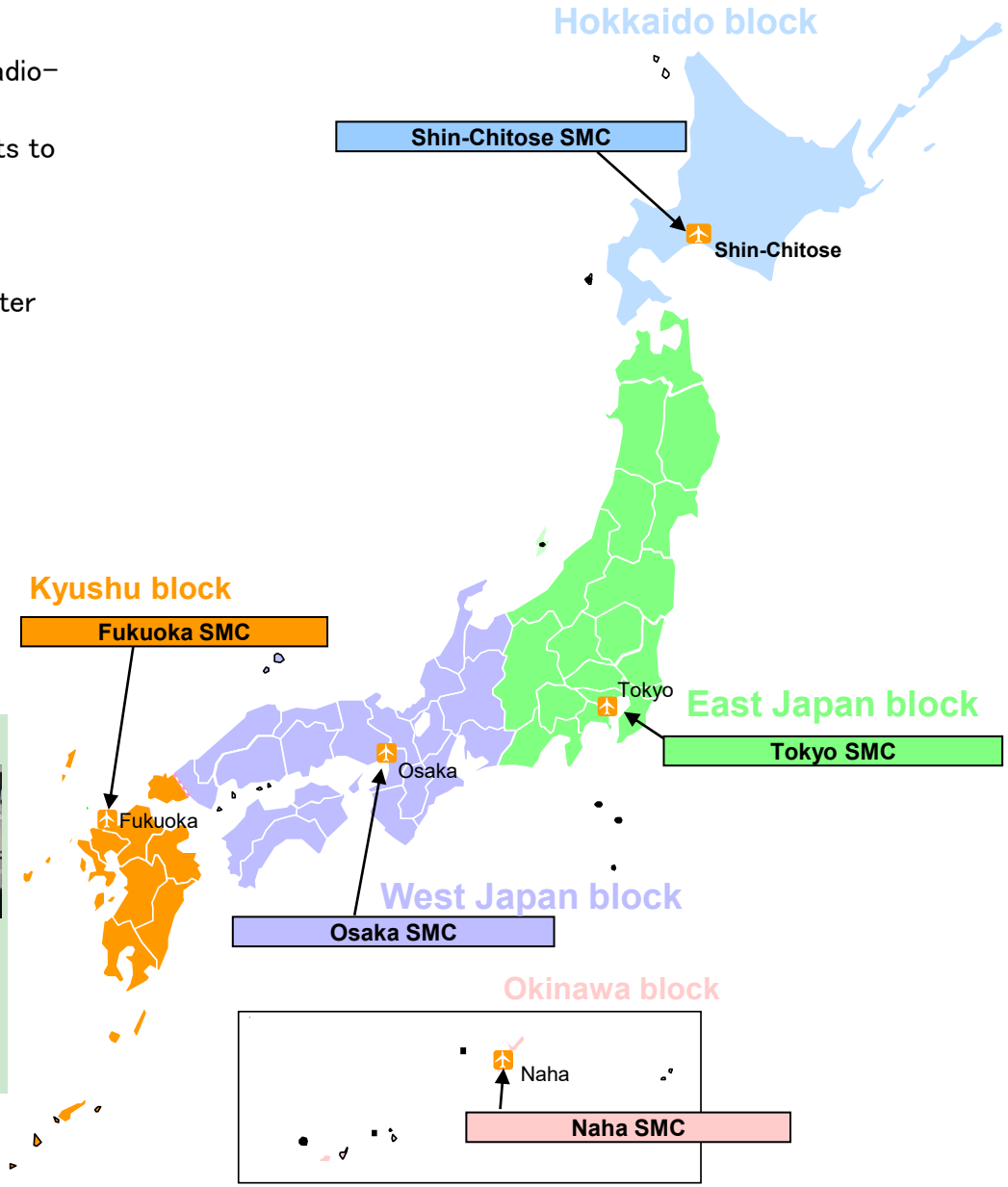




34 SMC (System Operational Management Center)

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).





35 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.

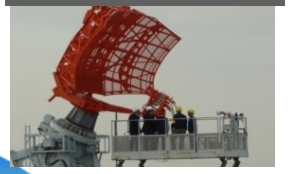
*Life cycle management is to develop facilities which realize to maintain stable operation and to improve efficiency of facility maintenance costs, through enhancing the quality of equipment

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.

Formulate Specifications

Equipment Performance Inspection



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.

Operational Data Analysis

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 Improvement Meeting

Technical Support

Test Evaluation

- Test 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.

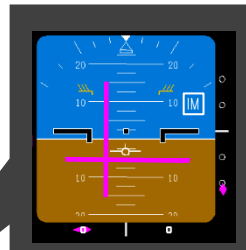
Test Evaluation

Technical Support

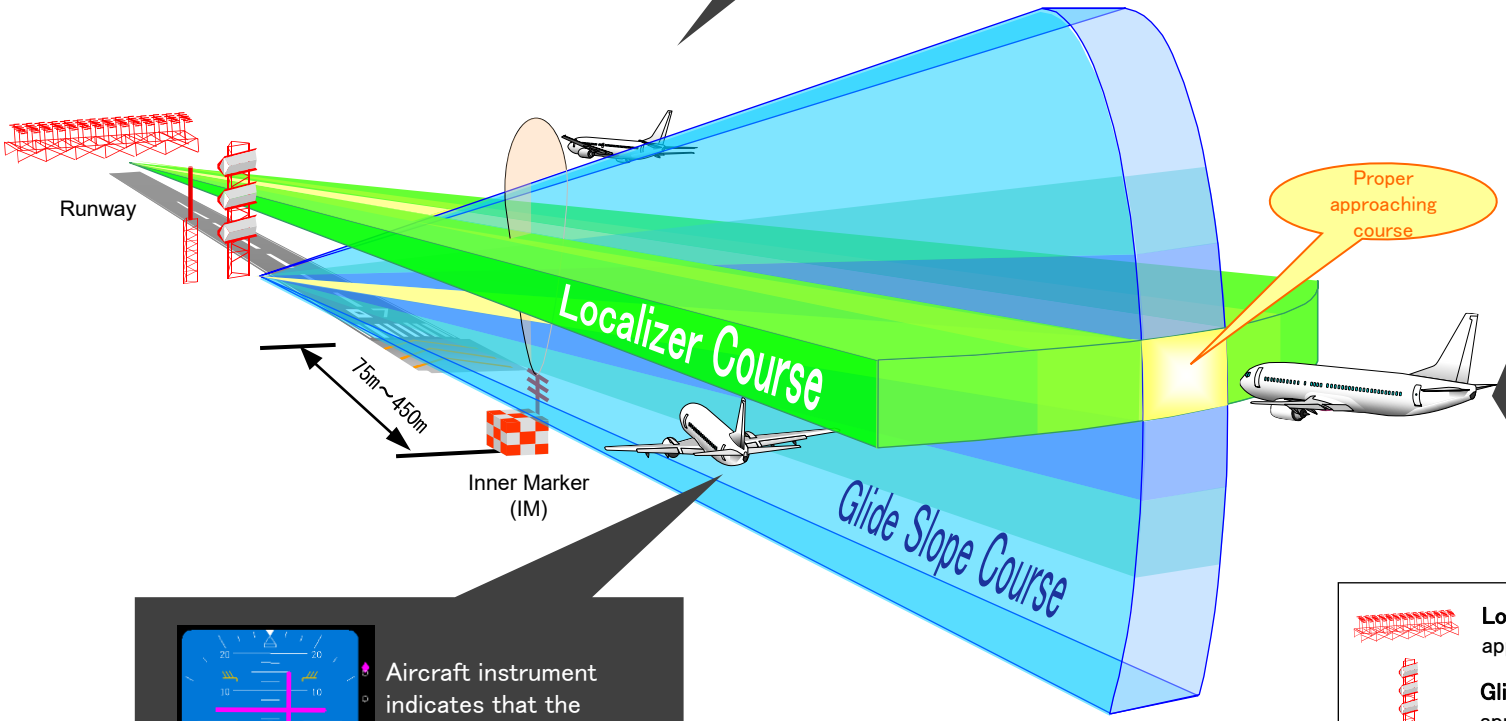
- Due to equipment failure or natural disasters, the air traffic services system may be unable to provide the services necessary for aircraft operations. When such unpredictable affairs occur, we provide technical information and make a technical analysis for prompt failure recovery.

36 ILS (Instrument Landing System)

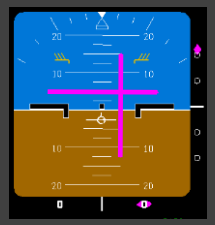
ILS (Instrument Landing System):
Instrument landing system (ILS) is a radio navigation landing system that provides precision guidance to the aircraft approaching and landing on the runway, using directive radio signals.



Aircraft instrument indicates that the aircraft is upper-right from ILS approaching course, and on the inner marker.



Aircraft instrumentation indicates that the aircraft is at the center of ILS approaching course, and **at a position of 8.7NM from landing point**



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).

37 A/G (Air to Ground Radio)

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.

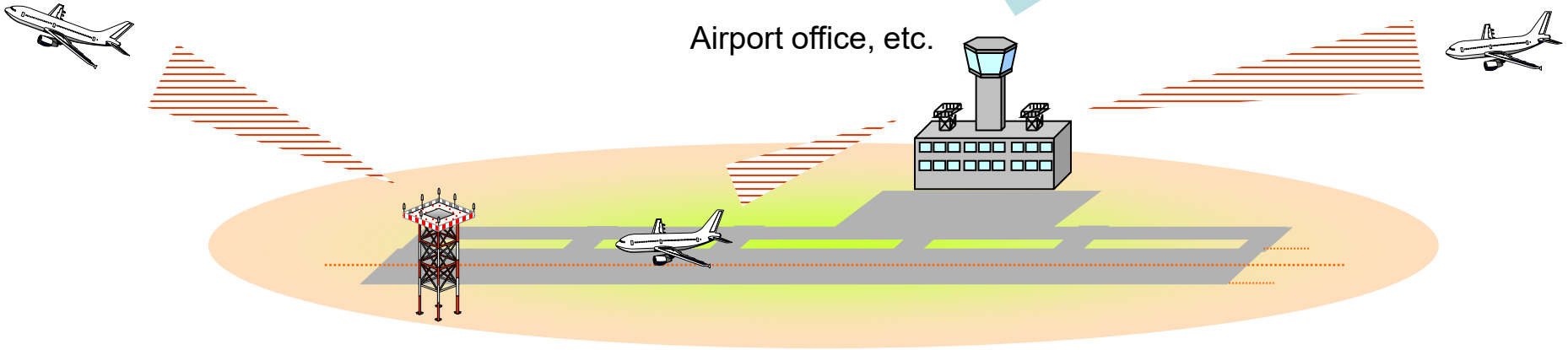
Air to Ground Radio(A/G) facility

A/G Antenna

Radio facility

Aerodrome Control facility

Terminal Control facility



38 MLAT (Multilateration)

・Multilateration (MLAT)

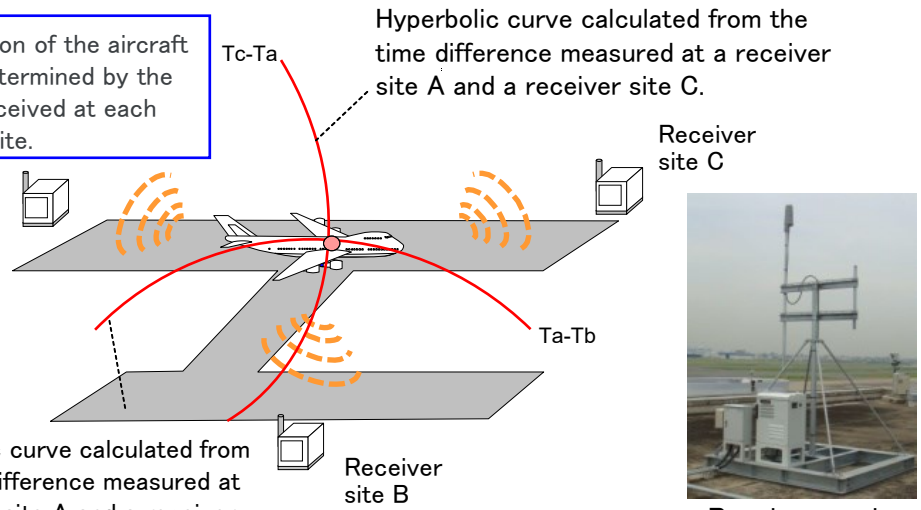
MLAT is used for the air traffic control service. It enables monitoring a blind area which cannot be covered by ASDE (Airport Surface Detection Equipment). In combination with ASDE, the system can monitor the movement of aircraft and vehicles, etc. more effectively.

・ASDE (Airport Surface Detection Equipment)

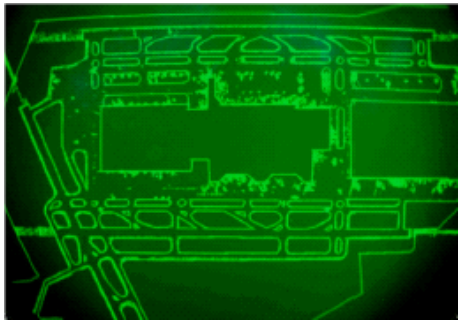
This is a high-resolution radar used for aerodrome control service by monitoring the movement of aircraft and vehicles, etc. on the airport ground to ensure their safety.

Positioning Principle of Multilateration

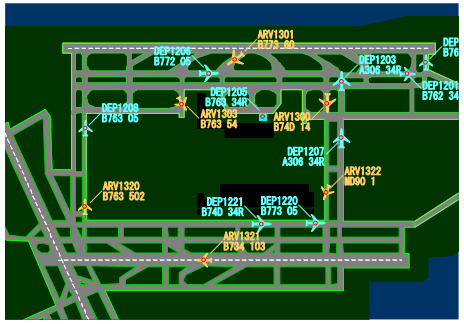
The position of the aircraft can be determined by the signals received at each receiver site.



Receiver station



Display of ASDE



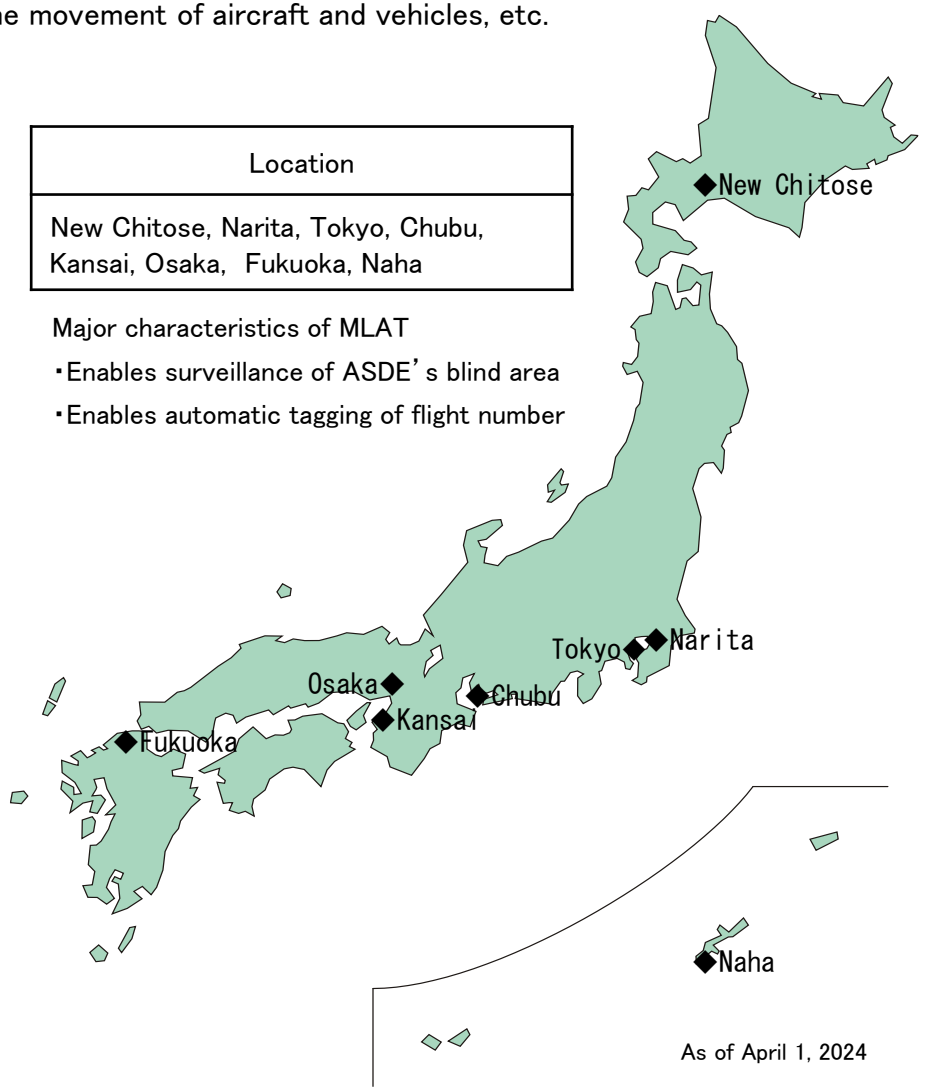
Display in combination with ASDE

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, 2024

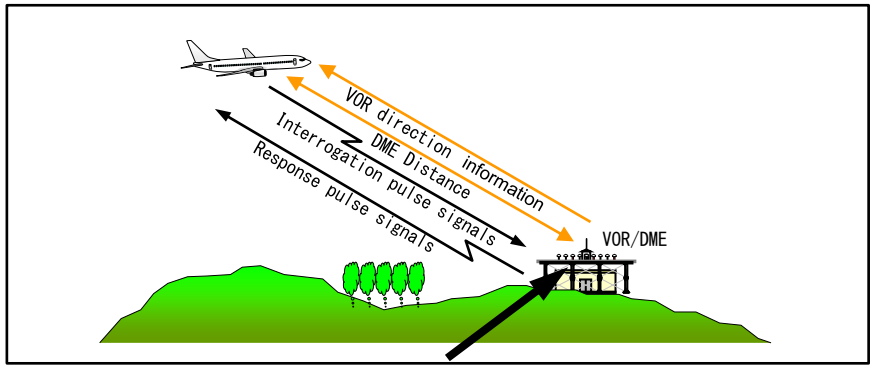
39 VOR/DME

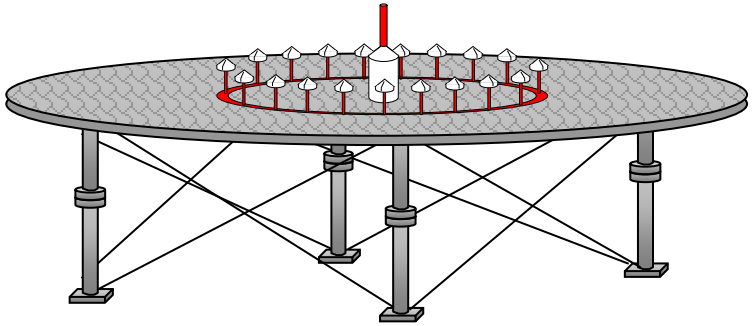
Aeronautical radio navigation facilities that provide direction and distance information to in-flight aircraft within the effective arrival distance of radio waves.

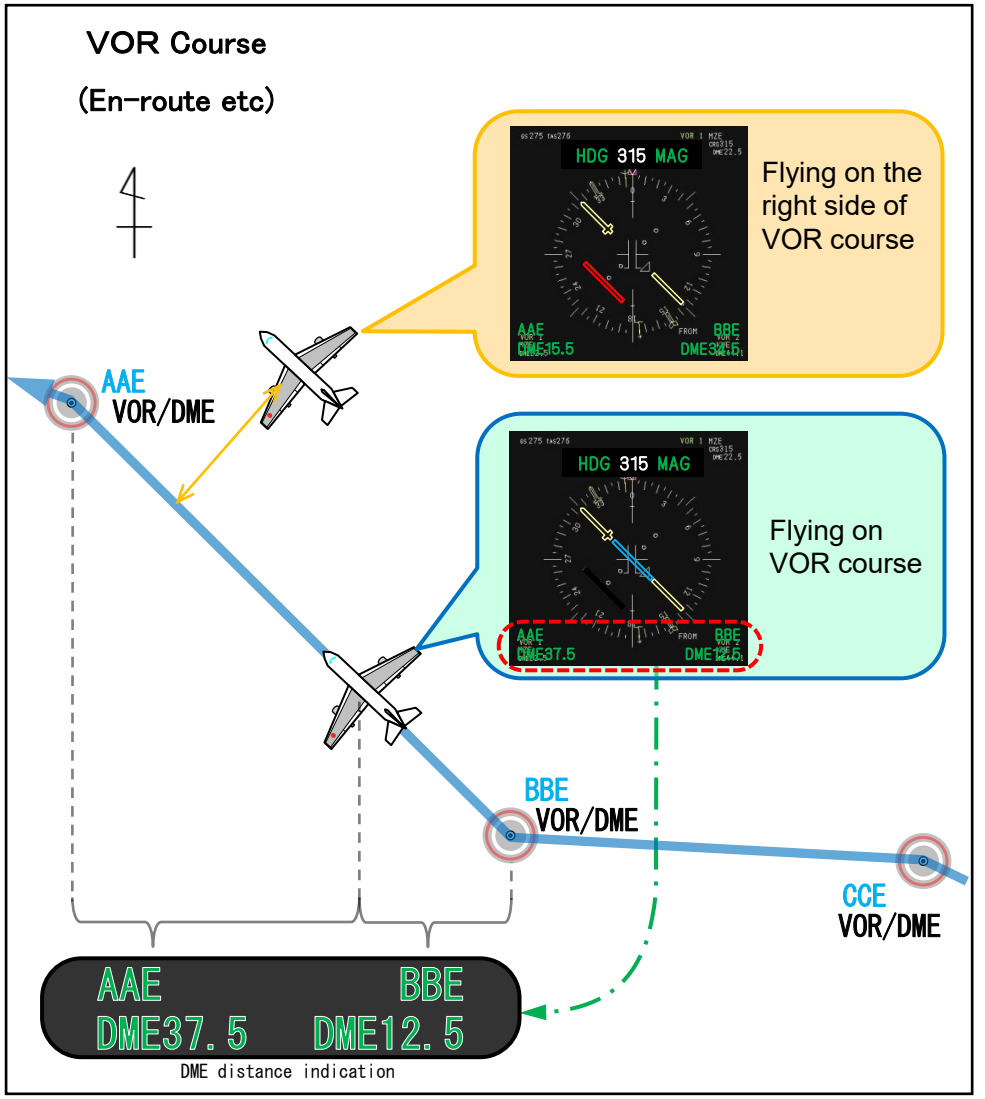
※the effective arrival distance：range of emitted radio waves

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.







40 ASR (Airport Surveillance Radar)

ASR (Airport Surveillance Radar)

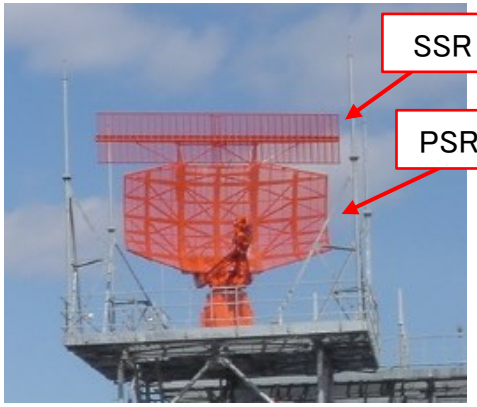
This system is used for terminal radar control, such as control of departing and arriving aircraft and determination of distance between two or more aircraft through the detection of locations of aircraft in the airspace within 110km (60NM) of an airport using a combination of PSR (Primary Surveillance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

・PSR (Primary Surveillance Radar)

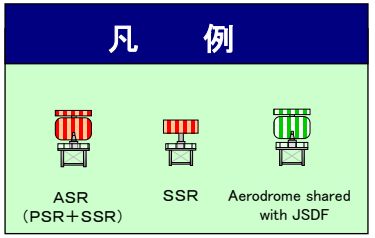
The system for detecting distance and direction to target(aircraft) using of reflected waves from radio signals emitted from an antenna.

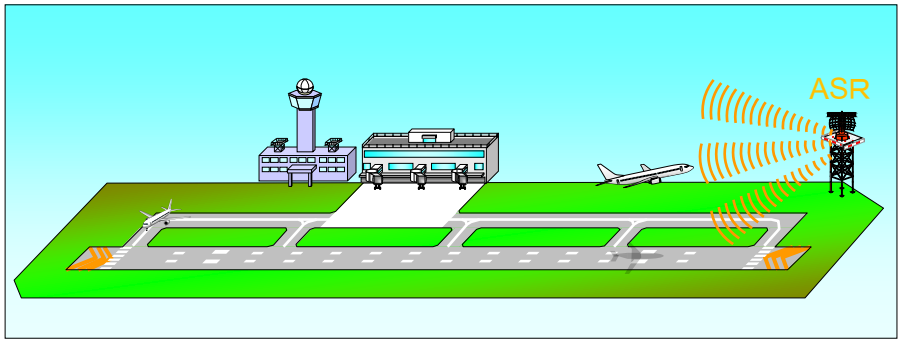
・SSR (Secondary Surveillance Radar)

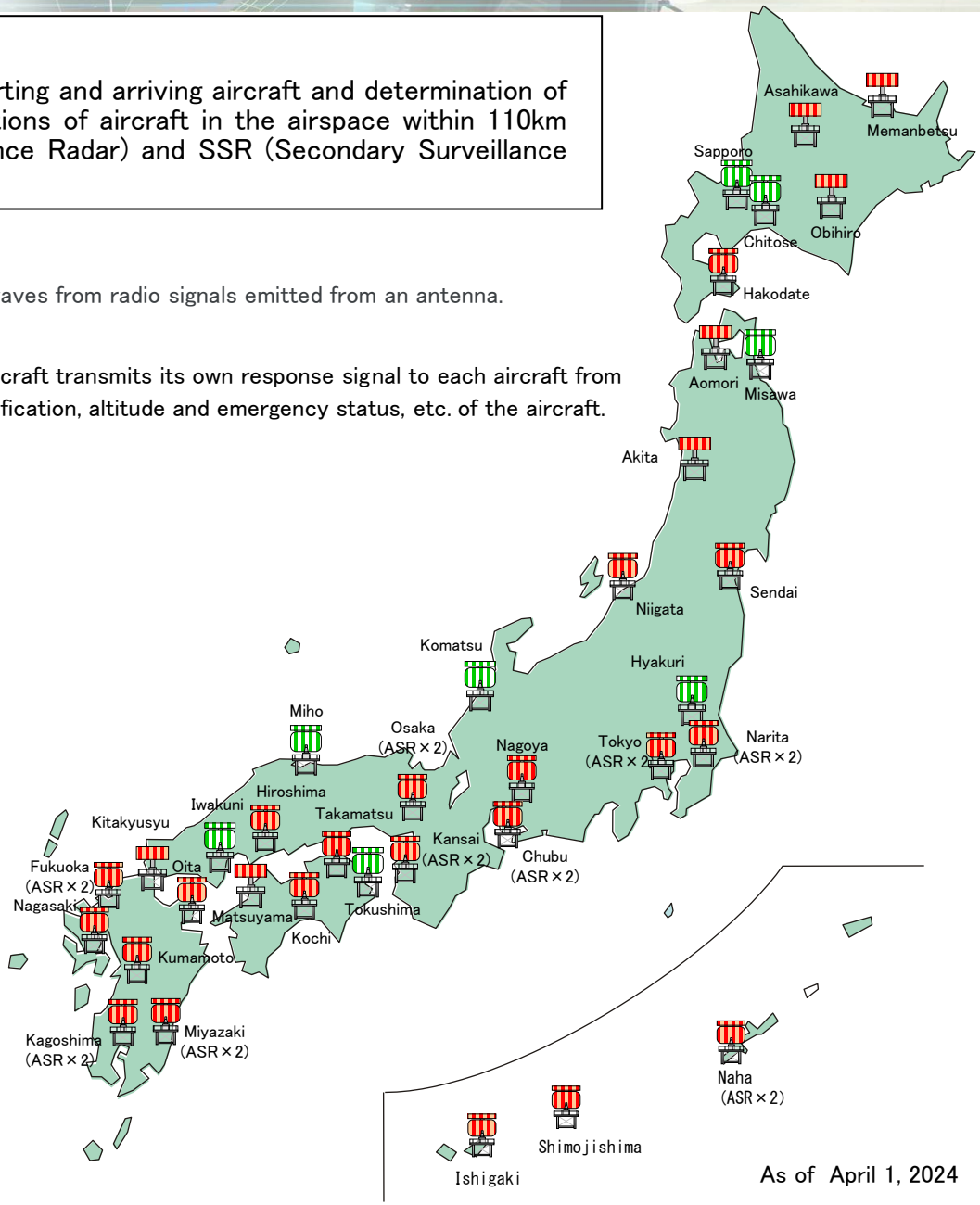
When an aircraft receives an interrogation radio signal emitted from this device, the aircraft transmits its own response signal to each aircraft from the on-board ATC transponder, and the ground-based radar screen displays the identification, altitude and emergency status, etc. of the aircraft.



ASR antenna







As of April 1, 2024

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

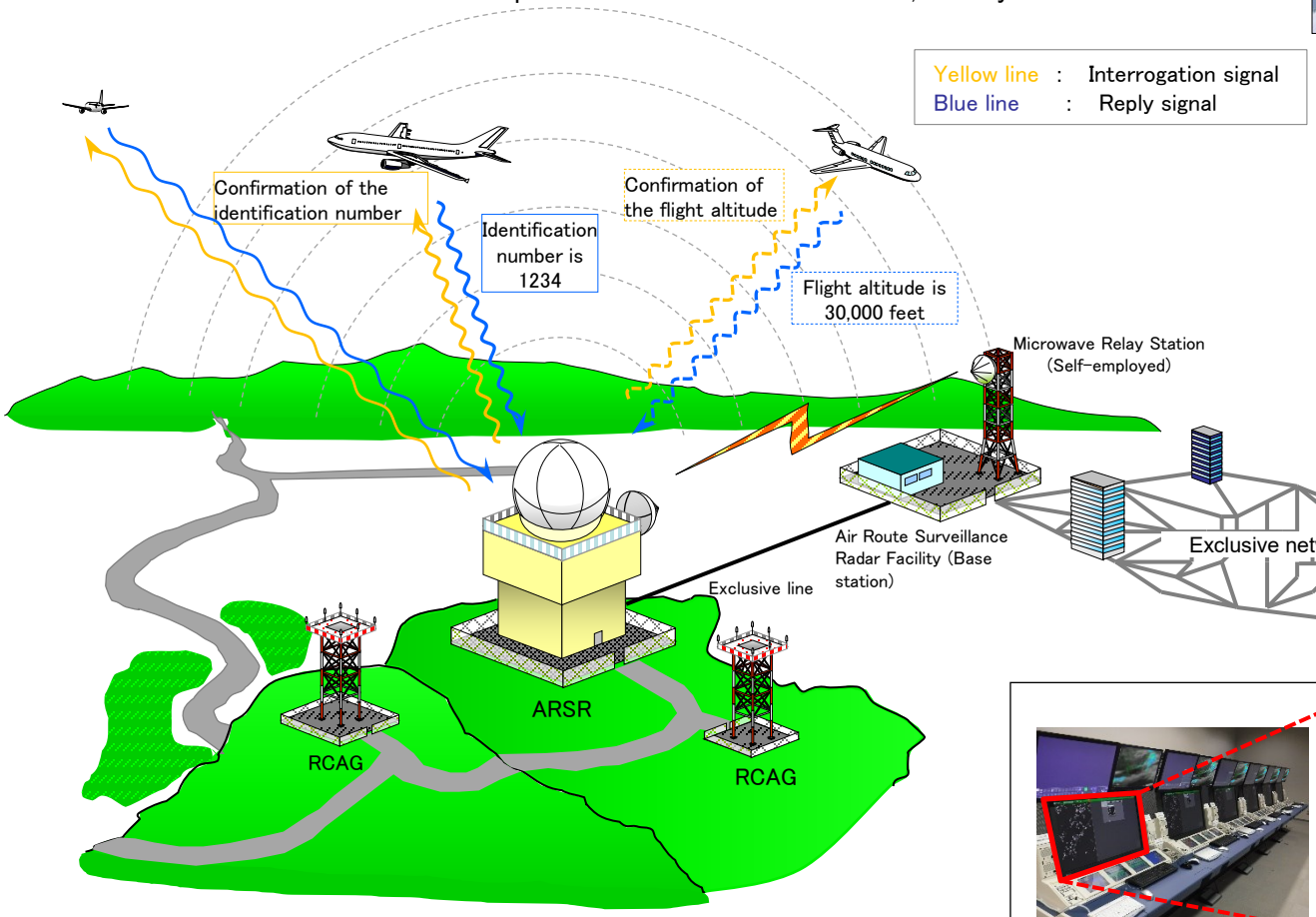
ARSR(Air Route Surveillance Radar)

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.

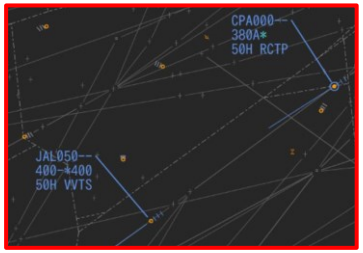
ARSR

ORSR



ARSR,ORSR antenna

Display equipment



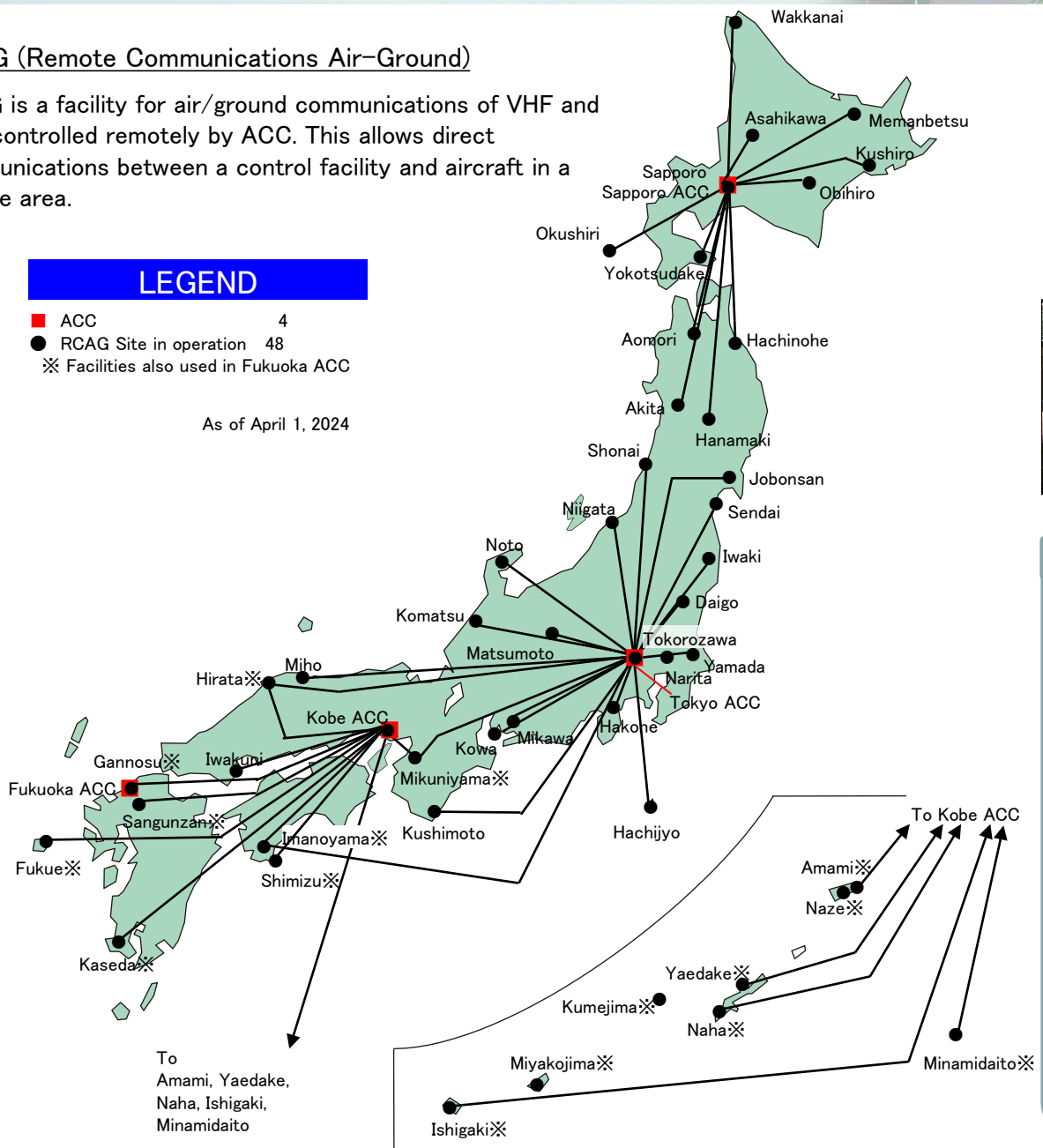
Display screen example

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.

42 RCAG (Remote Communications Air-Ground)

RCAG (Remote Communications Air-Ground)

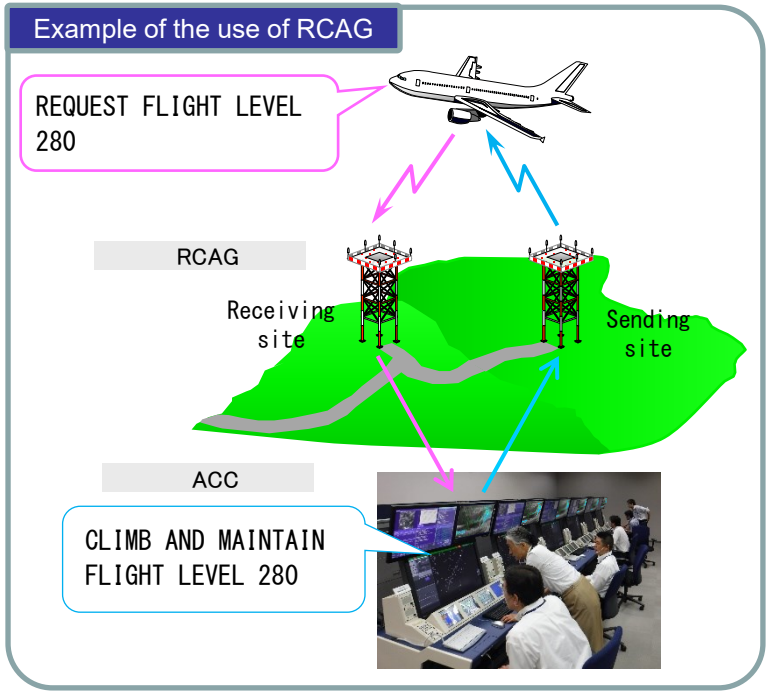
RCAG is a facility for air/ground communications of VHF and UHF controlled remotely by ACC. This allows direct communications between a control facility and aircraft in a remote area.



RCAG

ACC

Example of the use of RCAG

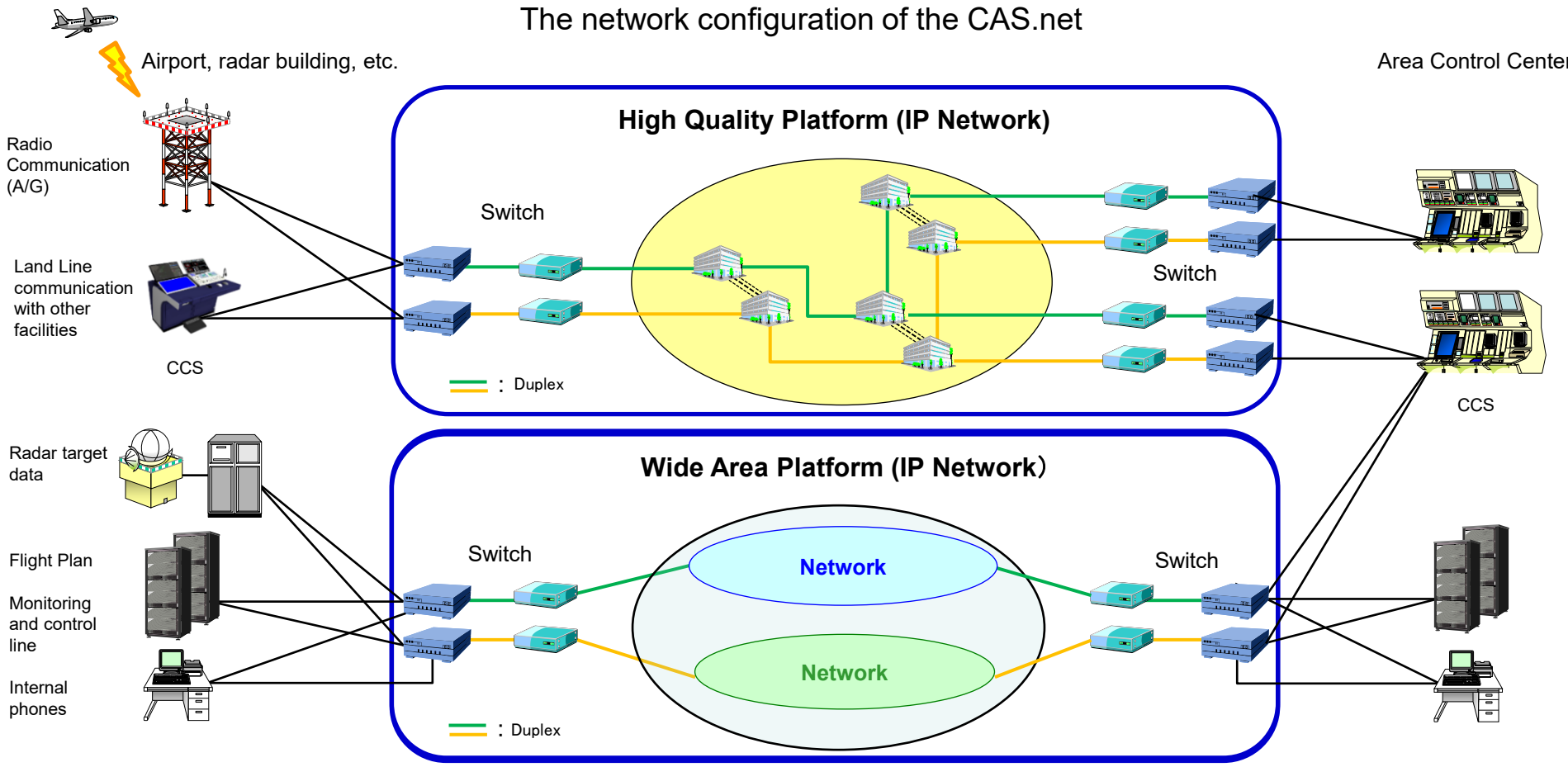


43 CAS.net (Civil Aviation Bureau Air Traffic Services Network)

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.

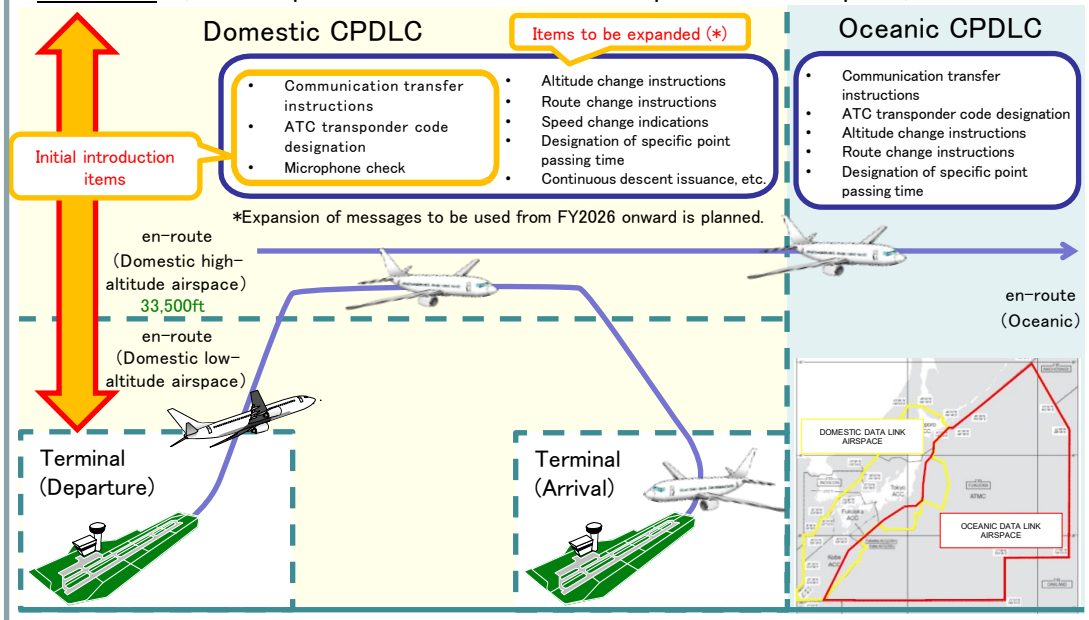
High Quality Platform : Accommodates ATC communication that requires high quality such as low Transmission delay.
Wide Area Platform ：Accommodates ATC communication other than High Quality Platform, and radar target data etc.



44 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)

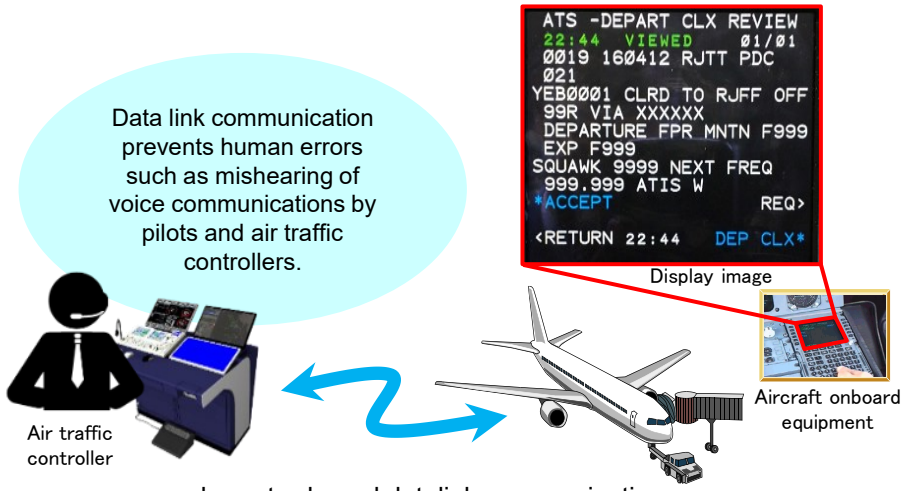


March 2022– Trial operation started (Altitude: 33,500 ft or higher, Message limited)
March 2023– Formal operation started(Altitude: unlimited (except terminal airspace), Message limited)

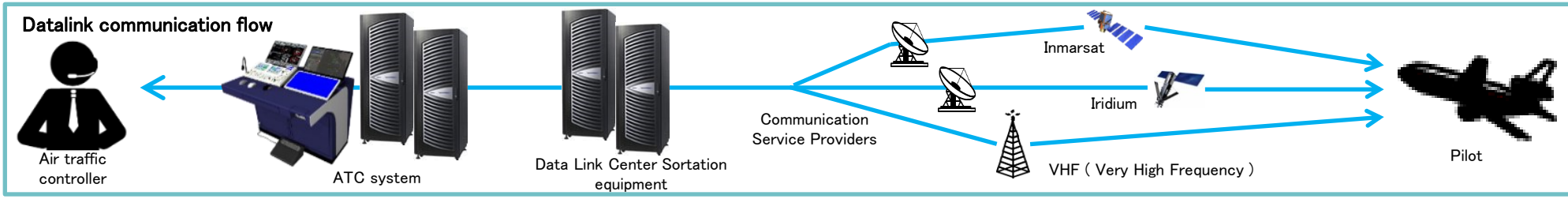
DCL

Introduced Airports: Narita INTL, Tokyo INTL, Chubu Centrair INTL, Kansai INTL, Osaka INTL, Fukuoka, Kagoshima (As of April 1, 2024)

- ·June 2012– : Trial operation started at Narita INTL and Tokyo INTL
- ·August 2015– : Official operation started
- ·2021– : Airports introduced sequentially expanded



Datalink communication flow



45 DAPs・ADS-B

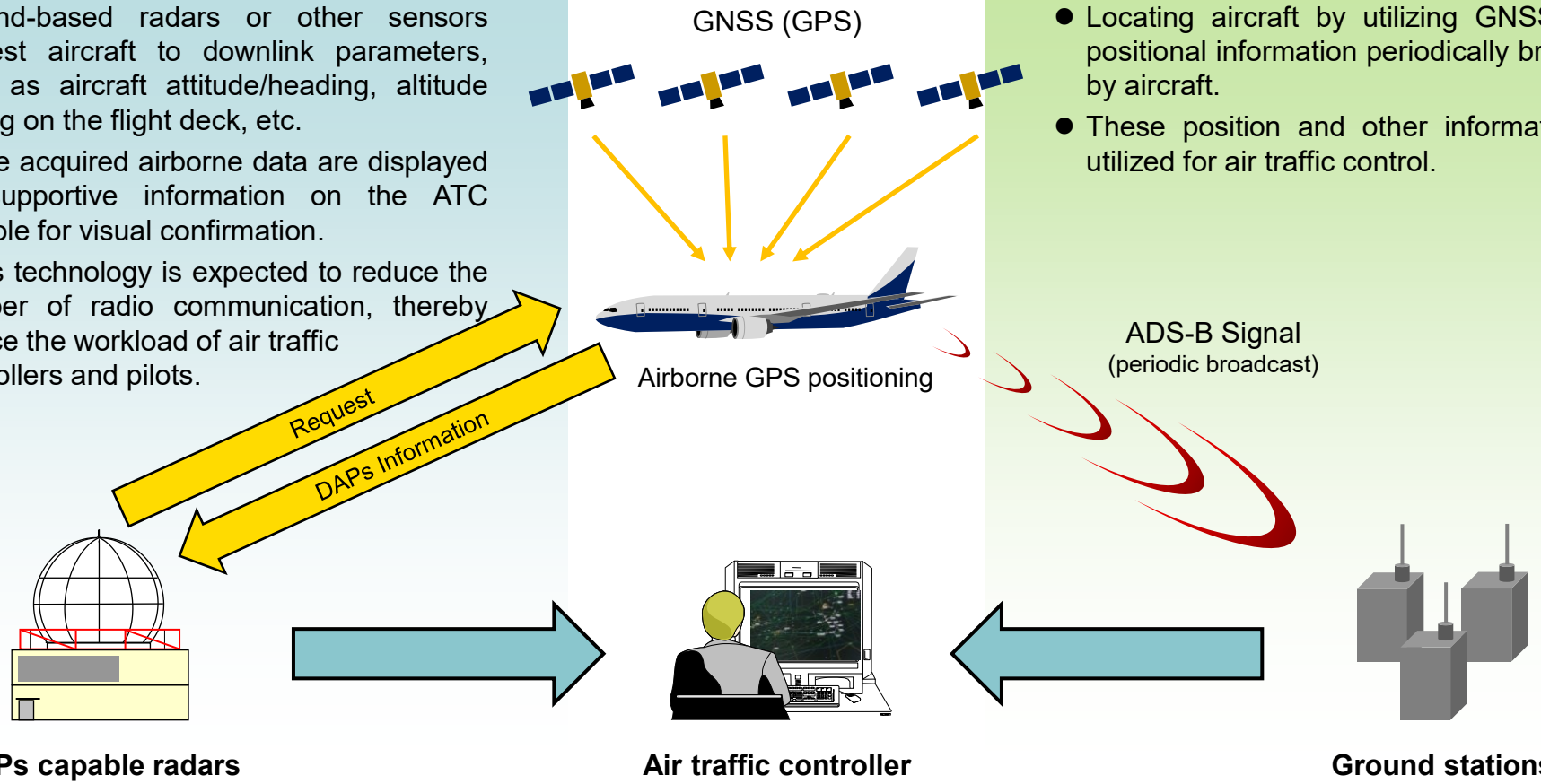
- DAPs (Downlink Aircraft Parameters) is the technology to acquire aircraft dynamic information, such as aircraft attitude and altitude setting, by sending request signal from the ground.
- ADS-B (Automatic Dependent Surveillance-Broadcast) is the technology in which aircraft periodically broadcasts 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.

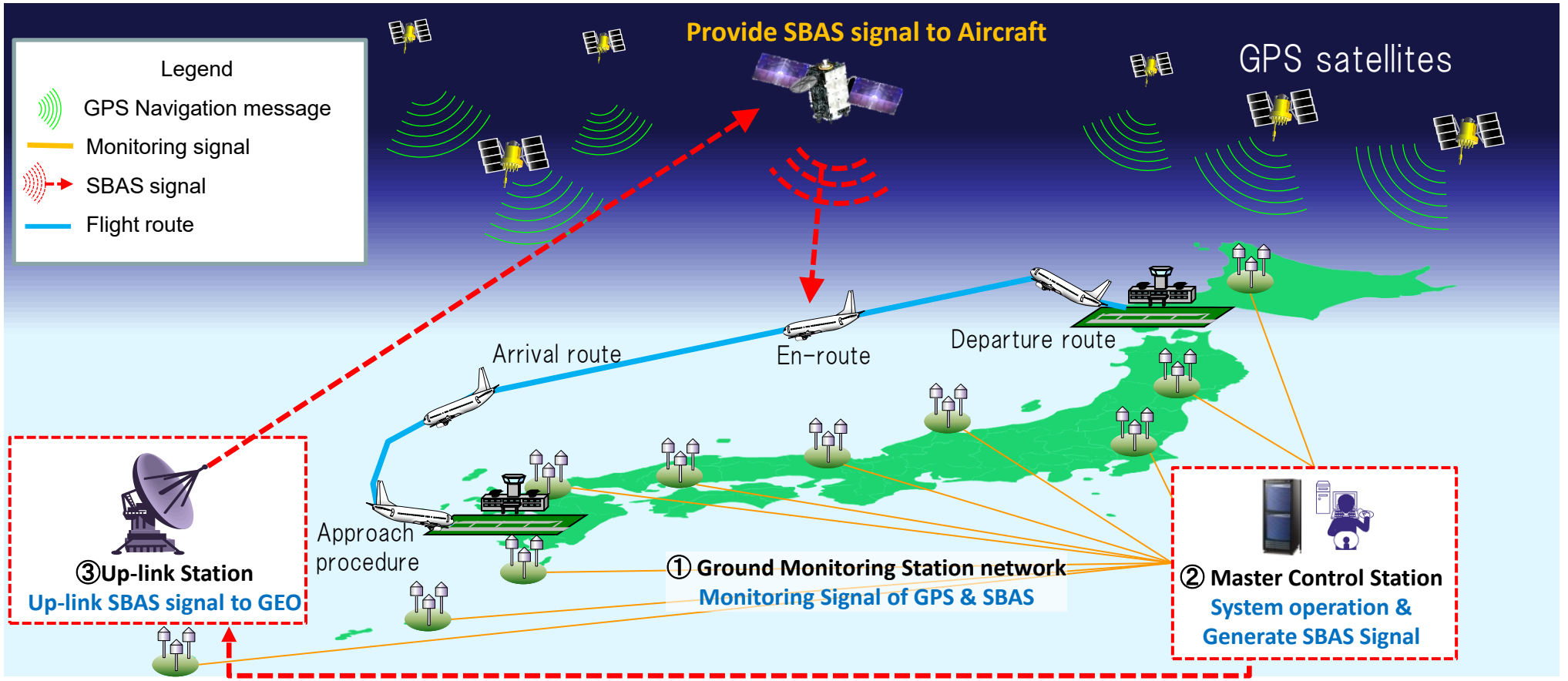
ADS-B

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



46 SBAS (Satellite Based Augmentation System)

SBAS comprised of ground reference stations, Geostationary satellite link and Master Control Stations improves the navigation system accuracy and integrity as well as safety for aircraft operations by excluding misleading information like GPS positioning error and anomaly.



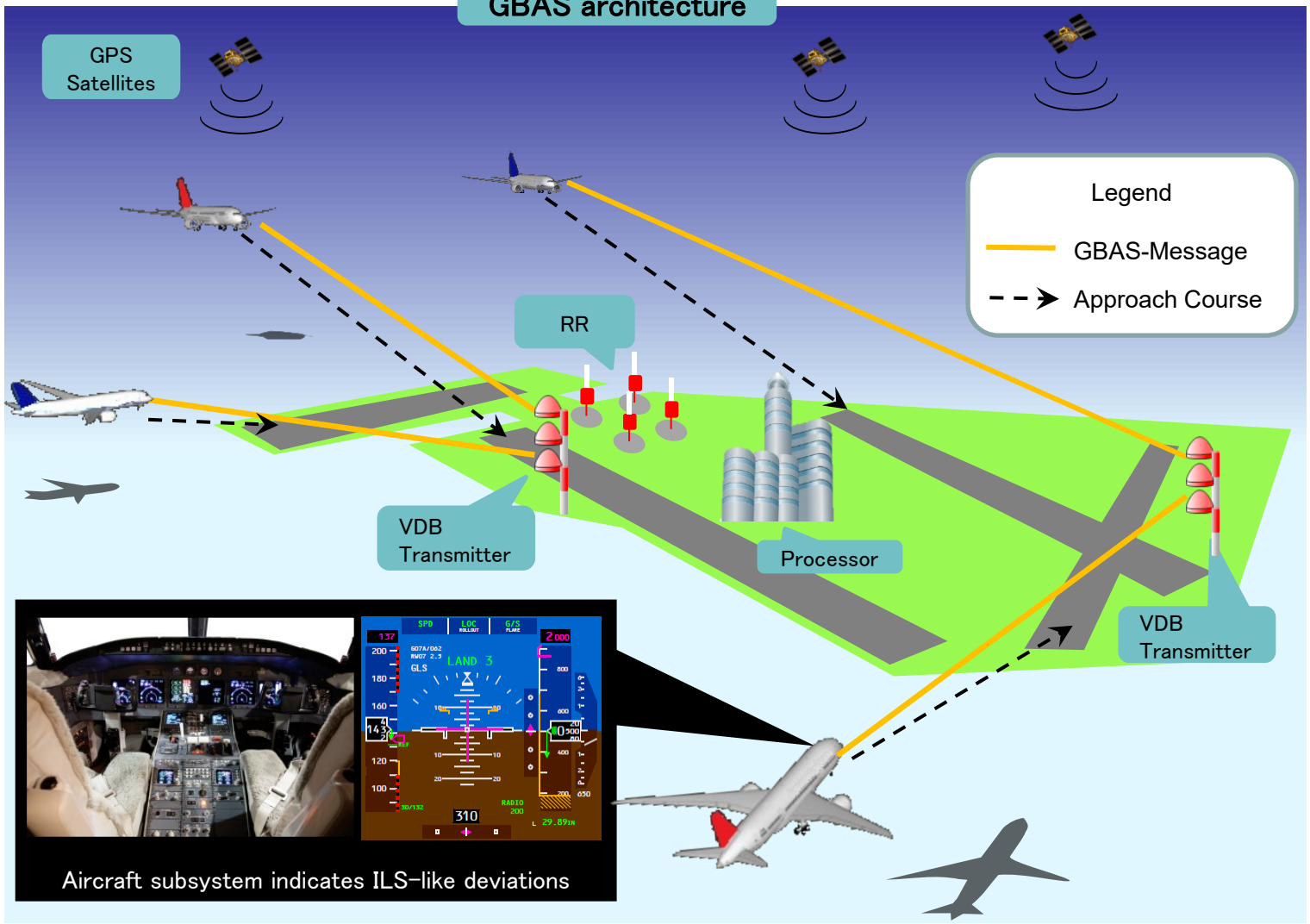
Function of SBAS

- **Integrity function :** Integrity function is the correctness of the information supplied by a navigation system.
- **Differential correction function :** Differential corrections to the existing GPS navigation services computed in a wide area to improve navigation services performance.
- **GEO Ranging function :** Transmission of GPS-like L1 signals from GEO satellites to augment the number of navigation satellites available to the users.

47 GBAS (Ground Based Augmentation System)

GBAS is a system for precision approach using GPS satellites that monitors positioning errors and malfunction of GPS satellites and broadcasts GBAS-Message(Differential corrections, Integrity Data and Path Definition) directly to aircraft from VDB transmitter. It is possible to provide precision approach service for multiple runways with a single ground subsystem.

GBAS architecture



Ground Subsystem

RR(Reference Receiver)

RRs receive GPS signals and transmits them to Processor.

Processor

Processor generates GBAS-Message and transmits it to VDB transmitter.

VDB(VHF Data Broadcast) Transmitter

VDB transmitter broadcasts GBAS-Message to aircraft.

48 Aeronautical Lighting System

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

（1）Aeronautical beacon （■）

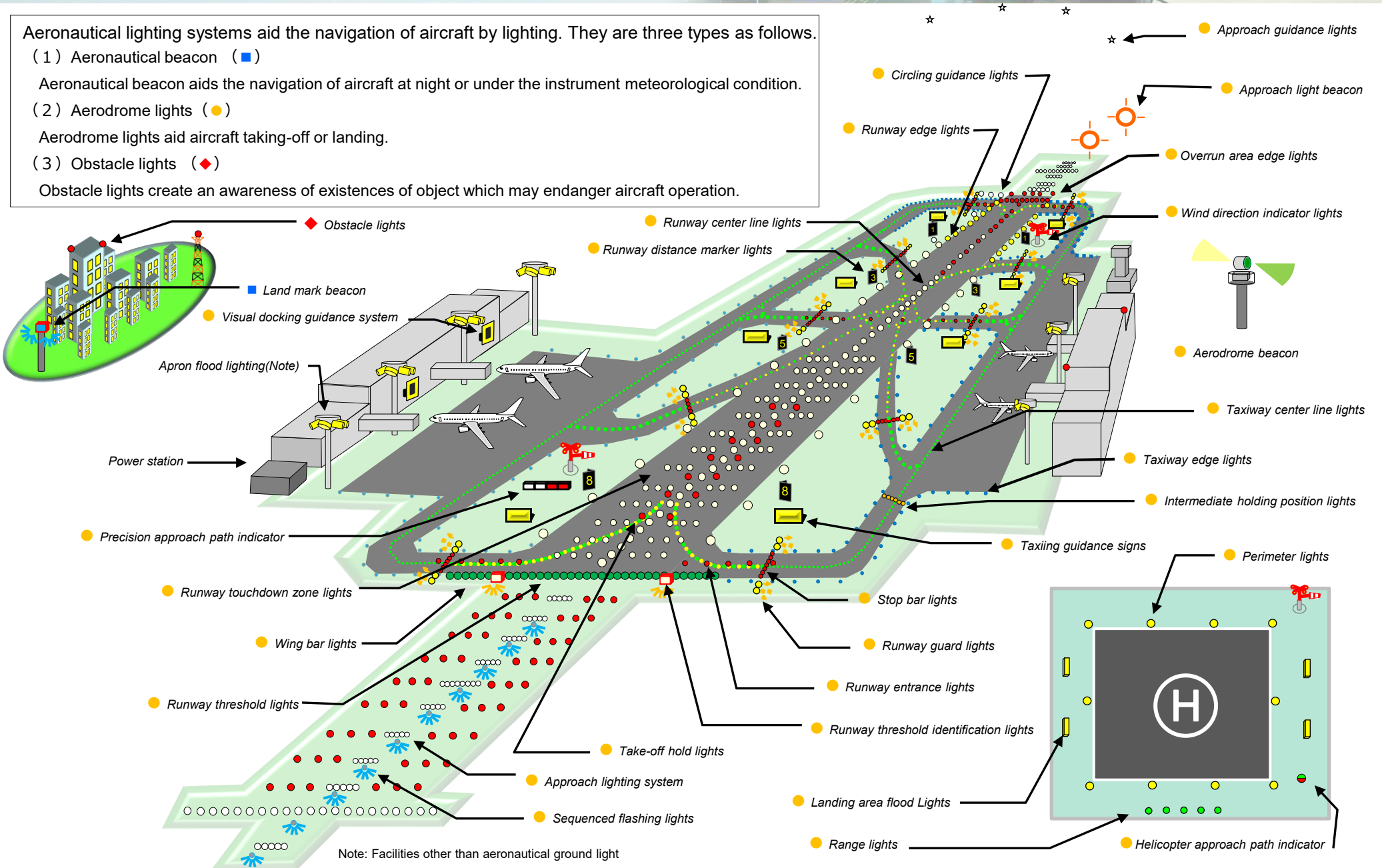
Aeronautical beacon aids the navigation of aircraft at night or under the instrument meteorological condition.

（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.

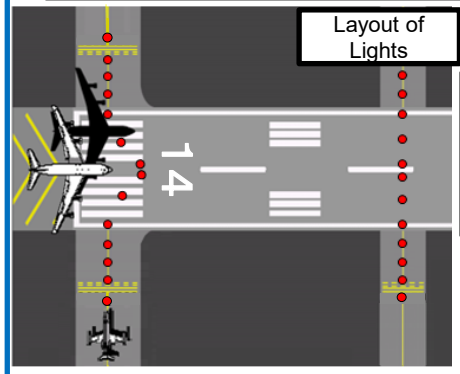


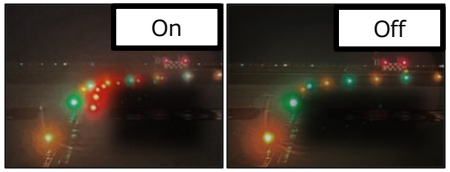
49 Runway Status Lights

【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



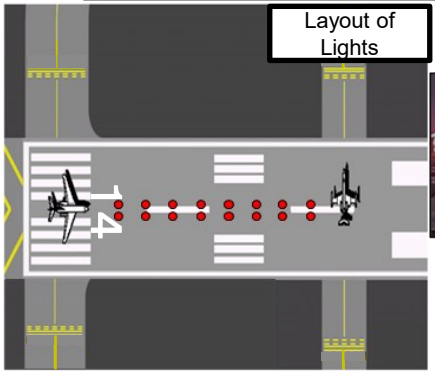


RELs are installed near Taxiway Center Line Lights (TCLL)(or).

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

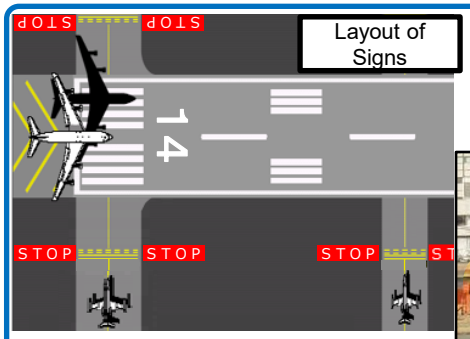


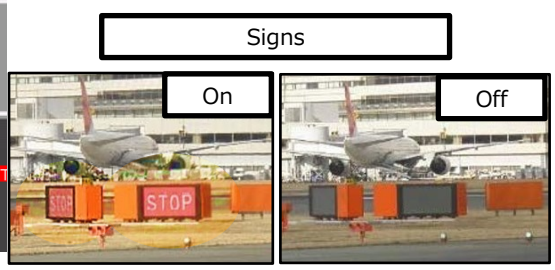
THLs are installed both sides of the Runway Center Line Lights (RCLL).

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 】

50 ATC Data System Concept Chart

Aviation Organizations※

Flight plan

Weather information

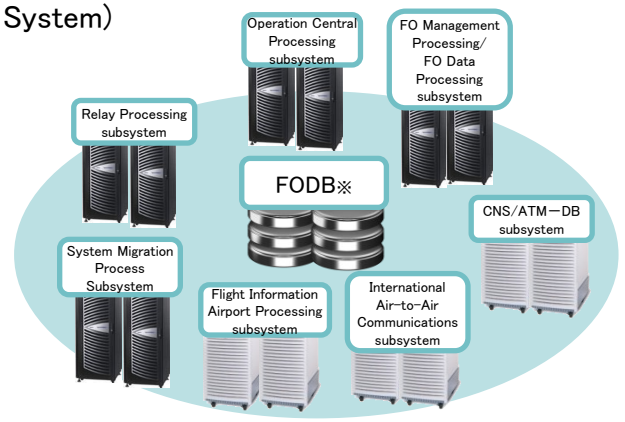
142044 RJAAYNYX
(2957/19 NOTAMN
Q)RJJJ/QMXLC/IV/M/A/000/999/3
A)RJTT B)1903161500 C)1903312
D)16-18 21 23-25 27 28 30 31 150
E)RWY16L/34R-CLSD DUE TO C

Aeronautical information

※Aviation Organizations：
Foreign ANS provider、Meteorological Agency、
Ministry of Defense、Airlines etc.

MASS
(Messaging-system for ATM as Swim Service)

FACE (Flight Object Administration Center System)



※FODB：Flight Object Data Base

Update

Distribution

ARSR/ORSR

ASR/SSR

ASR/SSR

Satellite

HARP
(Hybrid Air-route surveillance sensor Processing equipment)

ADEX
(ATC Data Exchange System)

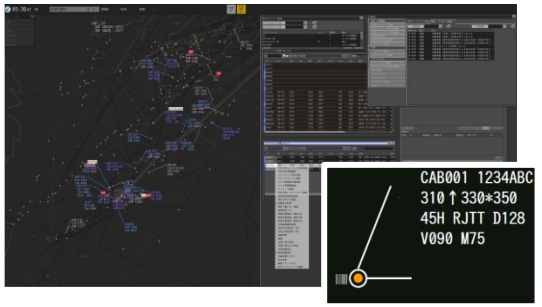
ICAP
(Integrated Control Advice Processing System)

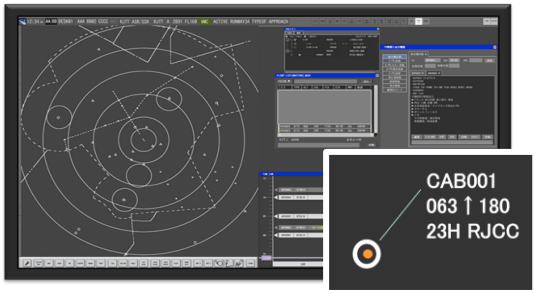
TEPS
(Trajectorized En-route Traffic Data Processing System)

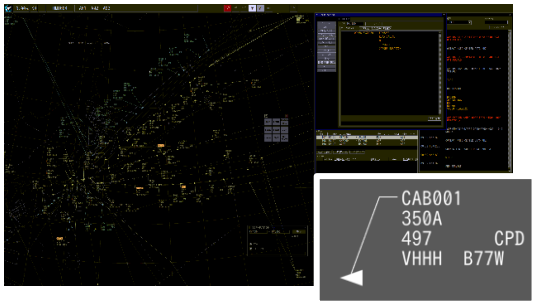
TAPS
(Trajectorized Airport Traffic Data Processing System)

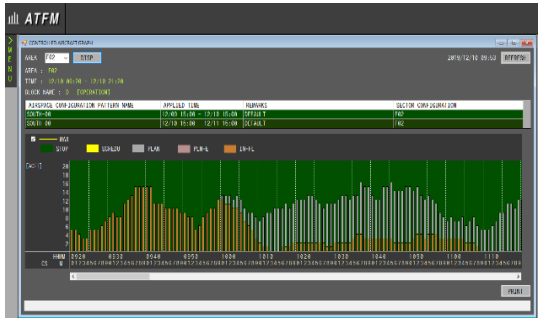
TOPS
(Trajectorized Oceanic Traffic Data Processing System)

TEAM
(Trajectorized Enhanced Aviation Management System)









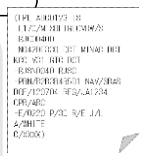
51 FACE (Flight Object Administration Center System)

FACE (**F**light Object **A**dministration **Ce**nter 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.

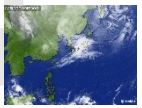
Aviation Organizations

Airlines



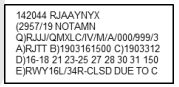
Flight Plan
※Departure and arrival airports, Flight number, route, etc.

Japan Metrological Agency



Weather Information

Ministry of Defense



Aeronautical Information

Foreign Organizations

FACE

Air Traffic Management Center (Fukuoka)

- Relay Processing subsystem
- Operation Central Processing subsystem
- System Migration Process Subsystem

Relay processing of each information and data, etc.

Fukuoka Area Control Center

Mutual back-up

Tokyo Area Control Center

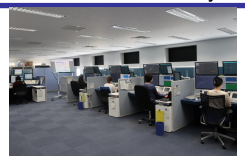
- FO Management Processing/ FO Data Processing subsystem
- Flight Information Airport Processing subsystem
- AIM subsystem

・Create database of each information
・Distribute to each system and airport

Transmission and reception of each information

Narita Airport

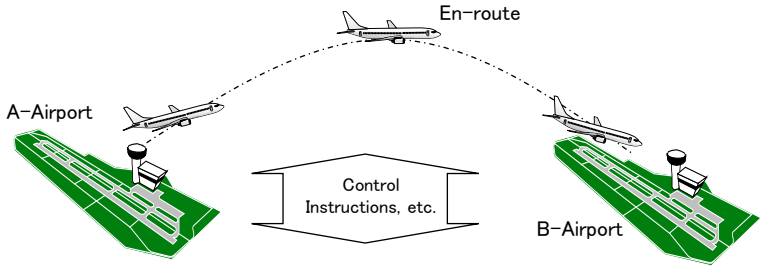
- International Air-to-Air Communications subsystem



Support for international air-to-air communications operations

Aeronautical Information Service Center(Narita) ・Each Airport

Management of aeronautical information, Providing information to operators, etc.



Display on ATC console, ATC support by system

Data linkage of all aircraft information from departure to arrival with each system and management by FACE

Each System

TAPS、TEPS、TOPS、
ICAP、TEAM、ADEX

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

TEPS（**T**rajectorized **E**n-route Traffic Data **P**rocessing **S**ystem）

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.

Sensors
such as ARSR/ORSR

Air route

～Pilot Readback～

TEPS001
Maintain present altitude and fly heading 330

Radio communications

TEPS

Aircraft Position Information

East base central processing system
Tokyo Area Control Center

HMI processing system
Area Control Center
Fukuoka / Tokyo
Sapporo / Kobe)

～ATC instruction～
TEPS001
Maintain present altitude and fly heading 330

FACE

Flight Plans
Weather information.

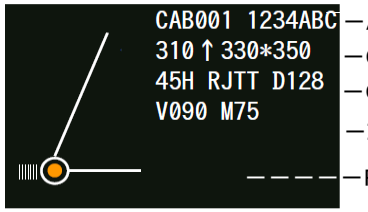
Displaying information, ATC instruction information etc.

West base central processing system
Fukuoka Area Control Center

TAPS

Hand-over information

Target Data Block

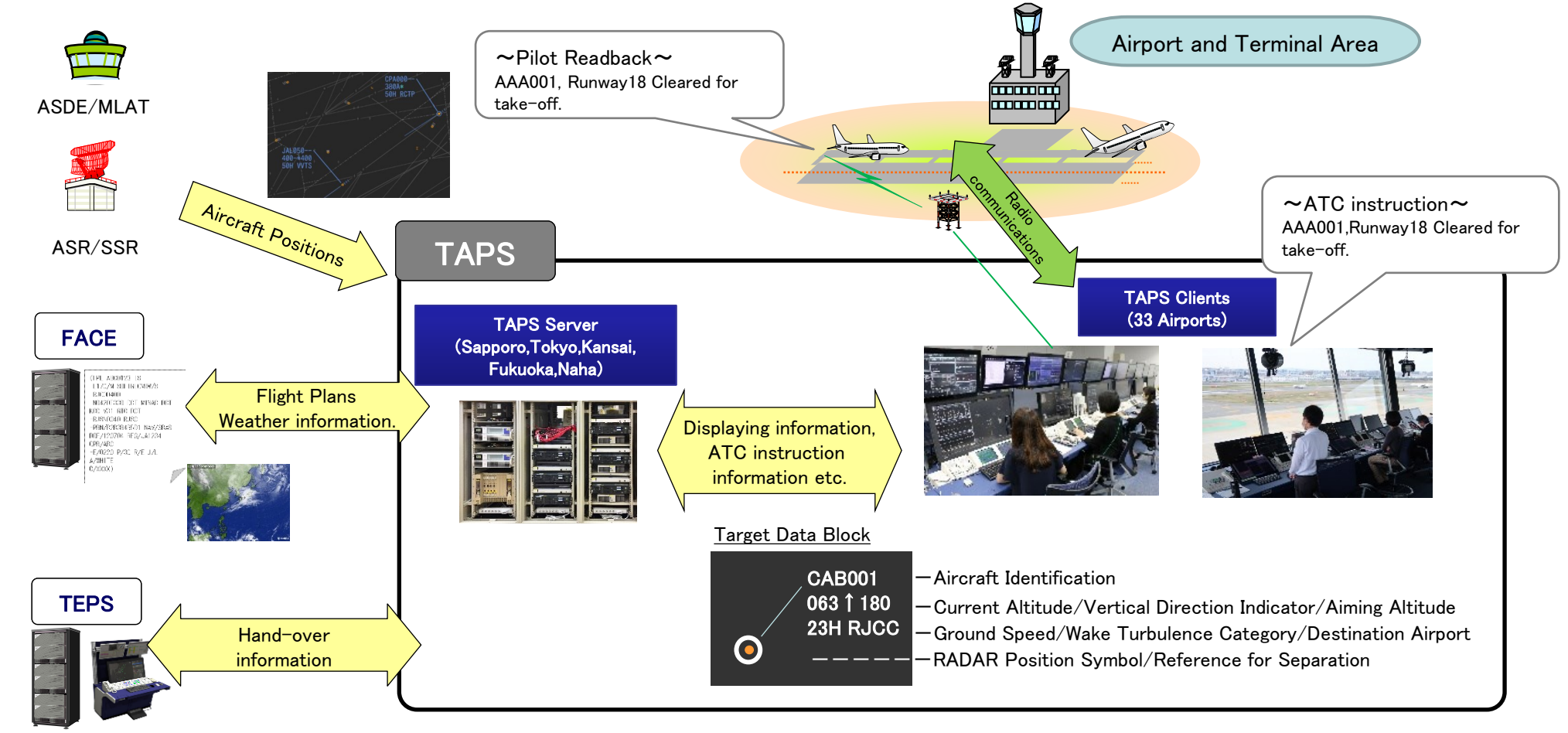


—Aircraft Identification ／memo
—Current Altitude ／ Vertical Direction Indicator ／ Aiming Altitude
—Ground Speed/Wake Turbulence Category/Destination Airport／Remaining distance
—Indicated heading / Indicated speed
—RADAR Position Symbol/Reference for Separation

53 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.



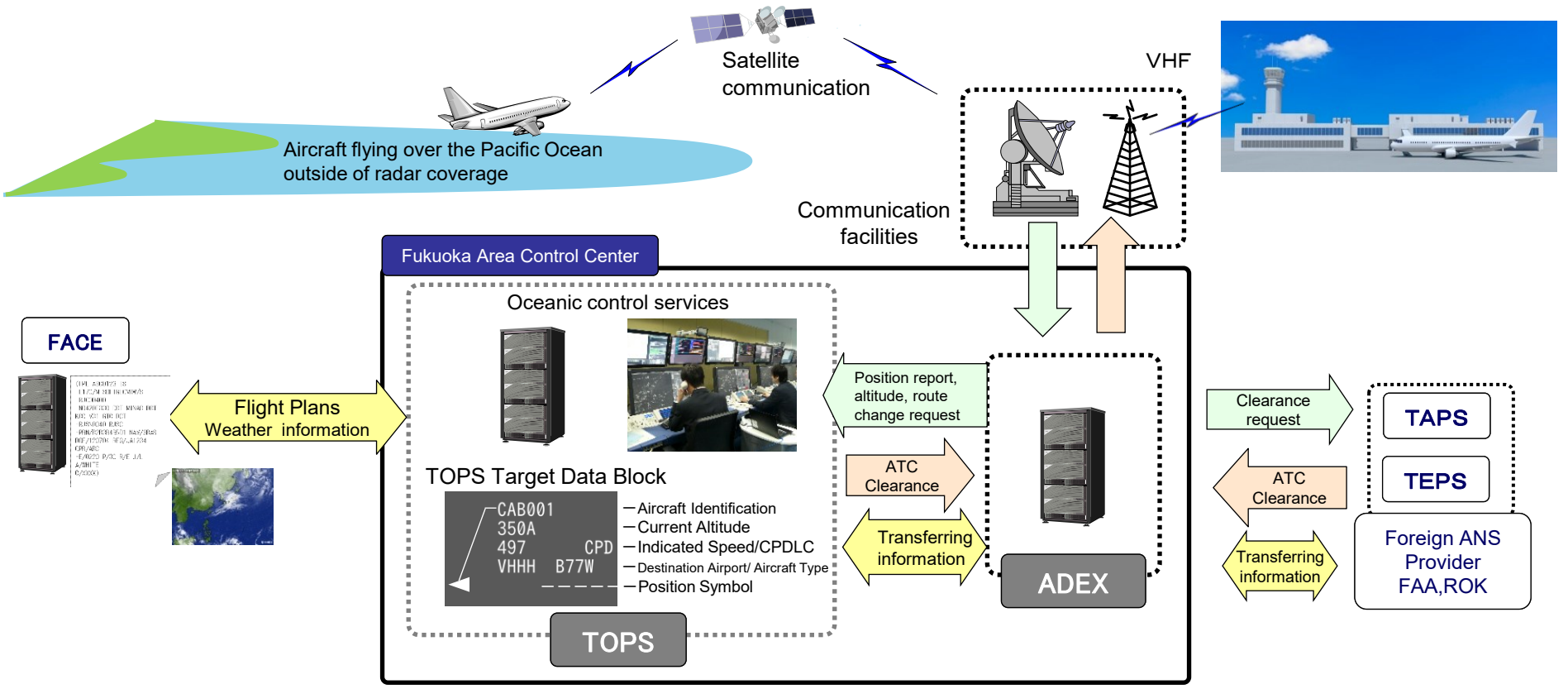
54 TOPS (Trajectorized Oceanic Traffic Data Processing System)/ ADEX (ATC Data EXchange system)

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)

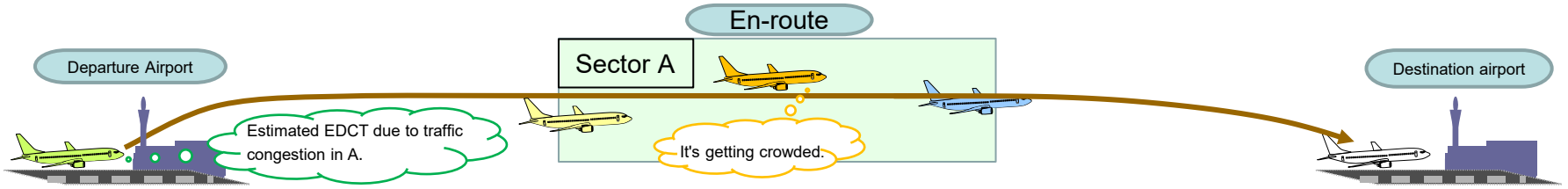
ADEX relays digitalization information on ATC clearance between aircraft and air traffic controllers or on transfer information between Japan and foreign ATC providers and transmits these information to the necessary facilities and systems.

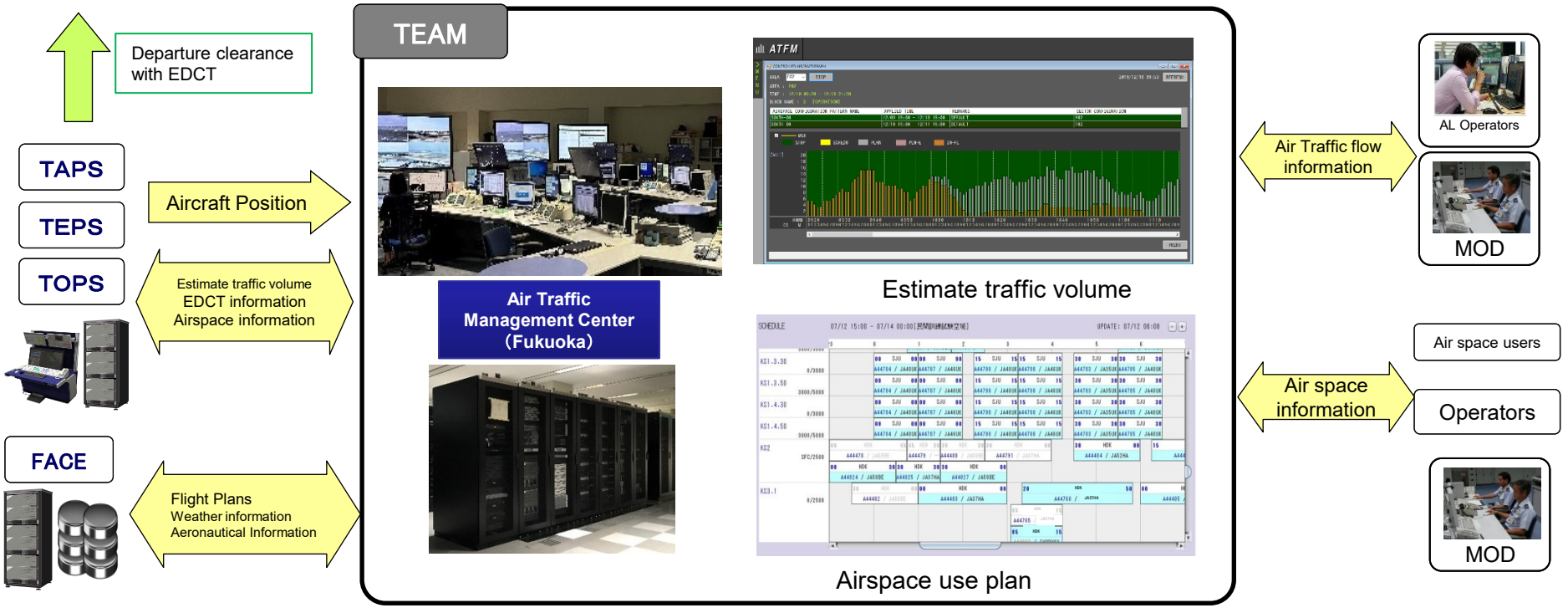


55 TEAM (Trajectorized Enhanced Aviation Management System)

TEAM (**T**rajectorized **E**nhanced **A**viation **M**anagement 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.



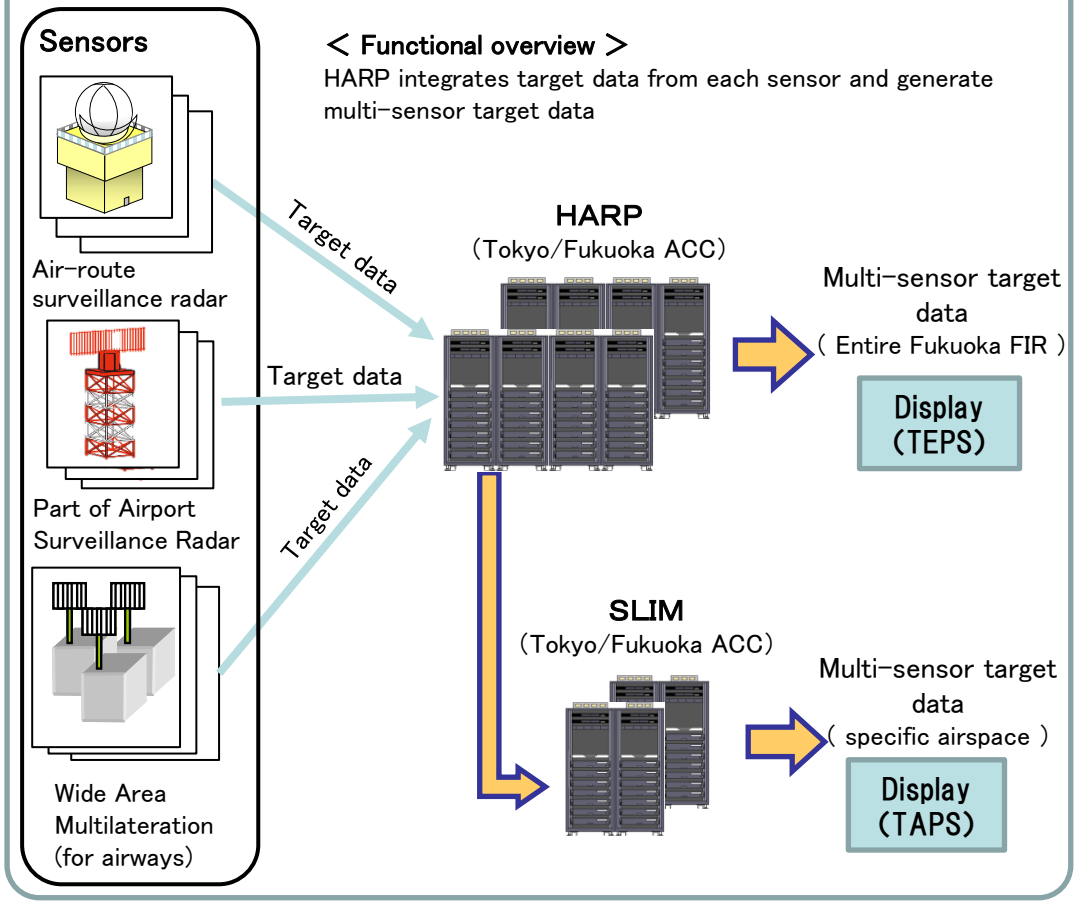


56 HARP (Hybrid Air-route suRveillance sensor Processing equipment) / SLIM (Selected airspace target data extract equipment)

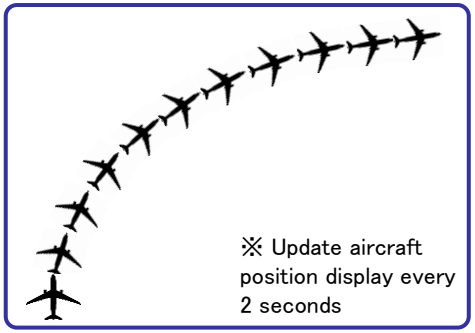
HARP (Hybrid Air-route suRveillance sensor Processing equipment)
HARP receives target data from Air-route Surveillance Radars, Airport Surveillance Radars and Wide Area Multilaterations all over Japan, and calculates the aircrafts' position by integrated processing. Then it outputs to display (TEPS)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

SLIM (Selected airspace target data extract equipment)
SLIM extracts targets in specific airspace from multi-sensor target data of output from HARP and inputs them to display (TAPS).

<Schematic>

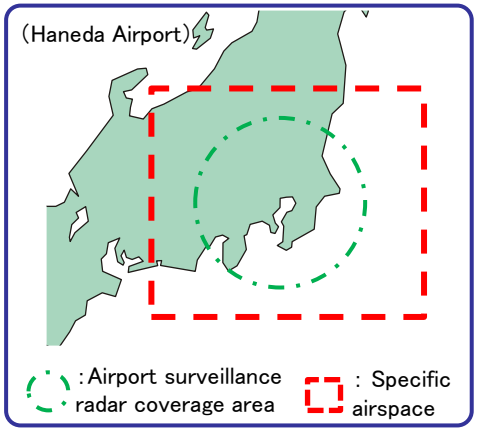


< HARP output (TEPS display) image >



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.

< SLIM output (TAPS 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

57 ICAP (Integrated Control Advice Processing System)

ICAP (**I**ntegrated **C**ontrol **A**dvice **P**rocessing 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 (DBCs) 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

Starting point of descent

Estimated departure time

Estimated land time

Trajectory of each flight

Trajectory

Trajectory

ICAP

TEPS・TAPS・TOPS

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

TEAM

- 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

58 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.

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 stars 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.

Airport Office

LOC GS VOR/DME

Radio Navigation Aids

PALS Apron Flood Lights

Aeronautical Lighting

TSR ASDE

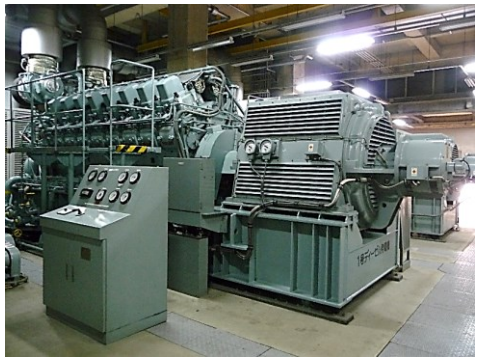
Control Tower

59 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 ge nerator supplies power to air navigation facili ties 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.

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.

60 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.

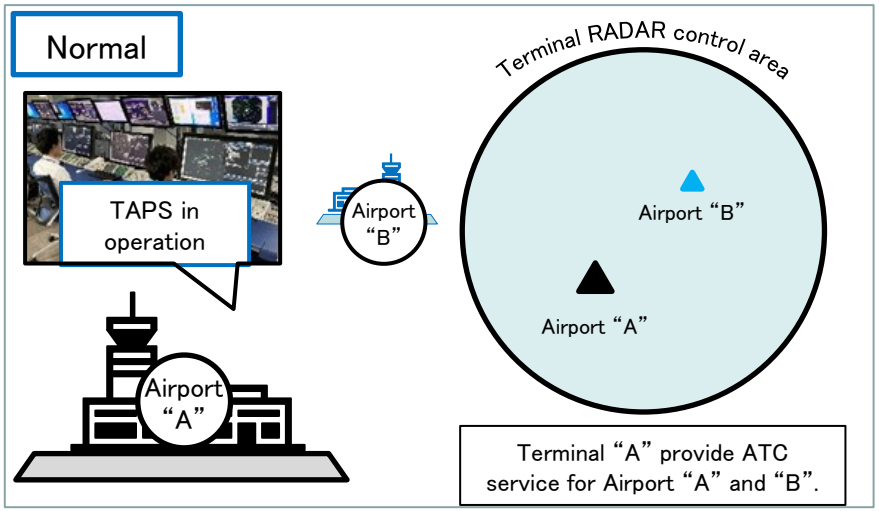
Presently, three emergency ATC towers and three emergency radar facilities are stored separately at three airports (Tokyo International Airport, Osaka Airport, and Fukuoka Airport).

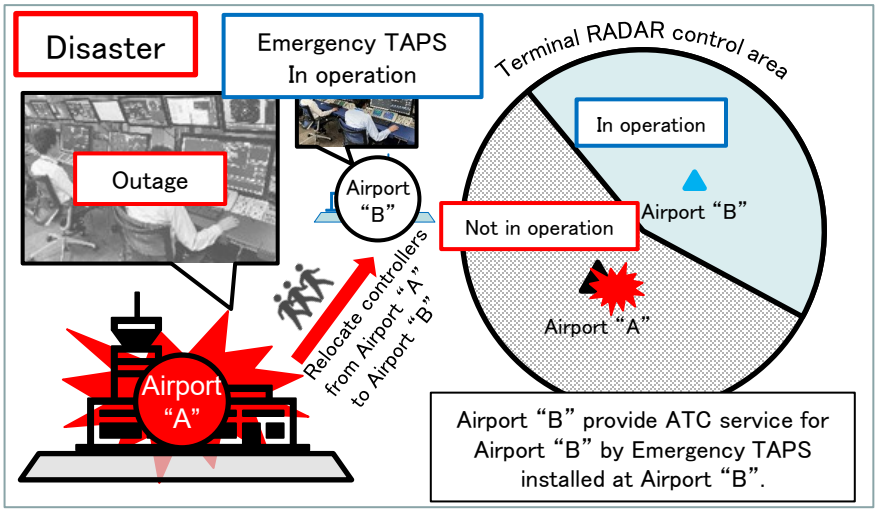
Emergency ATC tower

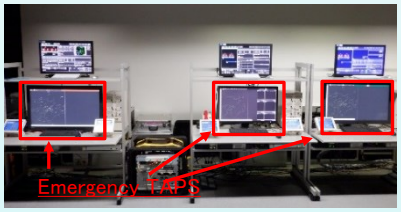
Emergency radar facility

61 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.





A disaster occurs	Transport	Install	Operation
			
Terminal control facility damaged and stopped functions due to an earthquake, fire or any other disaster.	Emergency TAPS is transported to the deployment facility.	Emergency TAPS installed at the deployment facility.	Terminal control facility resumed by Emergency TAPS.

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

※Storage facility

Always storage	Storage for transport
Narita × 1	Narita × 2 （2024FY）
Osaka × 1	Shimojishima × 1 （2024FY）

62 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.

63 Restructure of Domestic Airspace (En-route airspace)

In order to expand air traffic capacity at congested airports and airspace, such as those in the Tokyo metropolitan area, and to respond to future increases in air traffic volume, a fundamental reorganization of domestic airspace (separation of upper and lower airspace) is being implemented in stages to improve air traffic control capabilities.

Airspace configuration and vertical division

○ Previously, airspace capacity was improved by dividing sectors into smaller units and reducing the number of aircraft per sector.

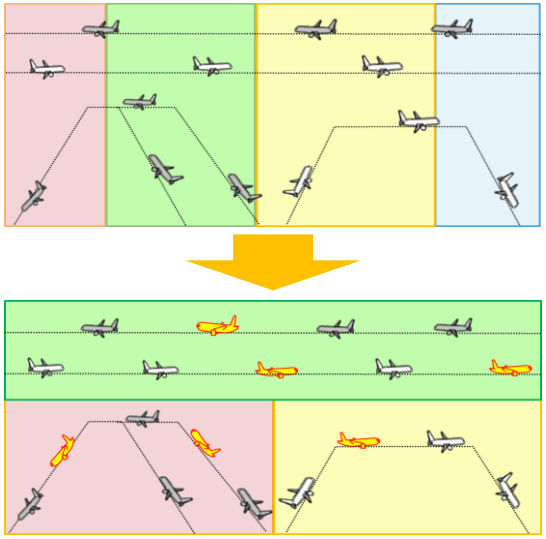
○ However, if the subdivision is carried out further than this, airspace capacity will decrease due to the increased workload for handovers between sectors and the lack of airspace for avoiding bad weather or sequencing aircraft.

○ In order to respond to future increases in traffic demand, airspace capacity will be expanded by separating the airspace into upper and lower airspaces, which is different from the conventional method.

○ We will improve processing efficiency by separating airspace into high altitudes for cruise aircraft and low altitudes for short-haul and departing/arriving aircraft.

→ By clearly dividing the roles of air traffic control operations, the processing capacity of each air traffic controller is improved.

【 Image of restructure】

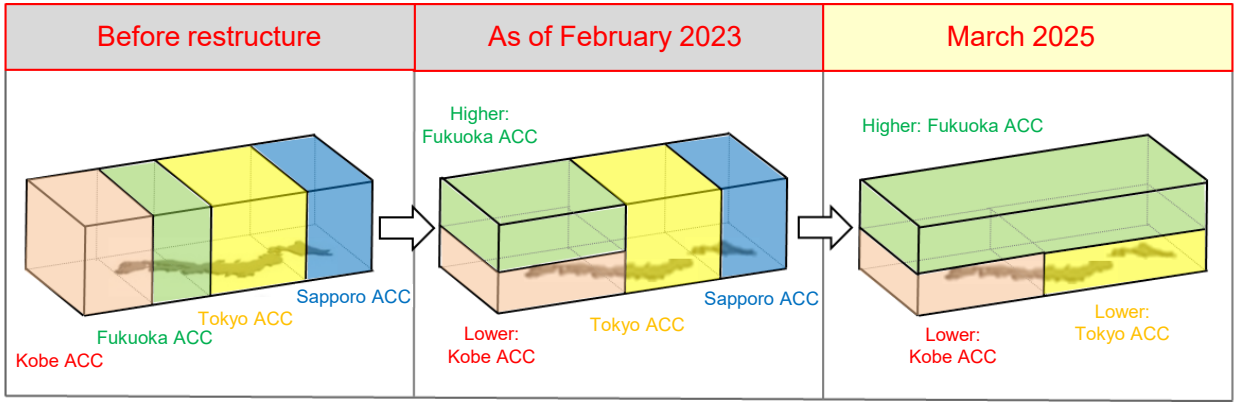


Restructure schedule

○ The vertical division of western Japan airspace was completed in February 2022.

○ The vertical division of Eastern Japan airspace started in 2023.

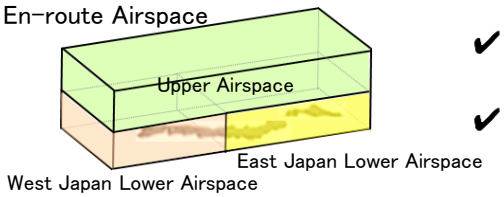
○ All domestic airspace will be divided into upper and lower airspaces by March 2025.



64 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.

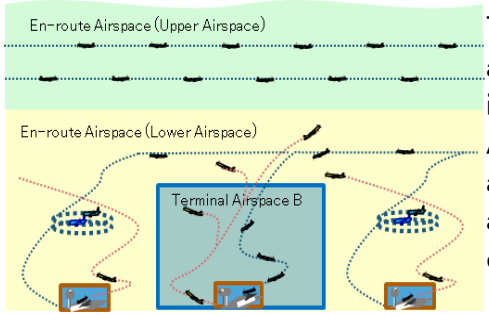
Expanding and Consolidating Terminal Airspace



✔Enhanced integration process for radar sensor data.

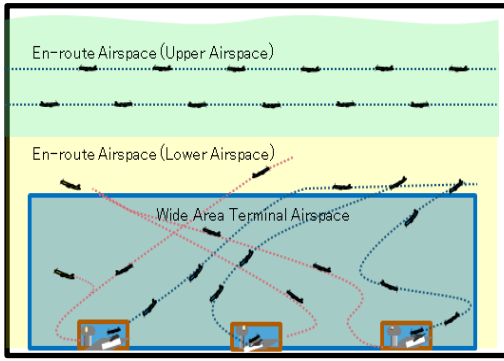
✔Expand and consolidate multiple adjacent terminal airspace and provide air traffic control integrally.

(Before restructure)



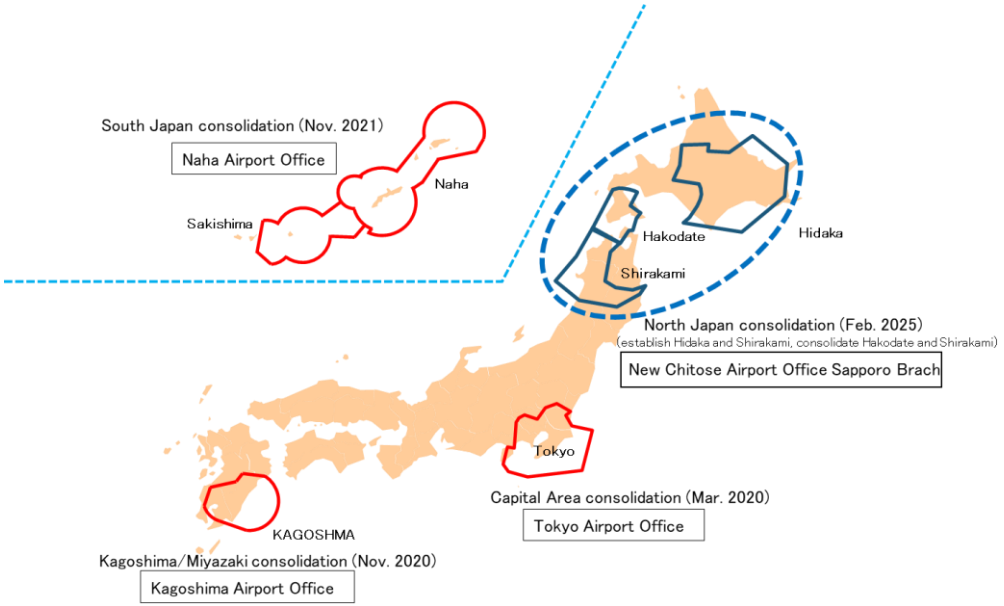
Terminal airspace is established at congested airports which has its own airport surveillance radar. Airports without a terminal airspace, departure/arrival delays, airborne holding and detours exist.

(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



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

North Japan Consolidation

【Organization:】

New Chitose Airport Office Sapporo Branch, from Apr. 2024

【Planned Schedule】

- Apr. 2024, Establish terminal airspace above east Hokkaido and Tohoku area (Hidaka／Shirakami Airspace)
- Feb. 2025, Consolidate Hakodate and Shirakami Airspace

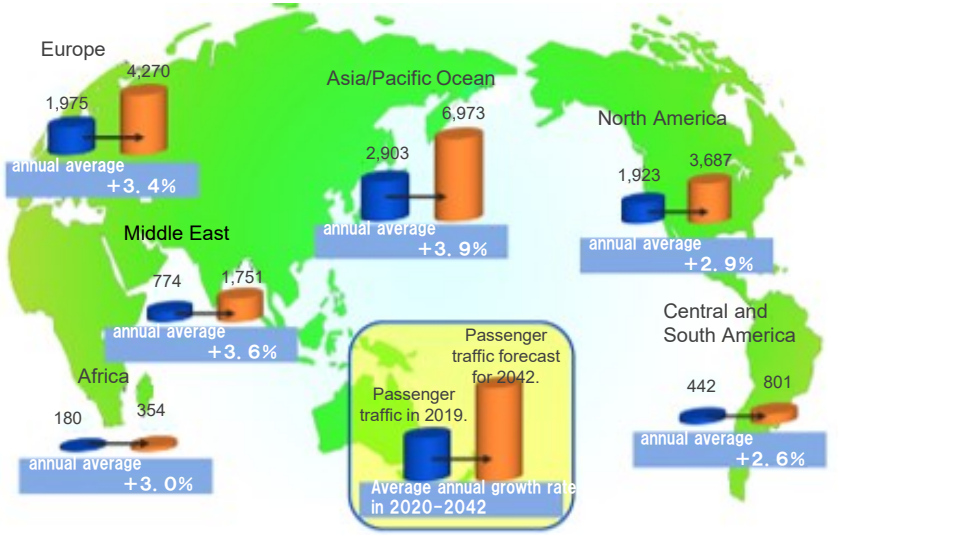
65 CARATS (Collaborative Actions for Renovation of Air Traffic Systems) (1)

○ 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 expanded from 2025 to 2040 in order to align with the future plans of the International Civil Aviation Organization (ICAO).

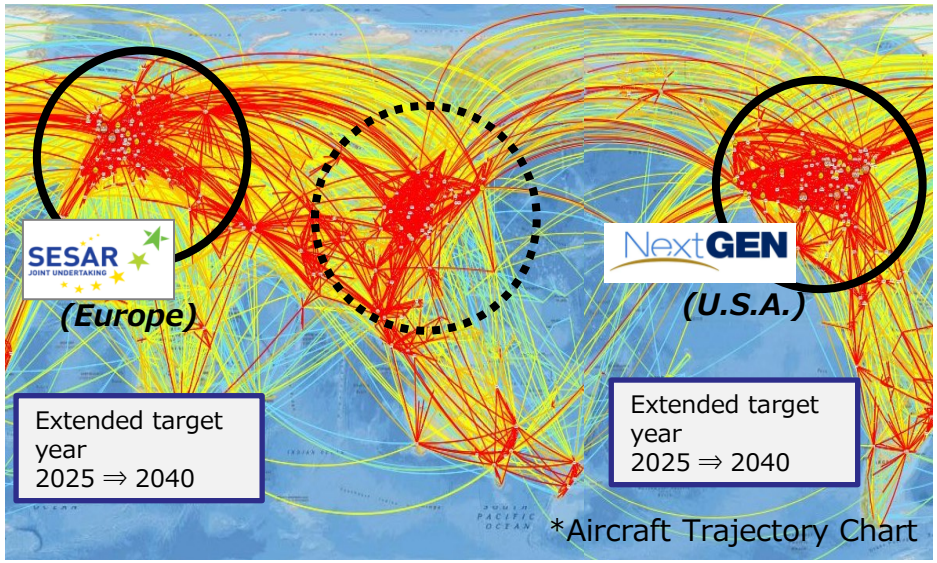
○ International Trends in International Air Transport



Source: Compiled by the Ministry of Land, Infrastructure, Transport and Tourism from data provided by the Japan Aircraft Development Association.

○ 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 37th ICAO General Assembly (October 2010), a resolution was adopted to address global warming in the international aviation sector.
➢ 2% reduction in fuel efficiency annually
➢ No increase in total CO_2 emissions after 2020

○ International Trends in Future Systems



Long-term vision for future systems in Europe and the U.S. (NextGEN, SESAR) in accordance with ICAO's vision.
Specific changes are being promoted.

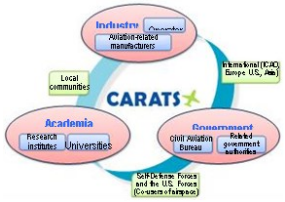
65 CARATS (Collaborative Actions for Renovation of Air Traffic Systems) (2)

○ Overview of CARATS

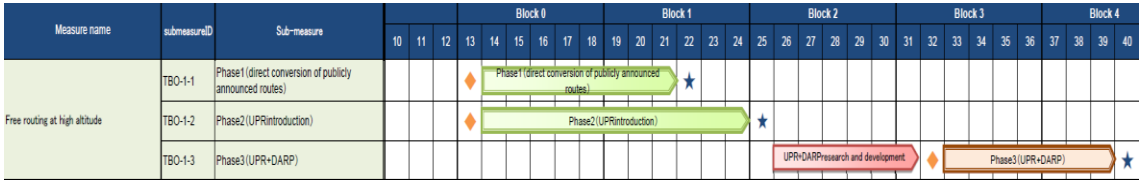
Direction of Change in CARATS	Summary
(1) Realizing trajectory-based operations (TBO)	Adjusting trajectories strategically and cooperatively prior to departure to achieve the flexible and optimal flight trajectory.
(2) Improving Predictability	Improving Predictability through calculation of ATC traffic control capacity, traffic flow forecasting, and sophistication of weather information.
(3) Promoting Performance-based Operation	ATC operation based on aircraft performance using high-precision RNAV (Area Navigation), satellite based navigation, etc.
(4) Realizing Satellite Based Navigation for All Flight Phases	Introduction of safe and highly flexible routing (4-Dimensional Trajectory, curved precision approaches) by satellite based navigation.
(5) Enhancing Situation Awareness on the Ground and in the Air	Improved situation awareness both on the ground and aircraft through the use of data communication and the introduction of air-to-air surveillance.
(6) Making Full Use of the Capability of Human Beings and Machines	Creating an environment that makes full use of the capacity of human beings and machines by allowing, for example, a pilot and a controller to focus on providing value-added service, by automating routine communication.
(7) Full information-sharing and Collaborative Decision-making	Introduction of a comprehensive network (SWIM: System Wide Information Management), etc.
(8) Realizing High-density Operation in Congested Airports and Airspace	Realization of high-density operation by utilizing support systems and accurate time management, 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.
- We are also considering reviewing the main text of CARATS (based on changing the target year from 2025 to 2040).



CARATS main text



CARATS Roadmap (excerpt)

CARATS HP
https://www.mlit.go.jp/koku/carats/

Official CARATS Youtube Channel
https://www.youtube.com/channel/UCrvA5VkicinKs8flyrtxSuQ

66 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.

SWIM

Systems for delivering information

- Flight information
- Aeronautical information
- Weather information

MASS

Providing environment for accessing to SWIM

Air Traffic Management Center

MASS: Messaging-system for ATM as Swim Service

・Flight plan
・Aeronautical information
・Weather information

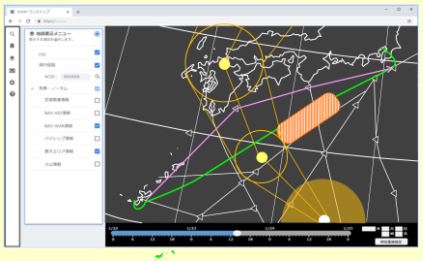
Standardized by XML (※) format

Processing huge amount of data with High-speed

Information Service Consumers (Such as Airlines、Airport manager)

Checkable operating status of the airport, weather status, and forecast on airspace congestion quickly.

- **Visualization of aeronautical information**
  See aeronautical information on a map, not in text
- **Visualization of weather information**
  See bad weather areas on a map, not in text



By unifying or standardizing data format, map or size, each piece of information can be displayed in layers.

Operators (such as airlines) can submit flight plan.

- **Preparation and submission of flight plan**
  Create and submit flight plan in reference to all the information necessary to operating aircraft at once.

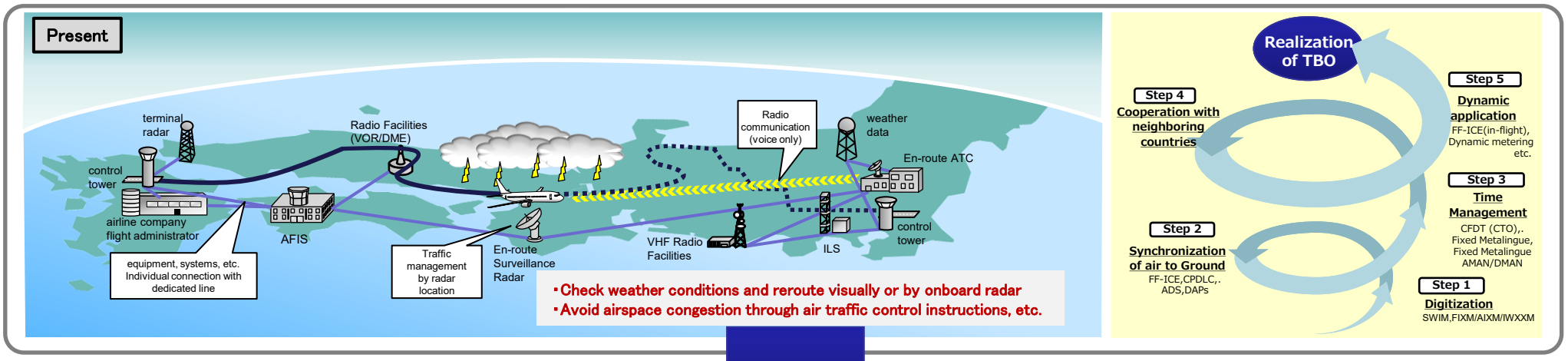
※ XML (Extensible Markup Language) : Widely-used language to facilitate data management and exchange

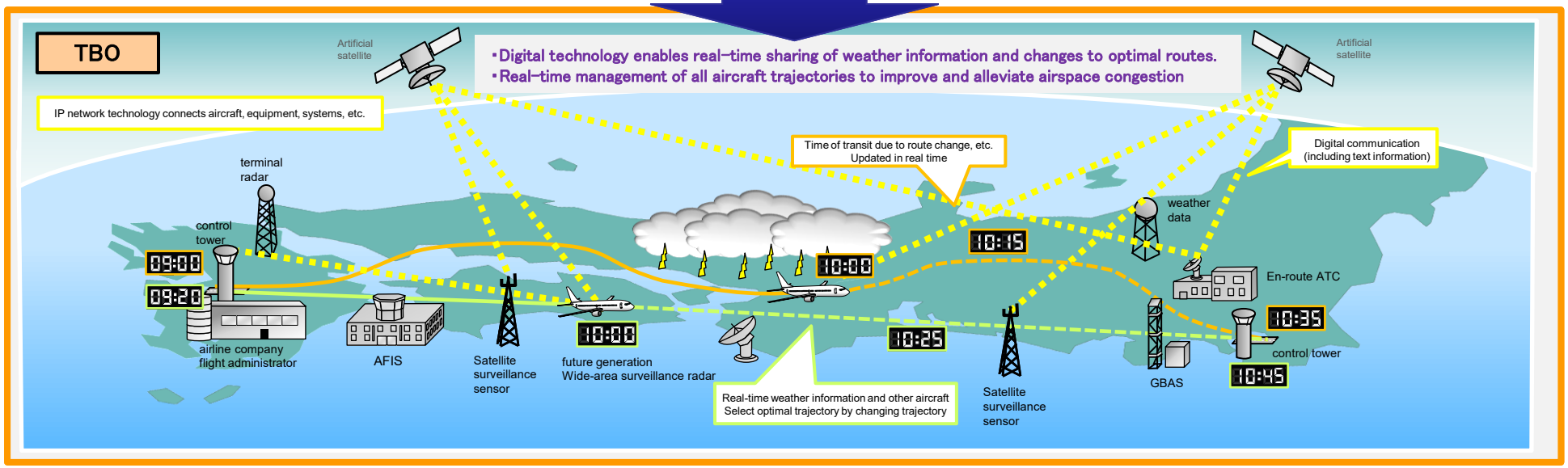
67 TBO (Trajectory Based Operations)

○TBO (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 clouds and volcanic eruptions), and ③contributes to carbon neutrality by reducing fuel consumption.

※Trajectory is an onboard computer calculation of the expected route by adding latitude, longitude, altitude, and time information.



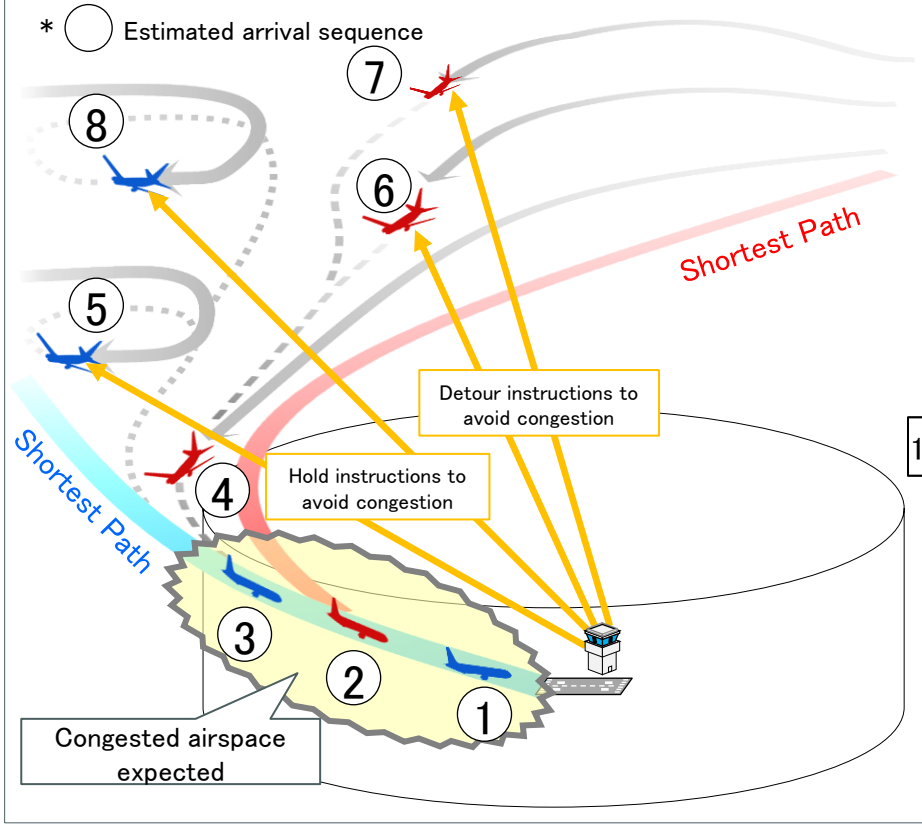


68 Time Based Management for TBO

○Efficient sequencing of departure and arrival aircraft is performed by specifying times for each milestone of aircraft operation.
○By reducing ATC instructions (detouring, holding in the air, holding on the ground) to avoid congestion due to arrival sequence, it is possible to increase the number of aircraft handled and reduce fuel consumption by shortening flight distances.
○Time Based Management will be part of Trajectory Based Operations that comprehensively share and manage aircraft routes, altitudes, and times.

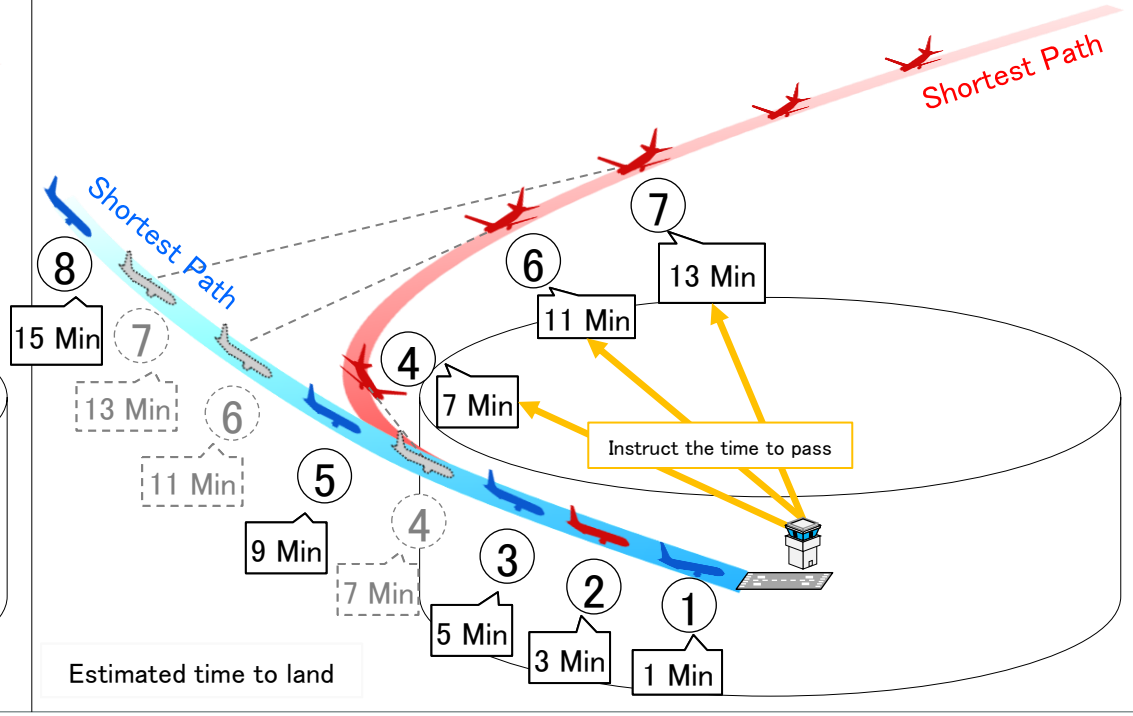
Current

Before approaching airspace where congestion is expected, air traffic controllers instruct aircraft to detour or hold in the air to avoid congestion.



Time Based Management

By managing aircraft landing times and passing times at specific points in real time, efficient and smooth operations are achieved.



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

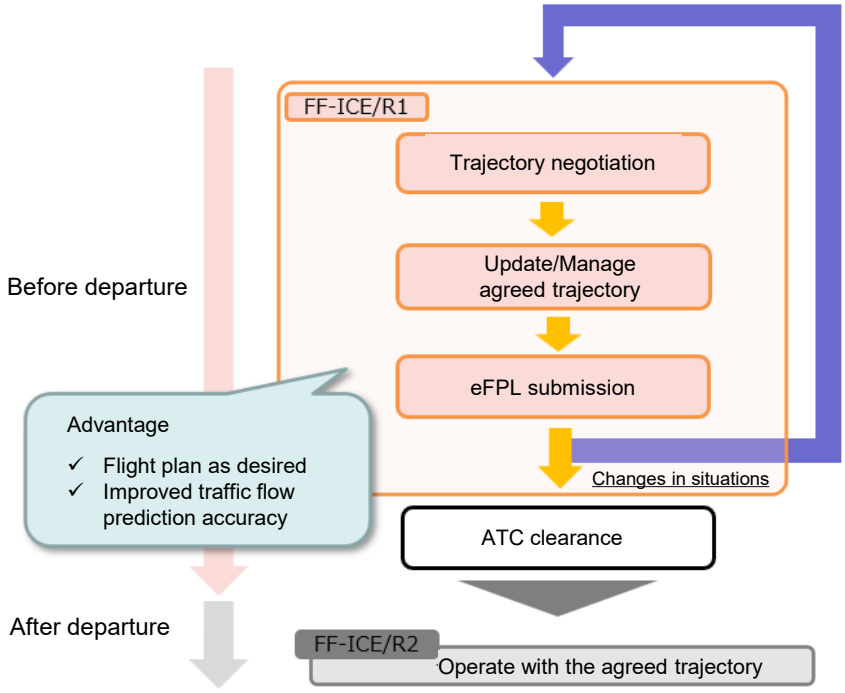
- An operational concept that uses information shared and exchanged in a collaborative environment to realize the ATM of the future.
- Utilizing SWIM*, based on digital flight plans that can include a wide range of flexible information, the company plans to introduce pre-flight trajectory (flight route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

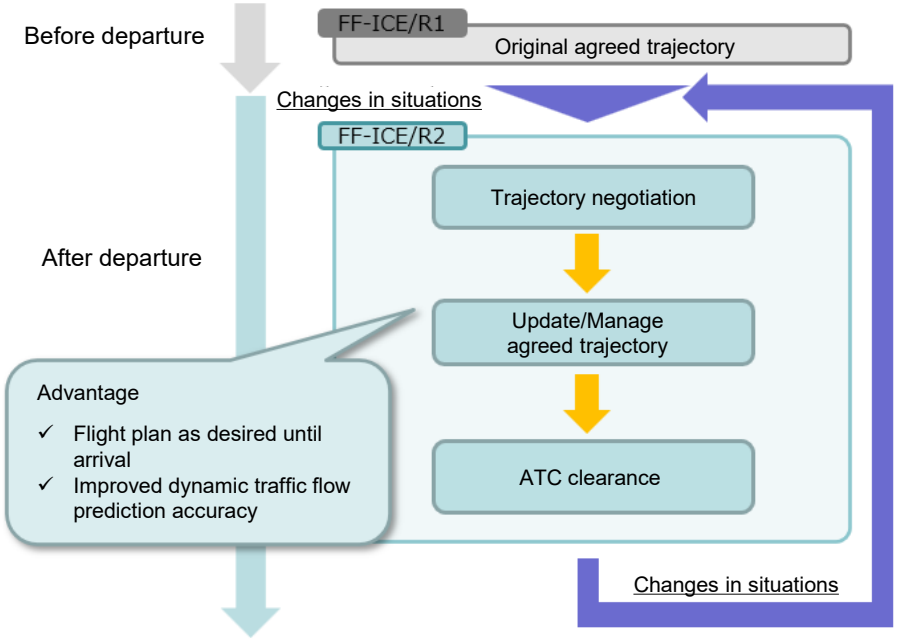
FF-ICE/R1*1: Pre-flight trajectory negotiations

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.





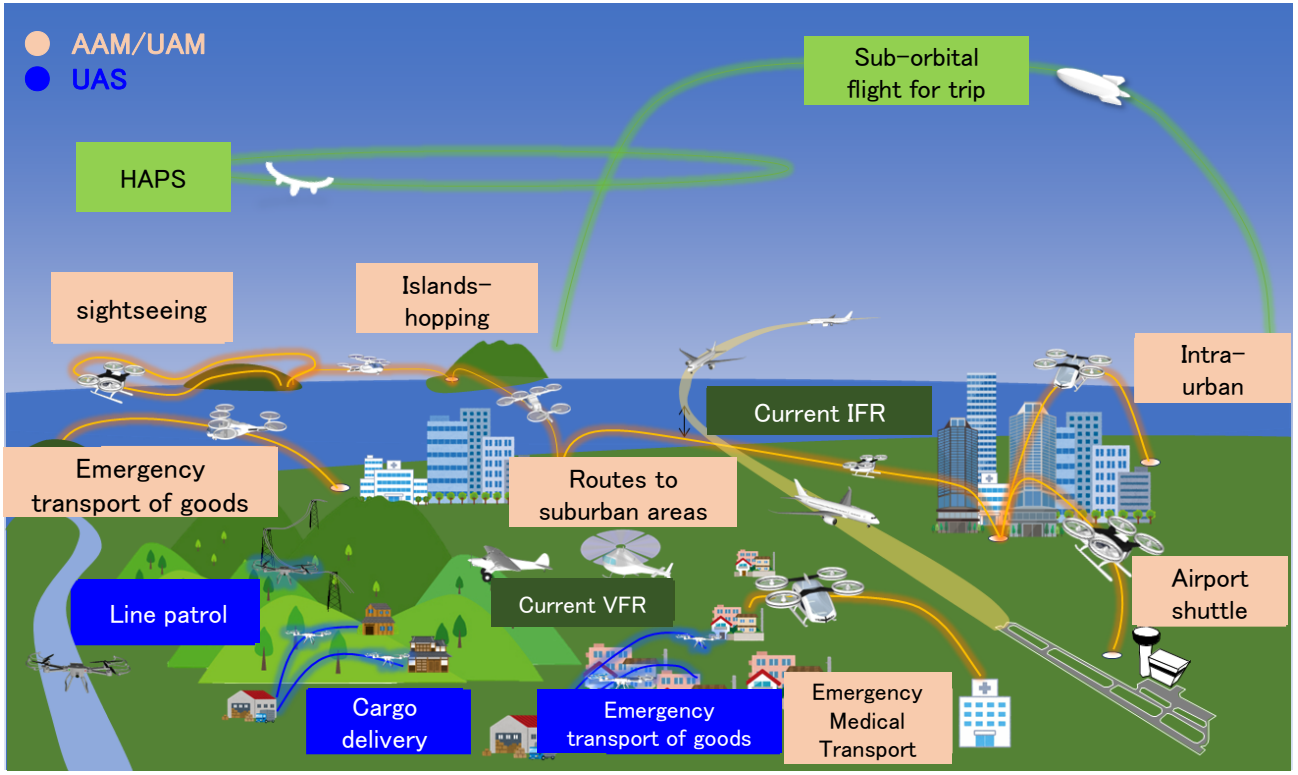
*1 FF-ICE R1 : Flight and Flow Information for a Collaborative Environment Release 1
*2 FF-ICE R2 : Flight and Flow Information for a Collaborative Environment Release 2

70 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

71 Traffic Management for AAM

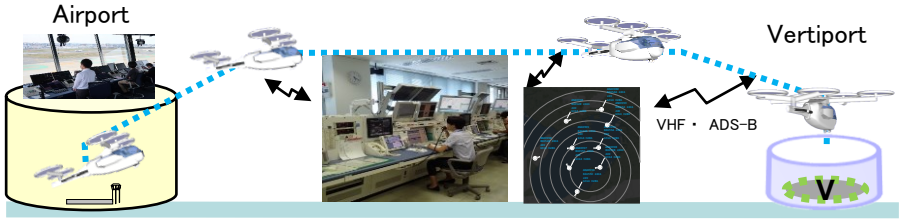
Traffic Management for AAM

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 provides the initial Urban Air Traffic Management (UATM)* service and prepare necessary structure and system for the Osaka Kansai Expo in 2025.

＊ 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.



UATM service at the Osaka Kansai Expo

Vertiport（related to Lights）

A “vertiport” is a type of airport dedicated to take-off/landing of AAM.
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 take-off/landing at night.

＊1 Planned to be operated as off-site take-off and landing area for AAM at the Osaka Kansai Expo.
＊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.

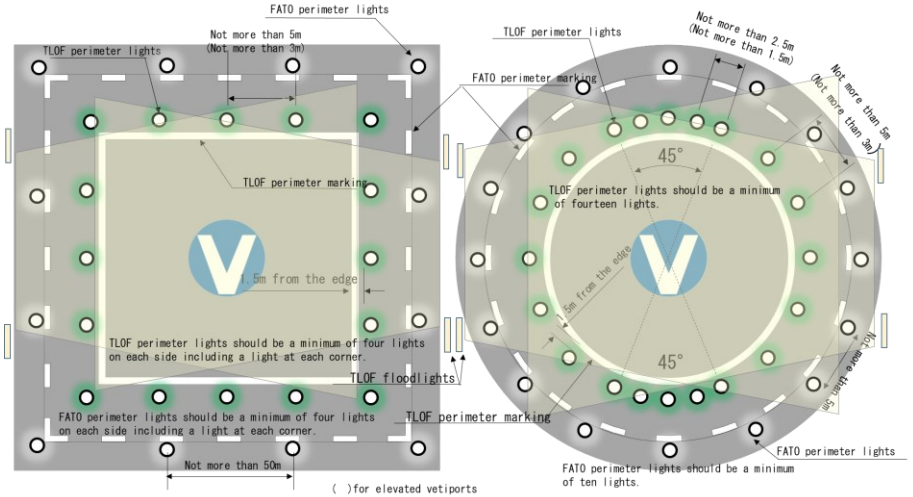
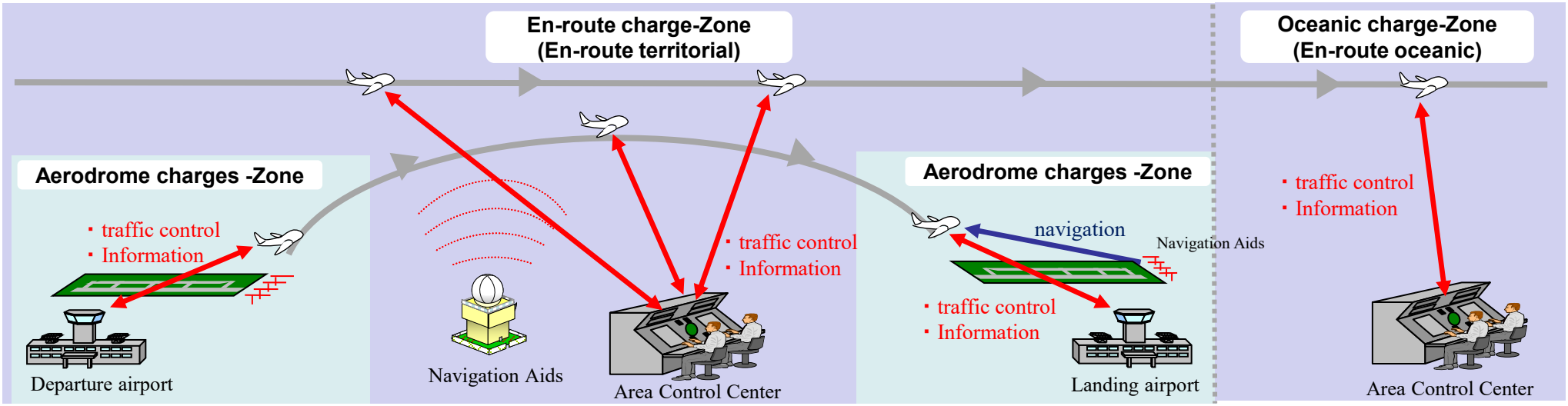


Image of lights installed at vertiports*2, 3

72 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)
Airport unit price × $(MTOW/50)^{0.7}$ *Maximum MTOW is 250	JPY 5,300 × (distance flown (km) −A※)/100 × $(MTOW/50)^{0.5}$ ※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

72 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

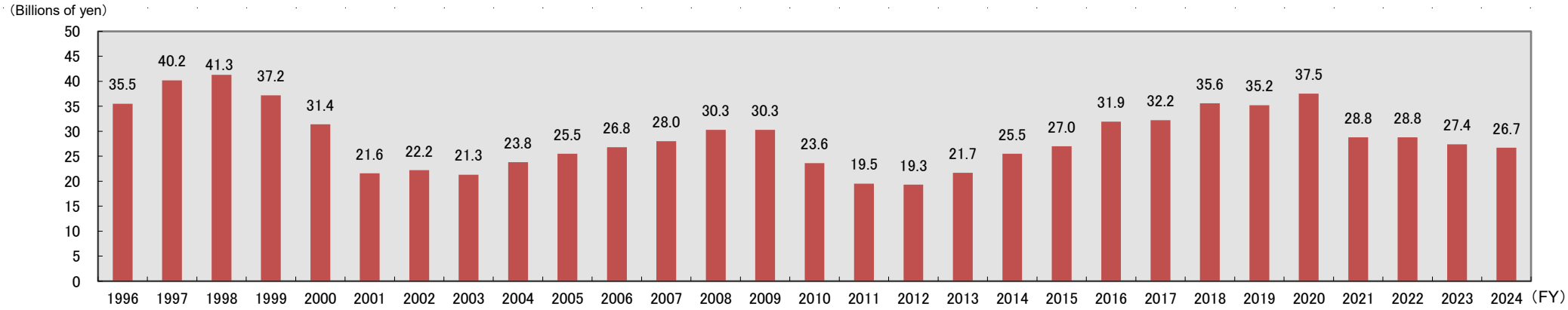
- The Air navigation service charges for routes to/from Okinawa (domestic and international cargo flights) will be reduced to 1/6 to 1/16 depending on the type of aircraft, etc.
- The Air navigation service charges for routes to/from remote islands (domestic flights) will be reduced to 1/6 to 1/16 depending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

73 Changes in Appropriations

○ Appropriations for developments of AIRWAY (En-route) FACILITIES (FY1996-FY2024)

(Billions of yen)

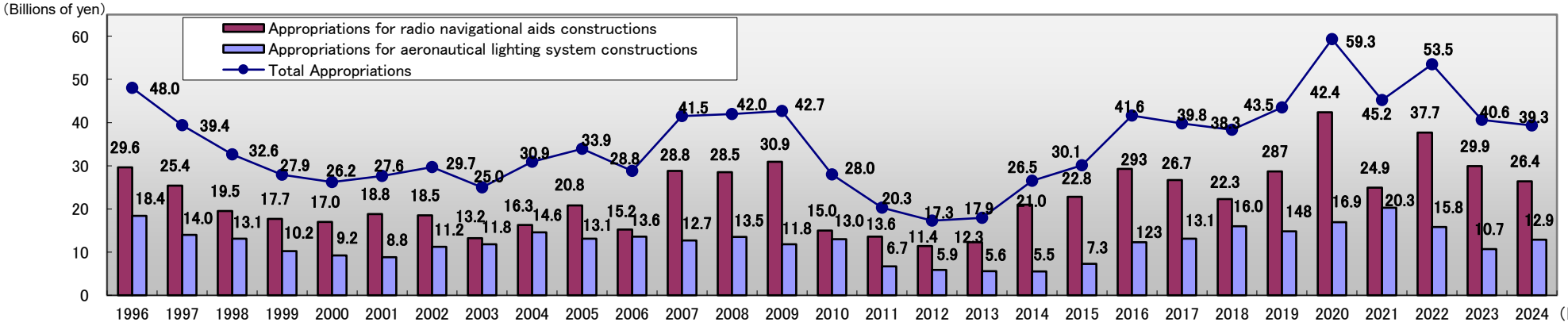
FY	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Appropriations	35.5	40.2	41.3	37.2	31.4	21.6	22.2	21.3	23.8	25.5	26.8	28.0	30.3	30.3	23.6	19.5	19.3	21.7	25.5	27.0	31.9	32.2	35.6	35.2	37.5	28.8	28.8	27.4	26.7



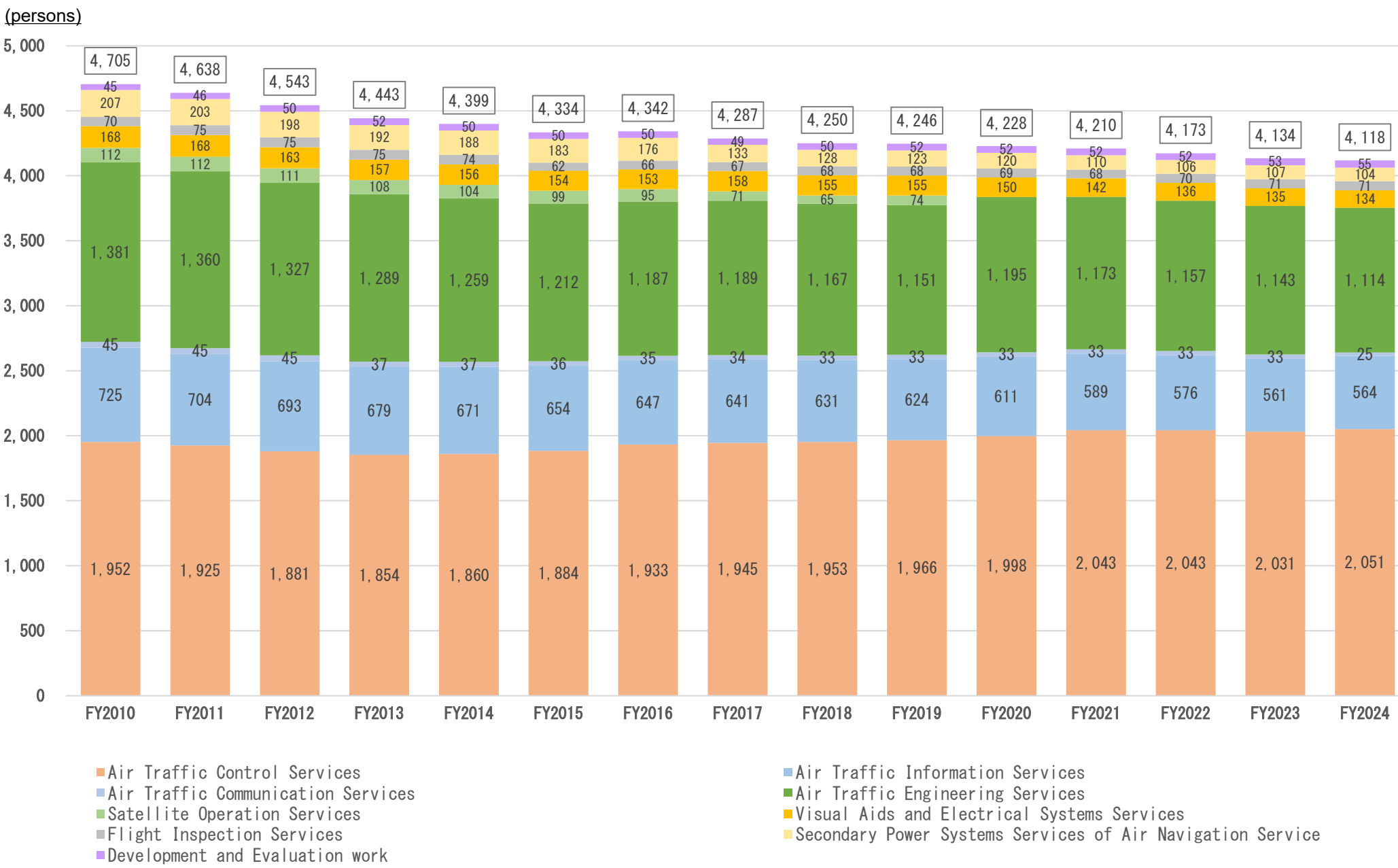
○ Appropriations for developments of AIRPORT FACILITIES (FY1996-FY2024)

(Billions of yen)

FY	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total Appropriations	48.0	39.4	32.6	27.9	26.2	27.6	29.7	25.0	30.9	33.9	28.8	41.5	42.0	42.7	28.0	20.3	17.3	17.9	26.5	30.1	41.6	39.8	38.3	43.5	59.3	45.2	53.5	40.6	39.3
− Appropriations for radio navigational aids constructions	29.6	25.4	19.5	17.7	17.0	18.8	18.5	13.2	16.3	20.8	15.2	28.8	28.5	30.9	15.0	13.6	11.4	12.3	21.0	22.8	29.3	26.7	22.3	28.7	42.4	24.9	37.7	29.9	26.4
− Appropriations for aeronautical lighting system constructions	18.4	14.0	13.1	10.2	9.2	8.8	11.2	11.8	14.6	13.1	13.6	12.7	13.5	11.8	13.0	6.7	5.9	5.6	5.5	7.3	12.3	13.1	16.0	14.8	16.9	20.3	15.8	10.7	12.9



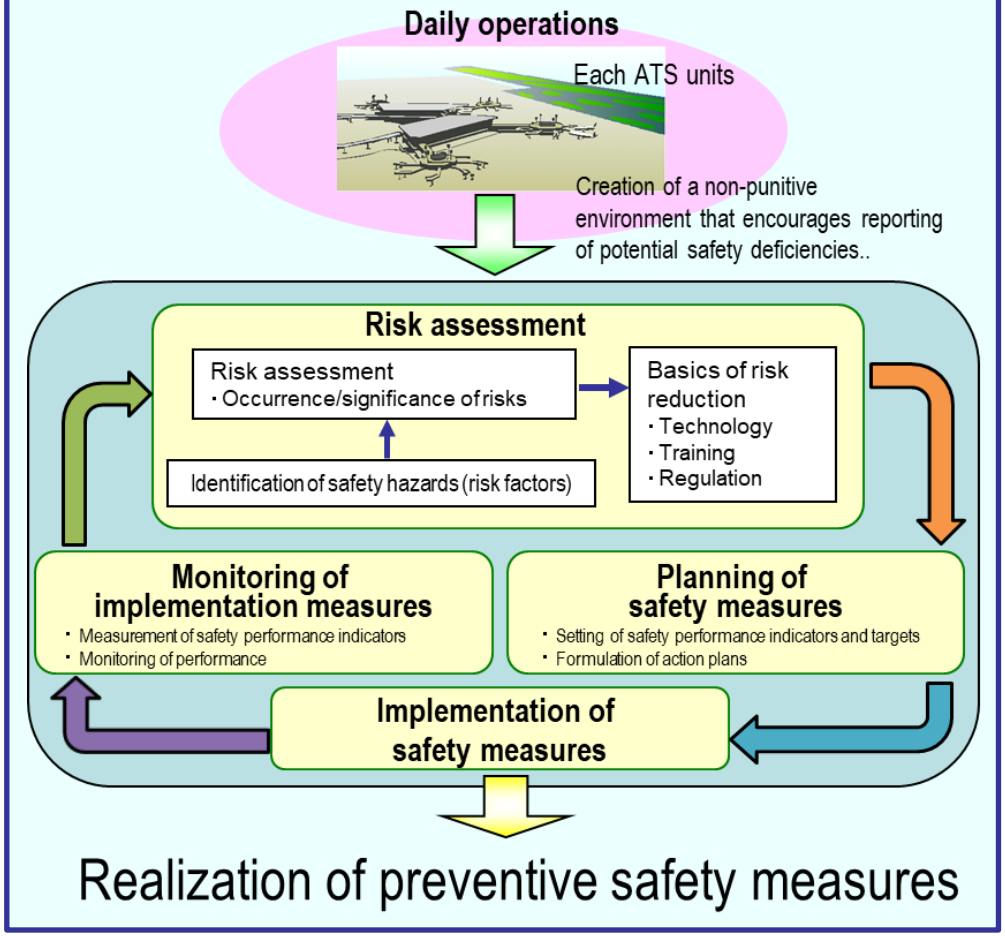
74 Number of Aircraft under Air Traffic Control and Number of AirNavigation Servicers



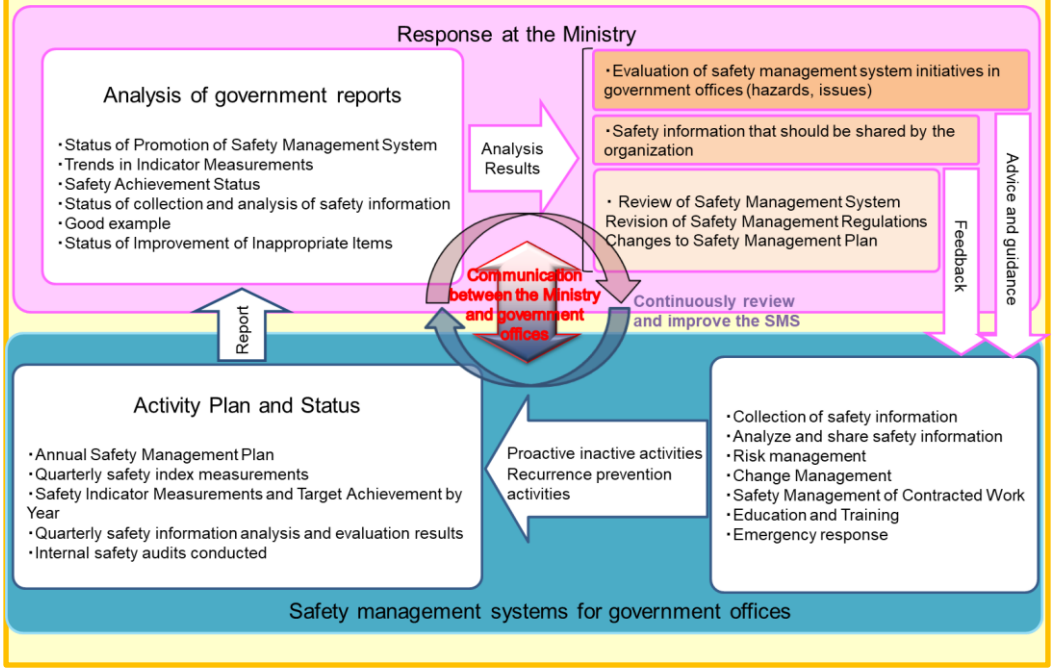
75 ATS Safety Management System (SMS)

・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.

76 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.

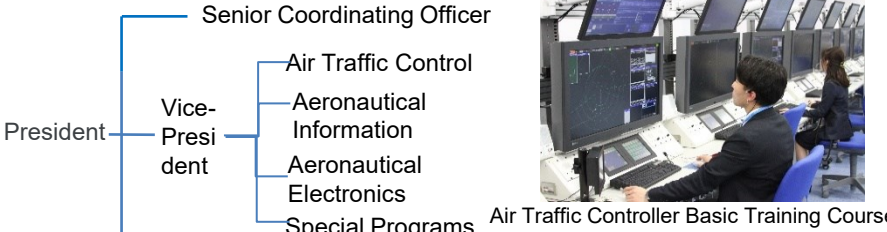
・The Aeronautical Safety College provides advanced education and training by using training equipment which is essential for actual services. This promotes the application of internationally-standardized training course development approaches, with the aim of upgrading education and training along with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

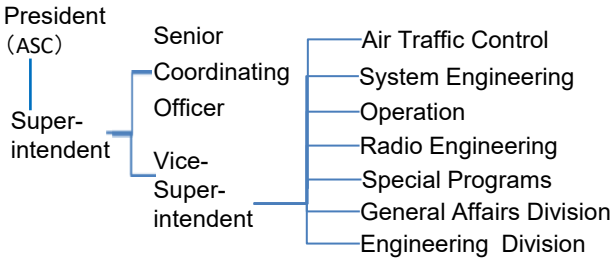

Aeronautical Information Course


Aeronautical Electronics Course


Visual Aids and Electricity Specialist Basic Course

IWANUMA Training Center (next to SENDAI Airport)

< Specialized training courses >

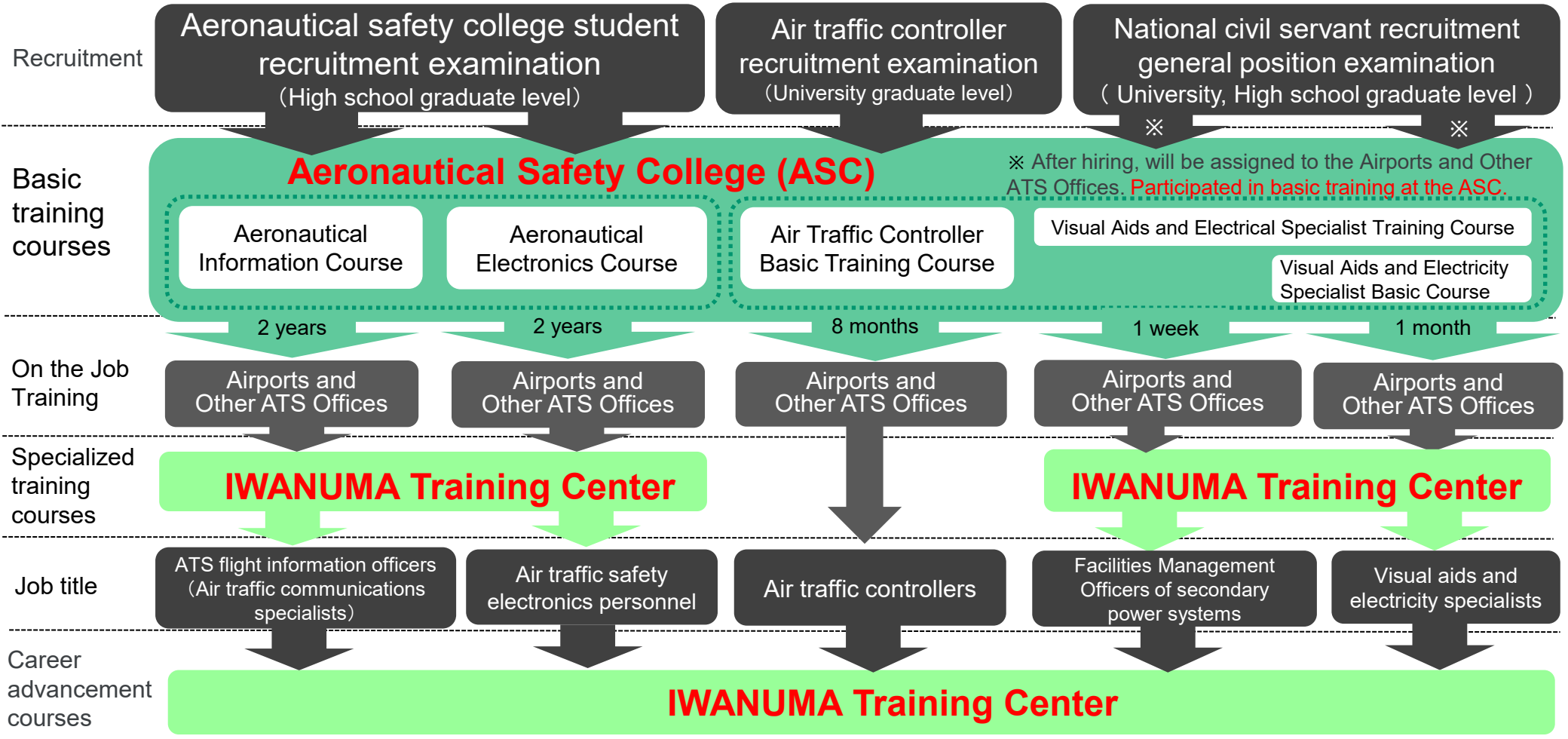


- Training equipment equivalent to the aviation safety radio facilities and air traffic control information processing systems currently in operation at Airports and Other ATS Offices are provided.
- Aeronautical Safety Personnel receive specialized training to develop their career.

76 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 】



77 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

78 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 94 members as of January 2024. (providing air navigation services for approximately 90% of the world's air traffic).

Global Head Office (Soesterberg)

- Africa regional office (Johannesburg)
- Asia Pacific regional office (Singapore)
- Europe regional office (Brussels)
- Latin America regional office (Miami)
- Middle East regional office (Soesterberg)
- ICAO Affairs office (Montreal)

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 advise

- **ACI: Airport Council International** — Operators of airport and airport building
- **CANSO: Civil Air Navigation Services Organization** — Air Navigation Service Provider
- **IATA: International Air Transport Association** — International Airlines

Mutual cooperation

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.