Contributing to Efficient Air Traffic Operations

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1. Aviation and Environment
2. What is Air Traffic Control (ATC)?
3. ATC's contribution to efficient flights

1. Aviation and Environment

CO2 emission from International Aviation

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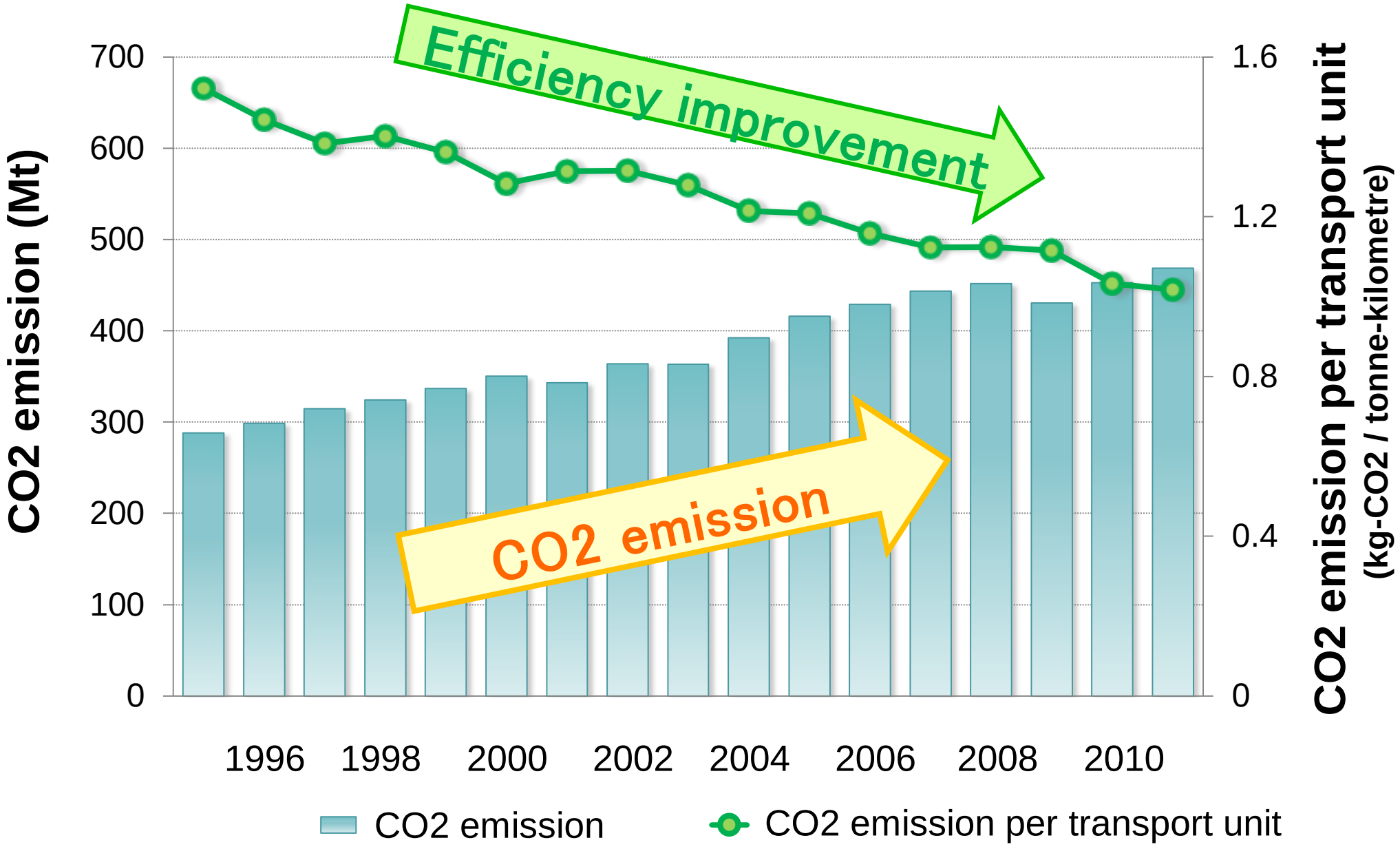

Source: ICAO 2013 Environmental Report

CO2 emission from Int' l Aviation

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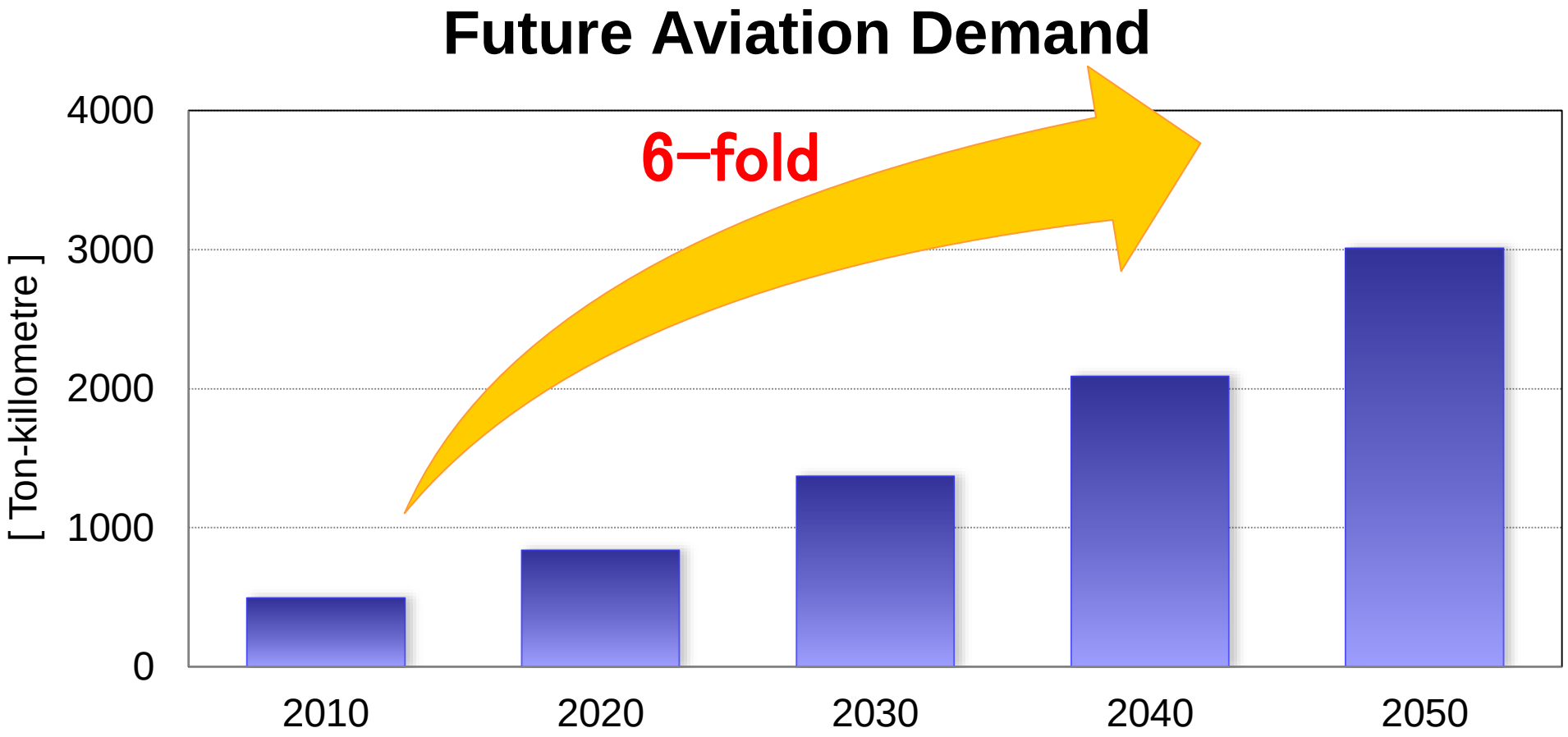

Source: ICAO 2013 Environmental Report

CO2 Emission ↑ = **Fuel Efficiency** ↑ × **Activity** ↑

Part of Int'l Aviation, Global CO2 emissions

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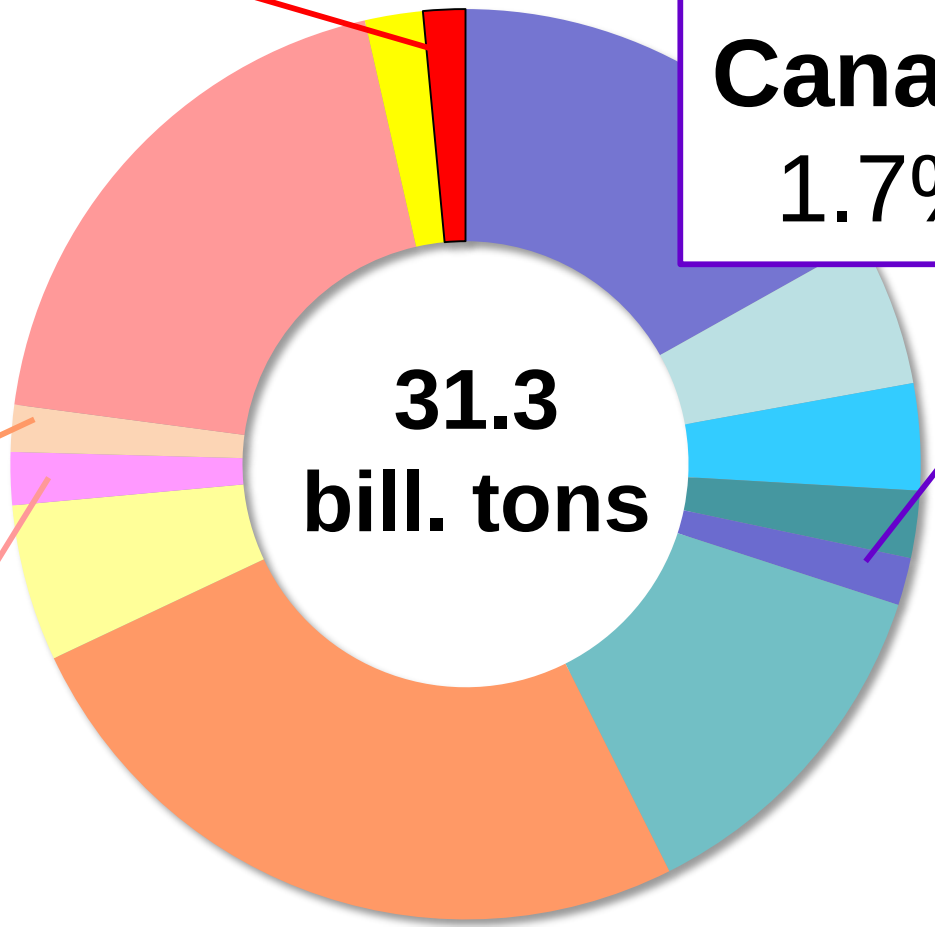
Int'l Aviation
1.5%
（470Mt）



Canada
1.7%

Iran
1.7%

Korea
1.9%

Global CO2 emissions(2011)

Source: CO2 Emissions from Fuel Combustion 2013 Edition（IEA）

Characteristics of Int'l Aviation sector

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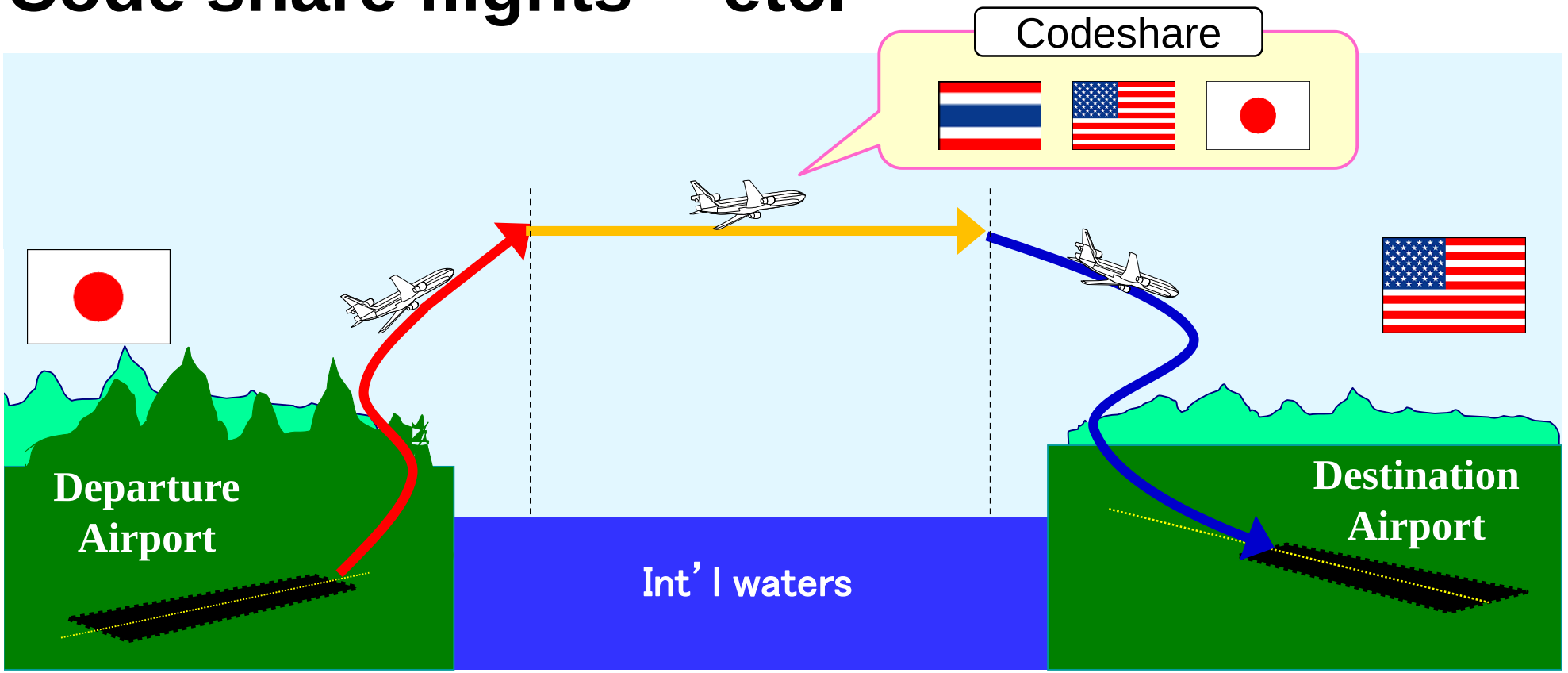
- Flying over different countries and int'l waters
- Code share flights etc.



Difficulty in allocating emissions to countries

⇨ **Working through ICAO** (Kyoto Protocol)

International Civil Aviation Organization (ICAO)

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INTERNATIONAL CIVIL AVIATION ORGANIZATION
A United Nations Specialized Agency

- Created in 1944 upon the signing of the Chicago Convention
- 191 Member States (as of Oct. 2013)
  Japan Joined in 1953.
- Setting standards and regulations necessary for aviation safety, security, efficiency and regularity, as well as environmental protection.

Headquarters in Montreal, Canada

ICAO Global aspirational goals

- Global aspirational goals for CO2 emissions reduction in Int'l aviation sector (ICAO Assembly Resolution in 2010)
  - ✈**Improving fuel efficiency by 2% annualy**
  - ✈**Stabilizing its global CO2 emissions at 2020 levels**

- Each state's actions contributing to global goals

Aircraft technology	**Operational improvements**
Alternative fuels	Market-based measures(MBMs)

2. What is air traffic control (ATC)?

Characteristics of Air transportation

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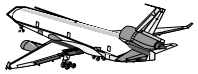

Aircrafts…

① move in 3D

- Laterally / Varticaly

② travel at High speed

- cruise speed of a commercial jet : 800km/h
- speed of helicopter(relatively low) : 200 km/h

③ cannot stop

- For safety, aircrafts cannot change speed sharply and stop in mid-air.

④ affected by Weather

- Aircrafts are subject to weather conditions such as cloud, precipitation, wind, and fluctuation of atmospheric pressure.
- They cannot see other aircrafts and obstacles especially in cloud.

For safe and efficient flight, Air traffic controllers manage aircraft through all aspects of their flight.

Air Traffic Control (ATC) from departure to arrival

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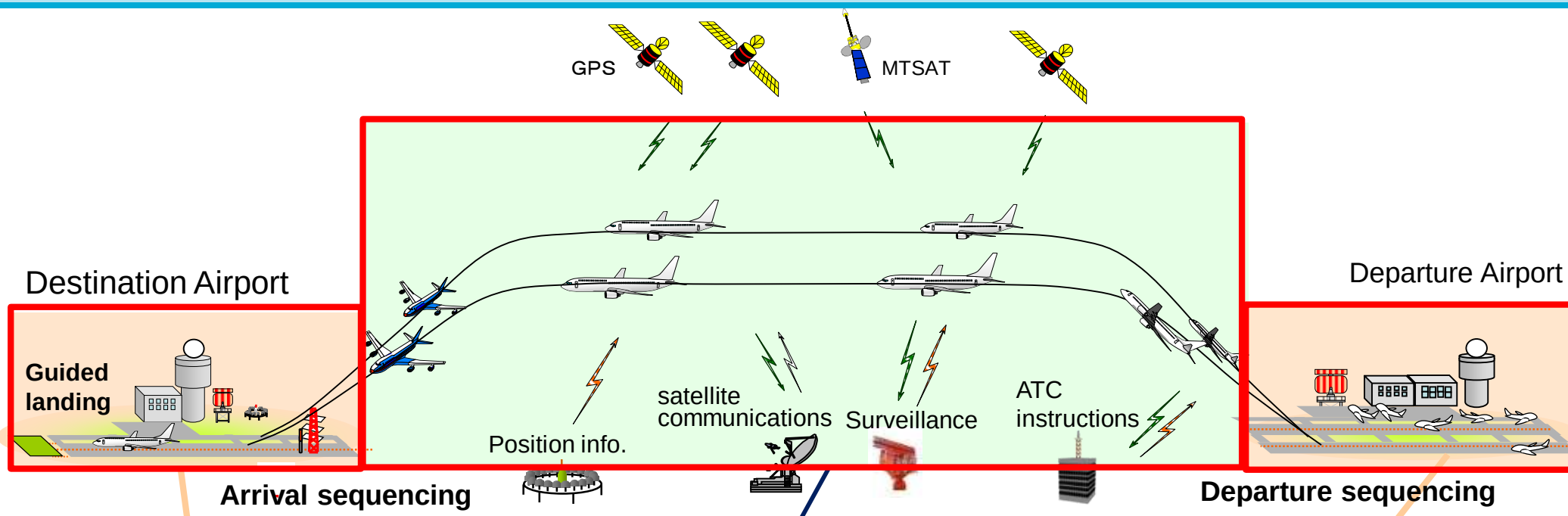

ATC service from control tower

ATC service using Radar system

ATC service from control tower

Air Traffic Management

Air Traffic Management

（ATM Centre ）

Designated Departure/En route/Approach path

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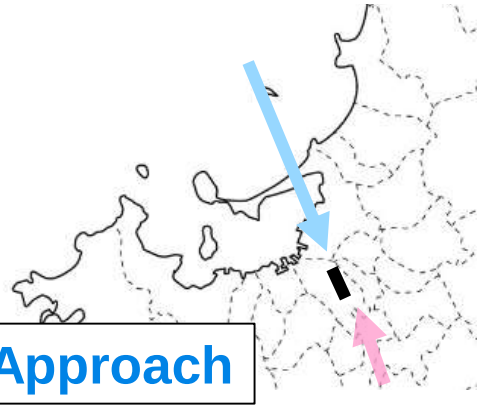
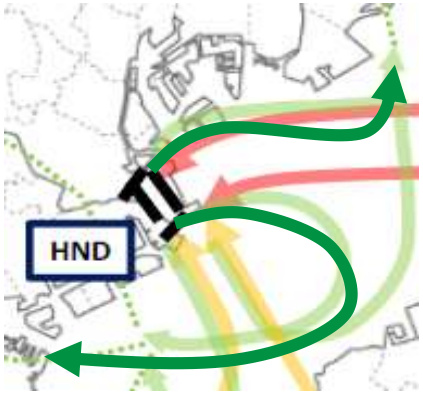
Example: Haneda to Fukuoka

Fukuoka



Approach

Haneda



Departure

Designated Departure/En route/Approach path

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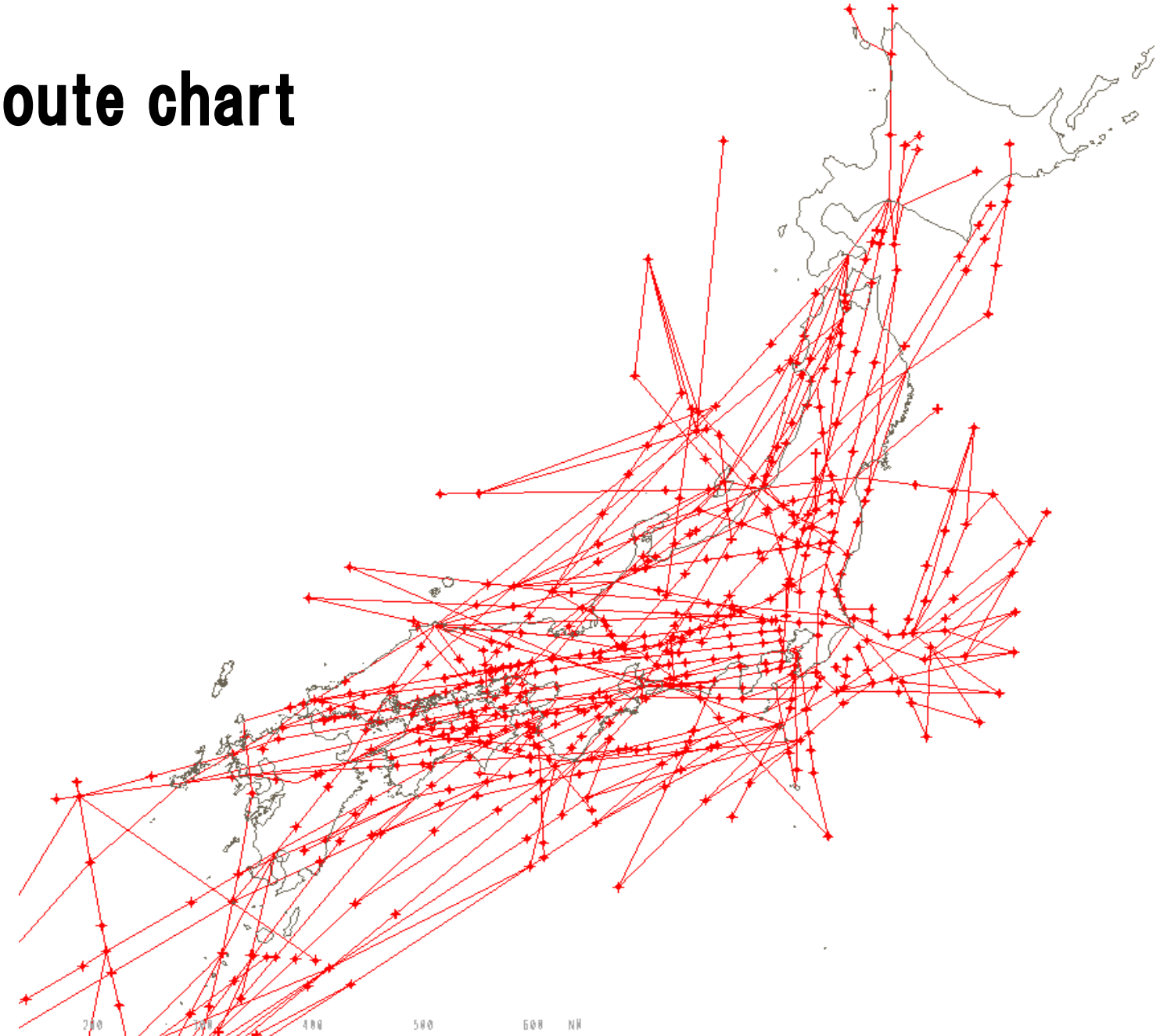
En route chart



Domestic Air Traffic Flow

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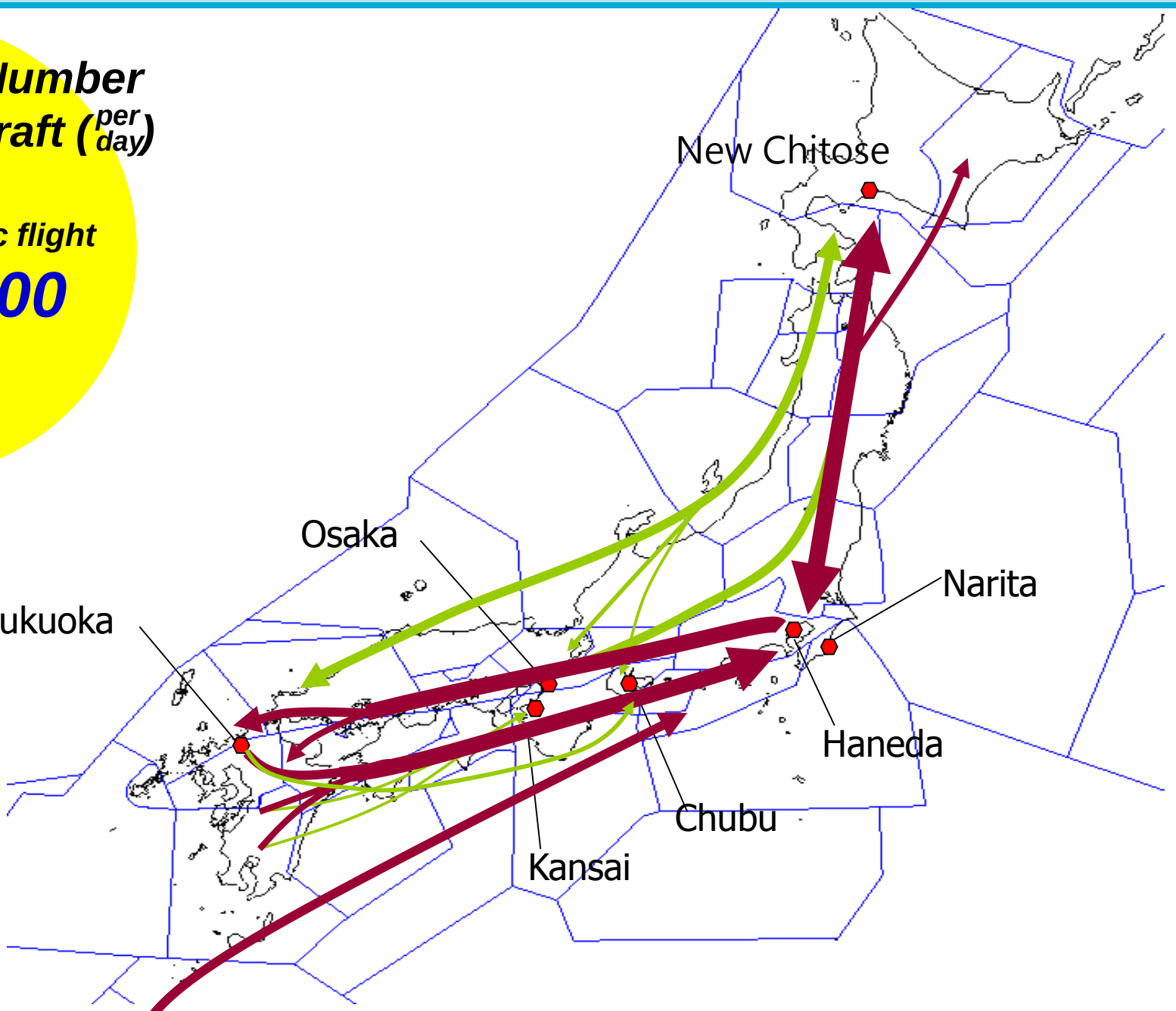
Total Number of aircraft (per day)

Domestic flight

2,300



International Air Traffic Flow

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Total Number of aircraft (per day)

Int'l flight

1,290

Overflight

520

Created from flight plans in 2012(Nov.)

Aircraft operating in Japan around 6p.m.

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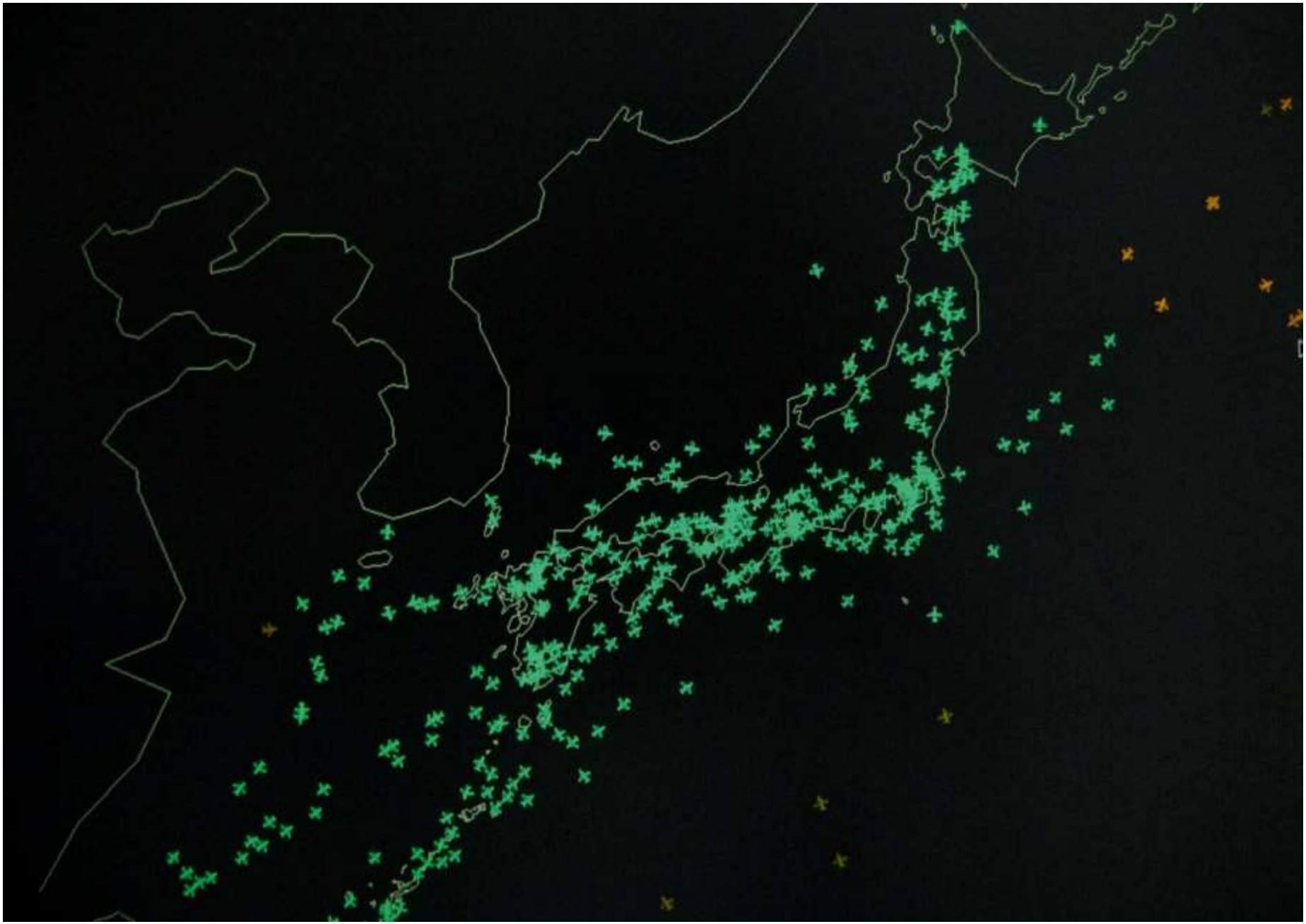

Air Traffic in Metropolitan Area

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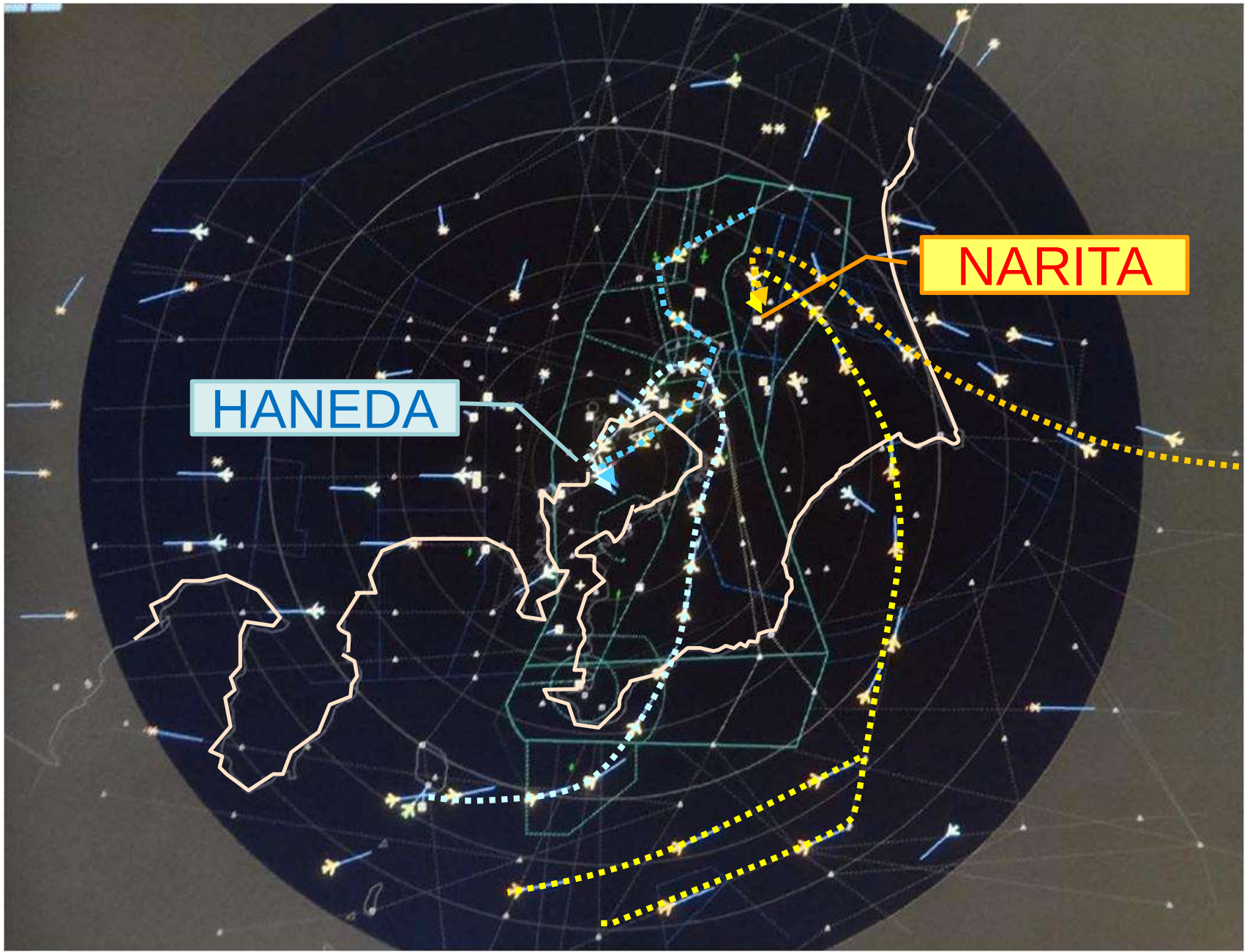

3. ATC's Contribution to efficient flights

ATC's Contribution to efficient flights

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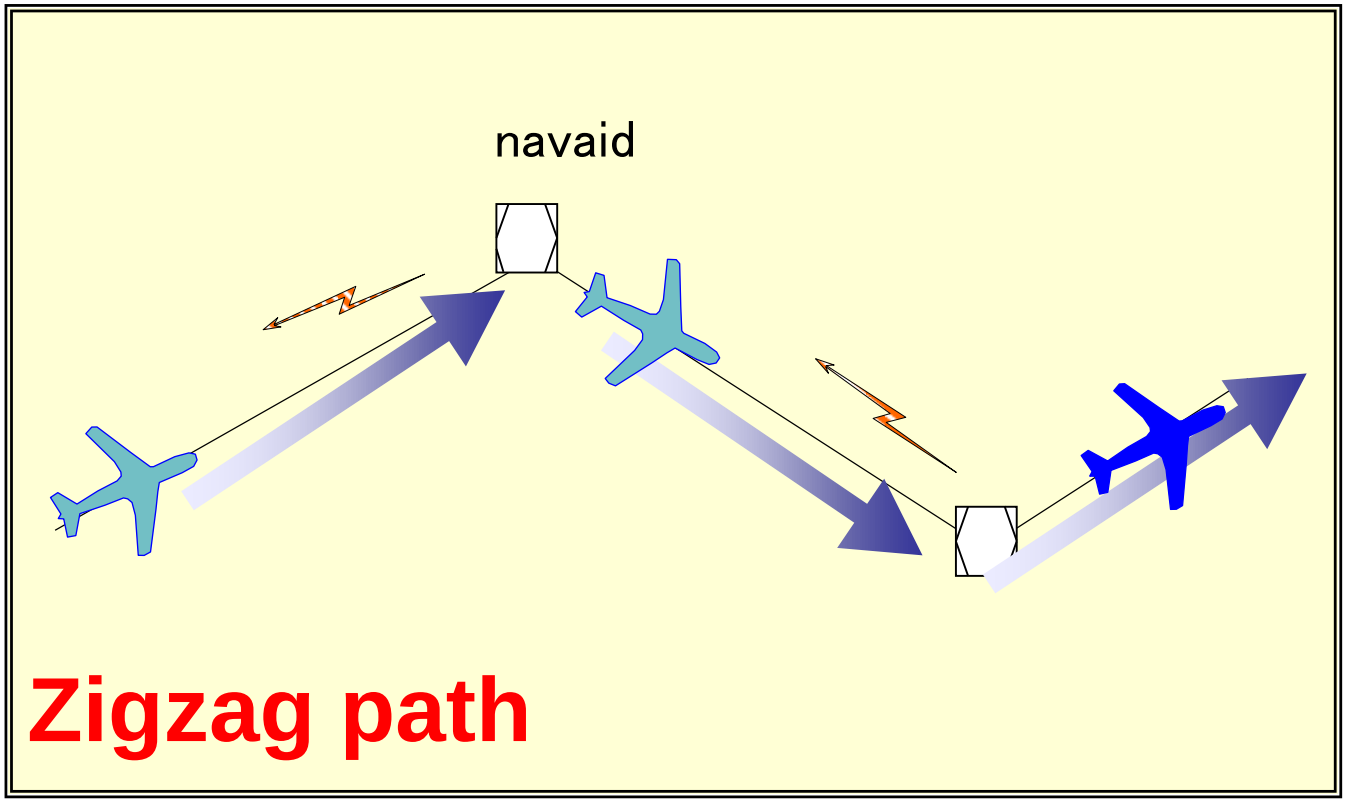
- Efficient flight by shortening flight path and time is effective for reduction of fuel consumption and CO2 emission.
- It also improves convenience for users.

ATC's Contribution

- ✓**Providing optimized routes**
- ✓ **Air Traffic Flow Management**
- ✓**Developing Future Air Traffic System**

＜Conventional navigation＞

navigating directly to and from ground-based navigational aids(navaids)



Point to Point Navigation（Introduction of RNAV）

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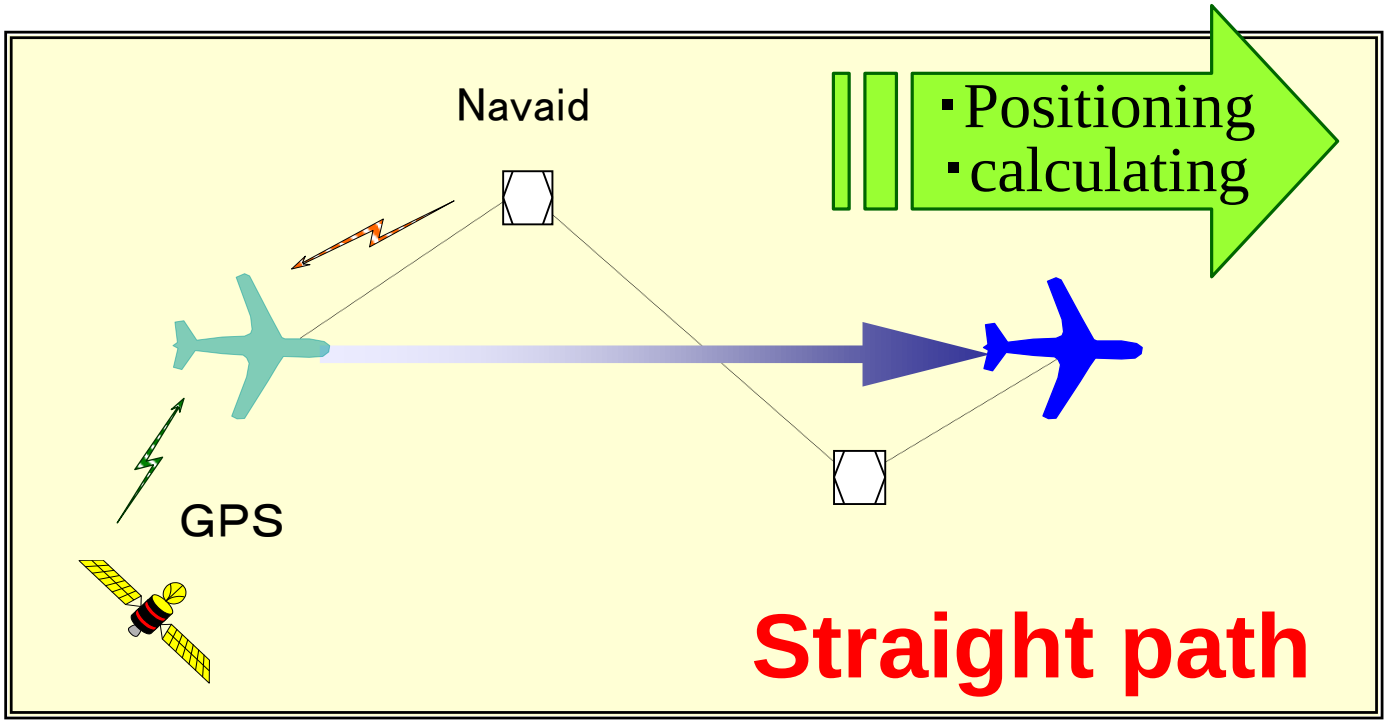
＜RNAV（Area Navigation）＞

flexible and optimum routing with satellite navigation, freeing airplanes from reliance on ground-based navaids



En route and Approach for Airport

Deployment of RNAV Approach in Airport

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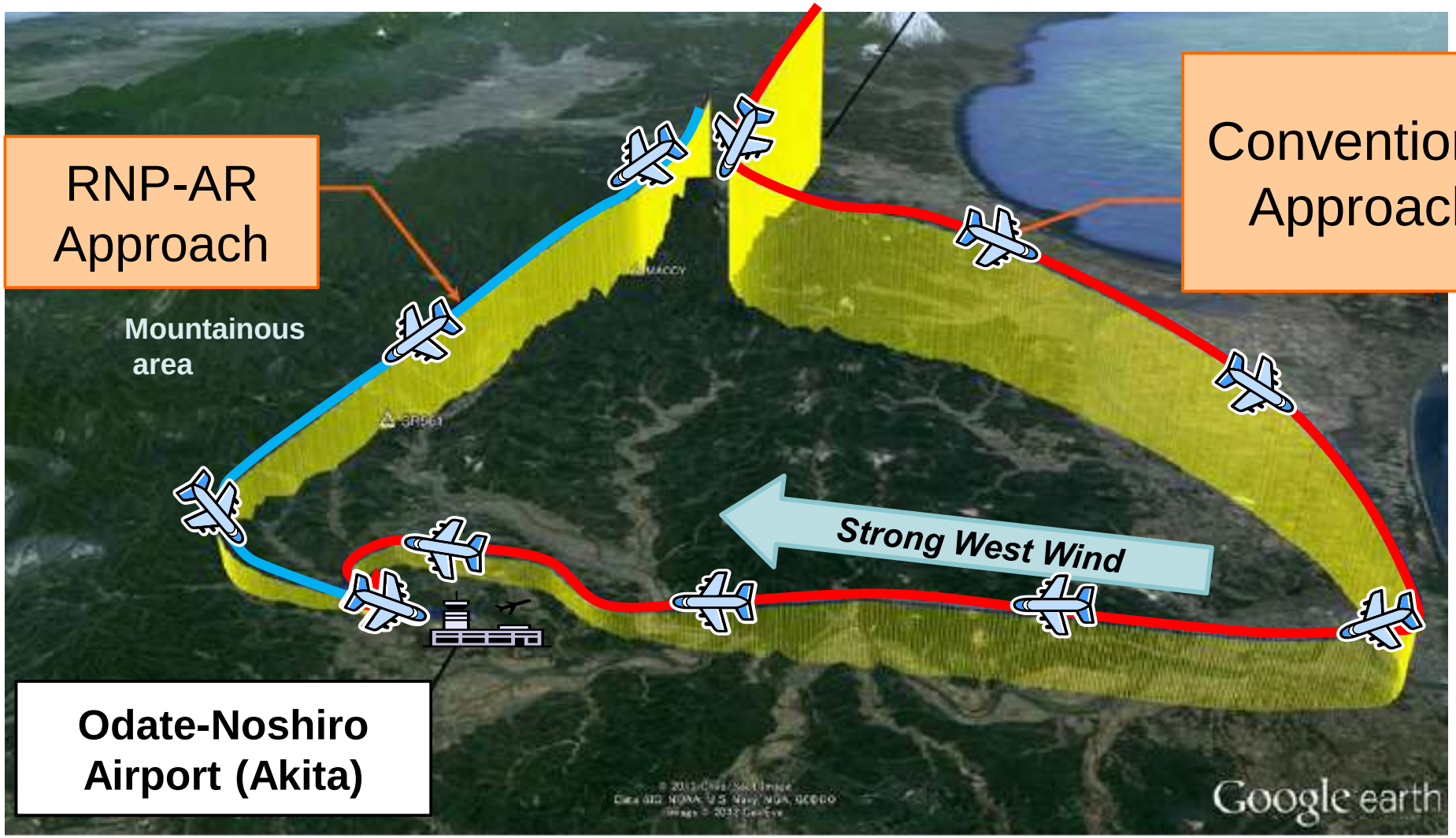
Introduction of higher accuracy RNAV Approach (RNP-AR Approach) shortens flight paths to the runway and improves access to Airport.



KUMAMOTO Airport Example①

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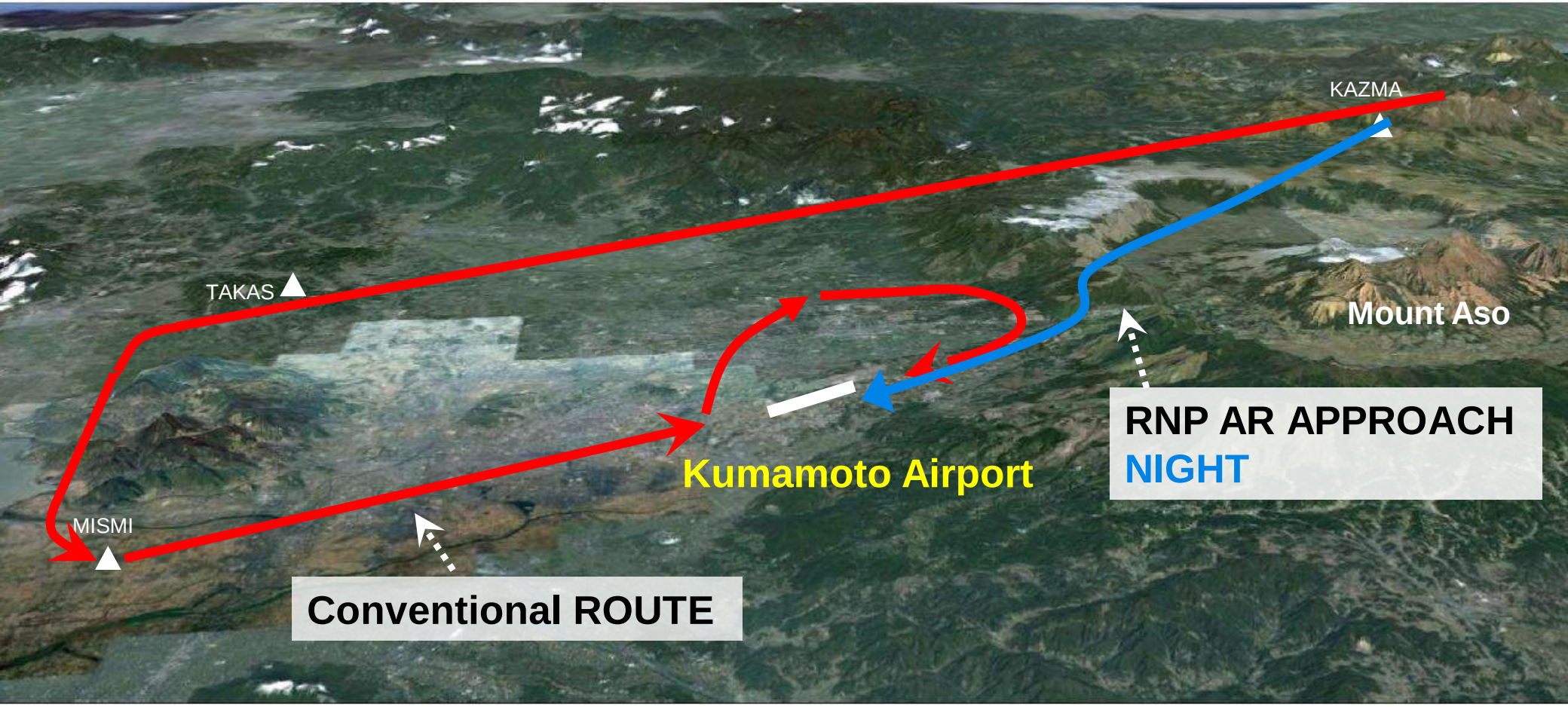
Kumamoto Airport



26.5nm (49km) REDUCTION OF FLIGHT DISTANCE

COMPARED TO CONVENTIONAL APP.

KUMAMOTO Airport Example ②

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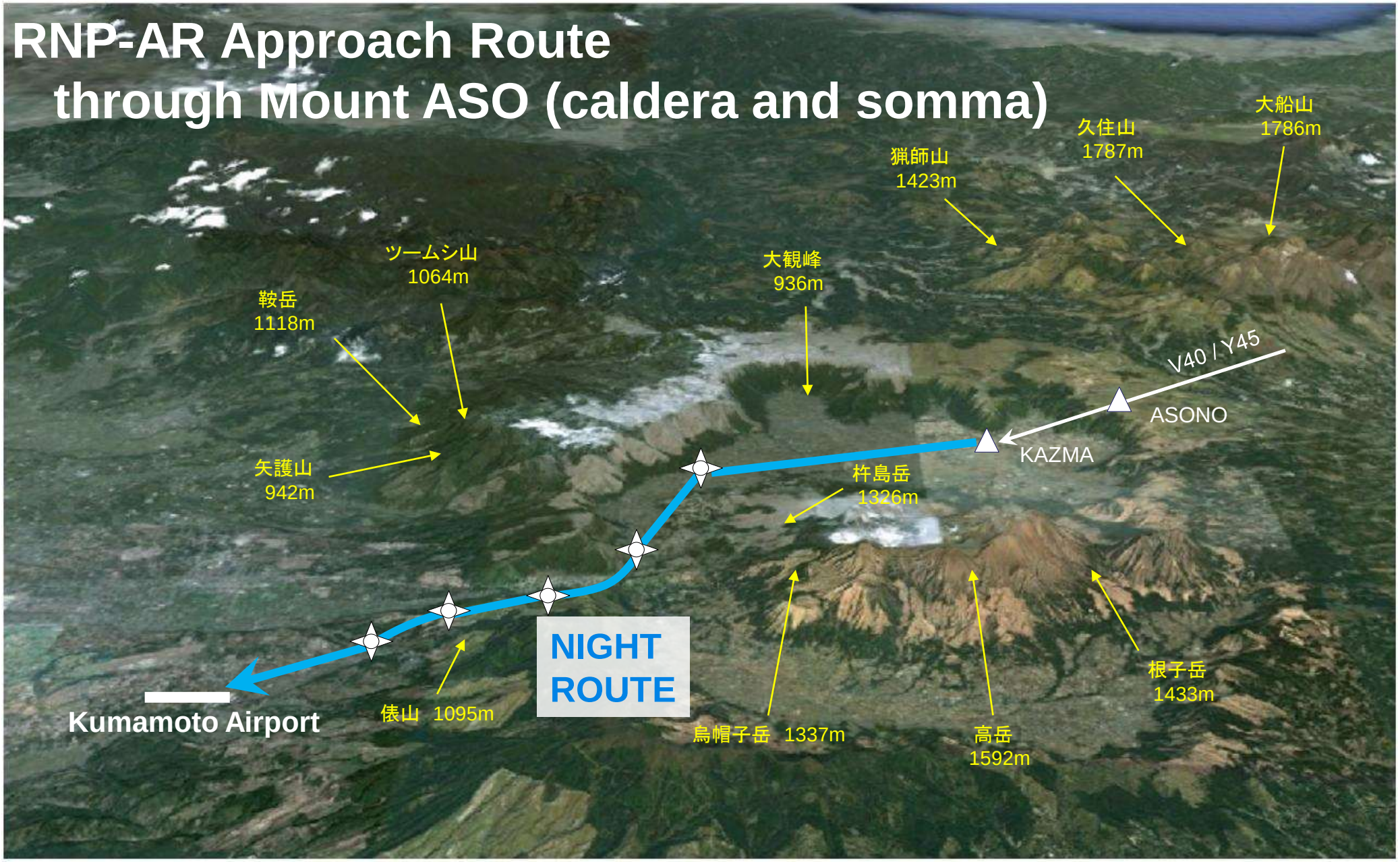

CDO (Continuous Descent Operations)

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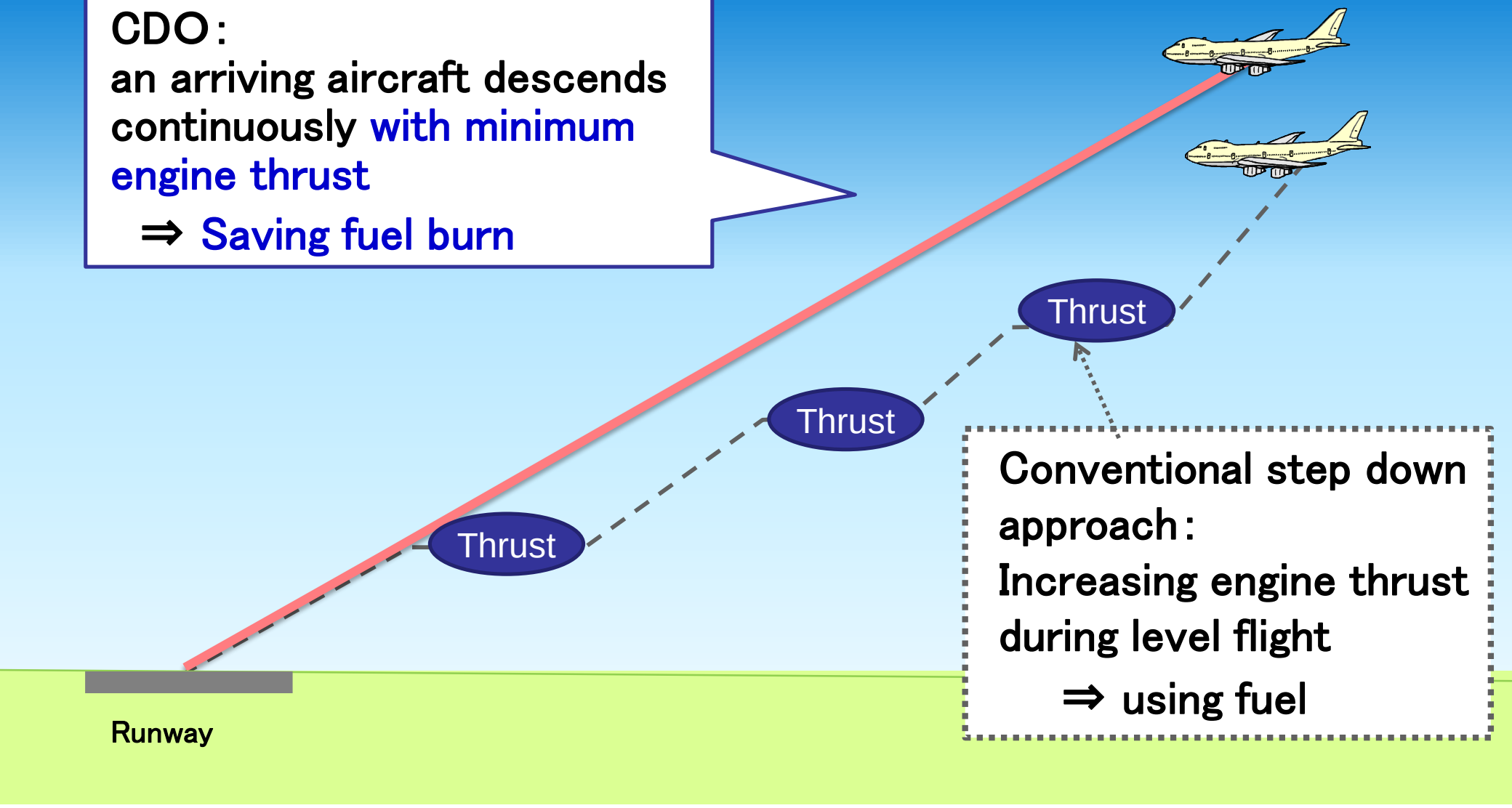
CDO:
an arriving aircraft descends continuously with minimum engine thrust
⇒ Saving fuel burn



Conventional step down approach:
Increasing engine thrust during level flight
⇒ using fuel

Introducing at Kansai Int'l air port and Naha airport

Air Traffic Flow Management (ATFM)

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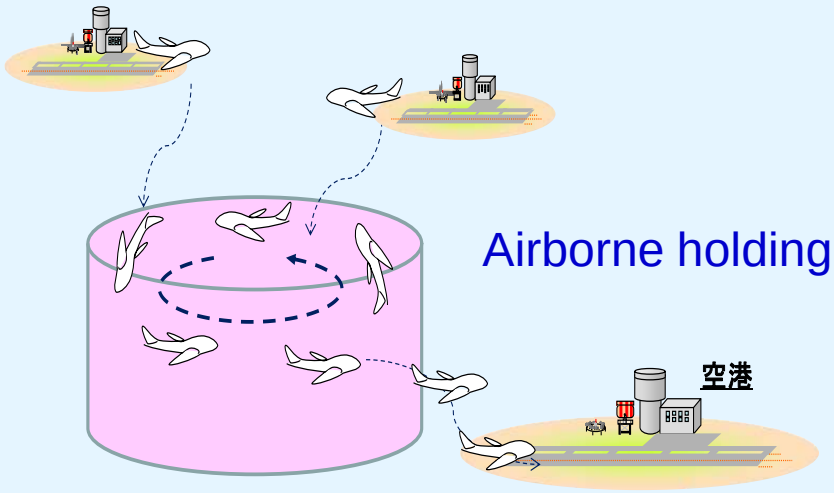
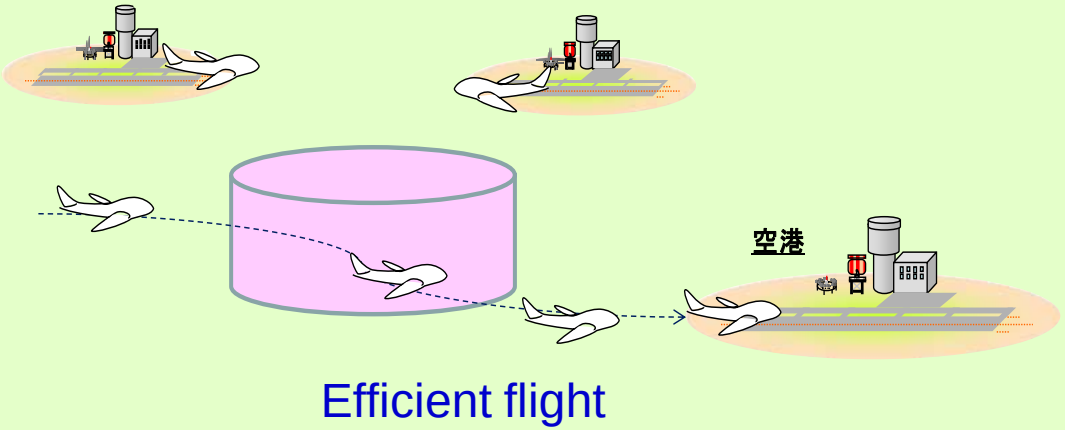
Rush hour / Bad weather conditions etc.



- Arrival demand exceeds an airport capacity

⇒
- Airborne holding
- Wasting fuel

Introducing ATFM



- Assigning ground delay and/or time for over fix

⇒
- Reduction in airborne holding
- Improved operational efficiency

Air Traffic Flow Management (ATFM)

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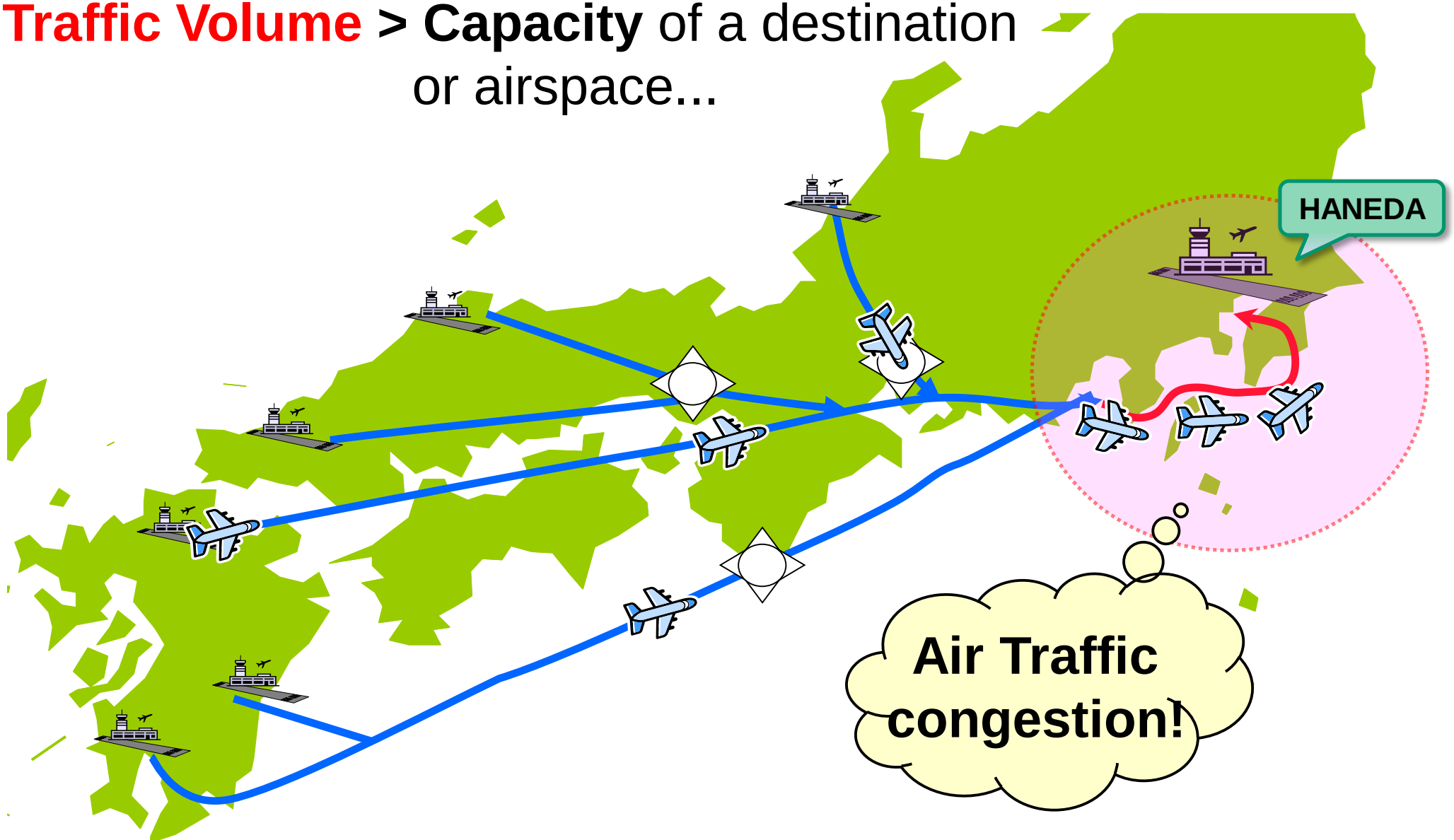
Without Air Traffic Flow Management

Traffic Volume > **Capacity** of a destination or airspace...



ATFM (Ground delay:EDCT)

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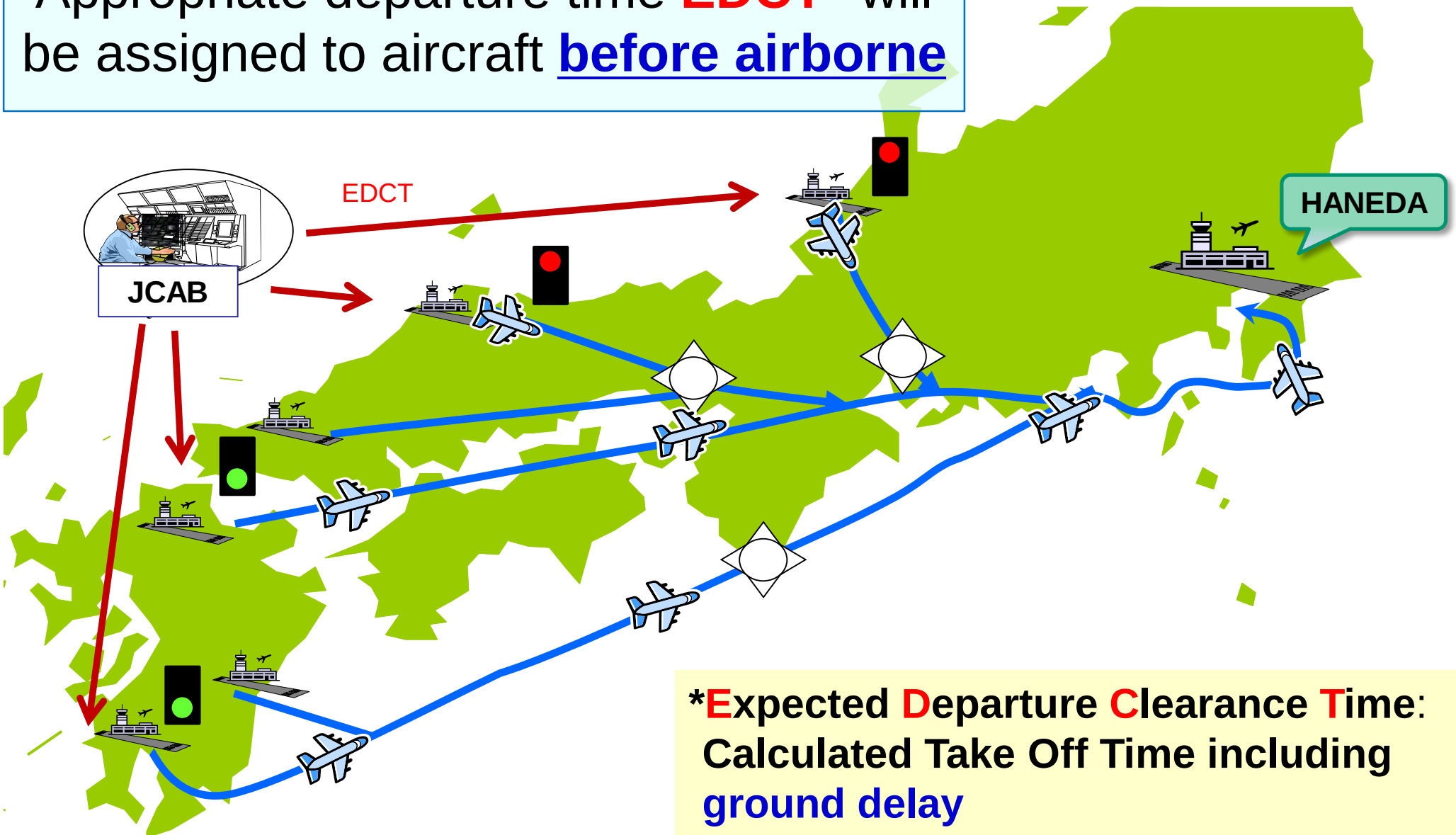
Domestic airport Only

Appropriate departure time **EDCT*** will be assigned to aircraft **before airborne**



***Expected Departure Clearance Time**: Calculated Take Off Time including **ground delay**

ATFM（Ground delay：EDCT）

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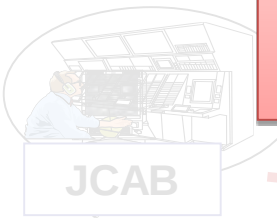
Domestic airport Only

However,

Unexpected airborne delay often causes congestion ...



HANEDA

Air Traffic Flow Management for in-flight aircraft(=SCAS) is necessary .

*Expected Departure Clearance Time: Calculated Take Off Time including ground delayed time

ATFM (SCAS)

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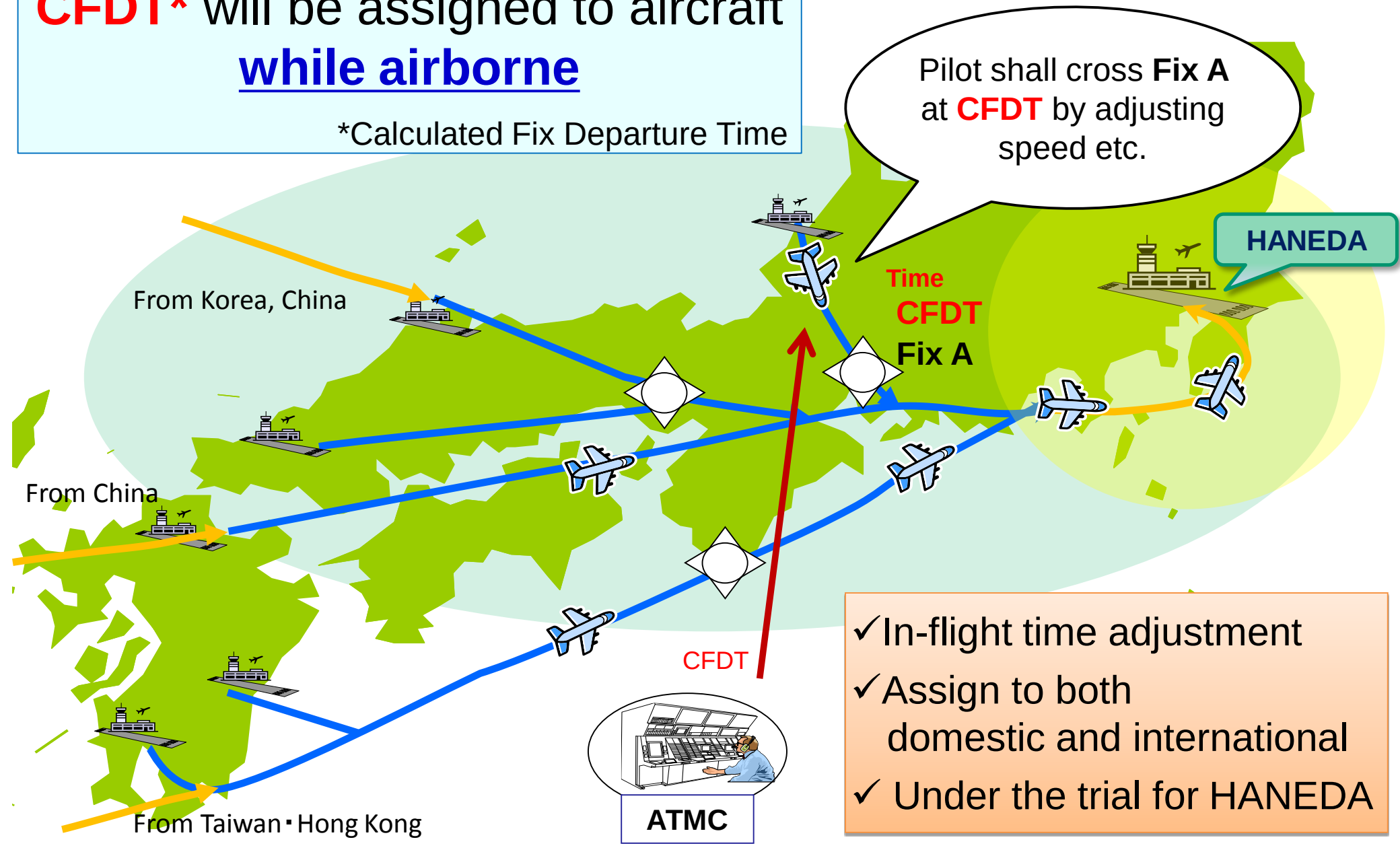
CFDT* will be assigned to aircraft **while airborne**

*Calculated Fix Departure Time



- ✓In-flight time adjustment
- ✓Assign to both domestic and international
- ✓ Under the trial for HANEDA

Efficient Use of JASDF Training Airspace

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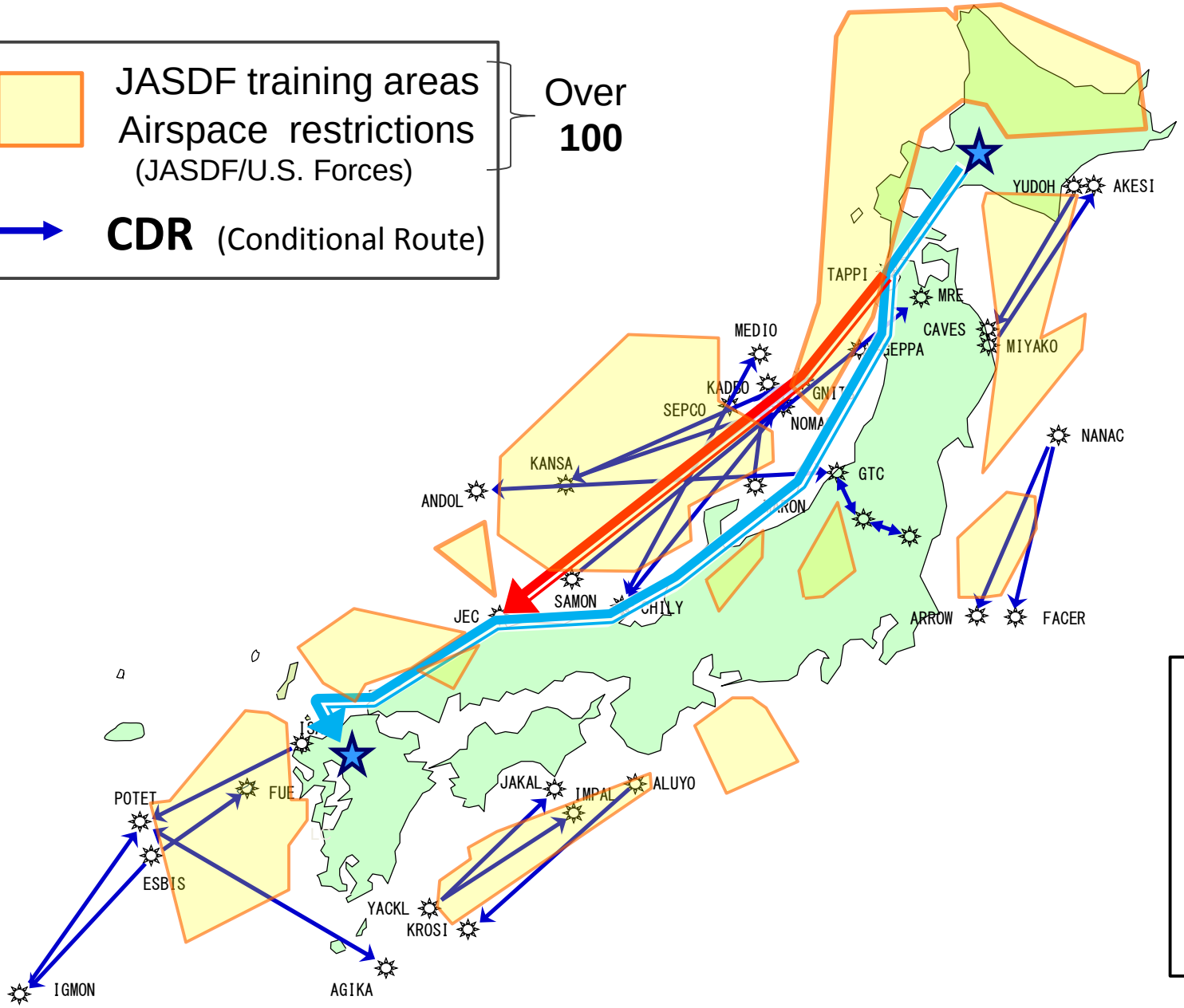
JASDF training areas
Airspace restrictions
(JASDF/U.S. Forces)

Over **100**

CDR (Conditional Route)



New-Chitose to Fukuoka

CDR ×

CDR ○

Optimized Oceanic routes

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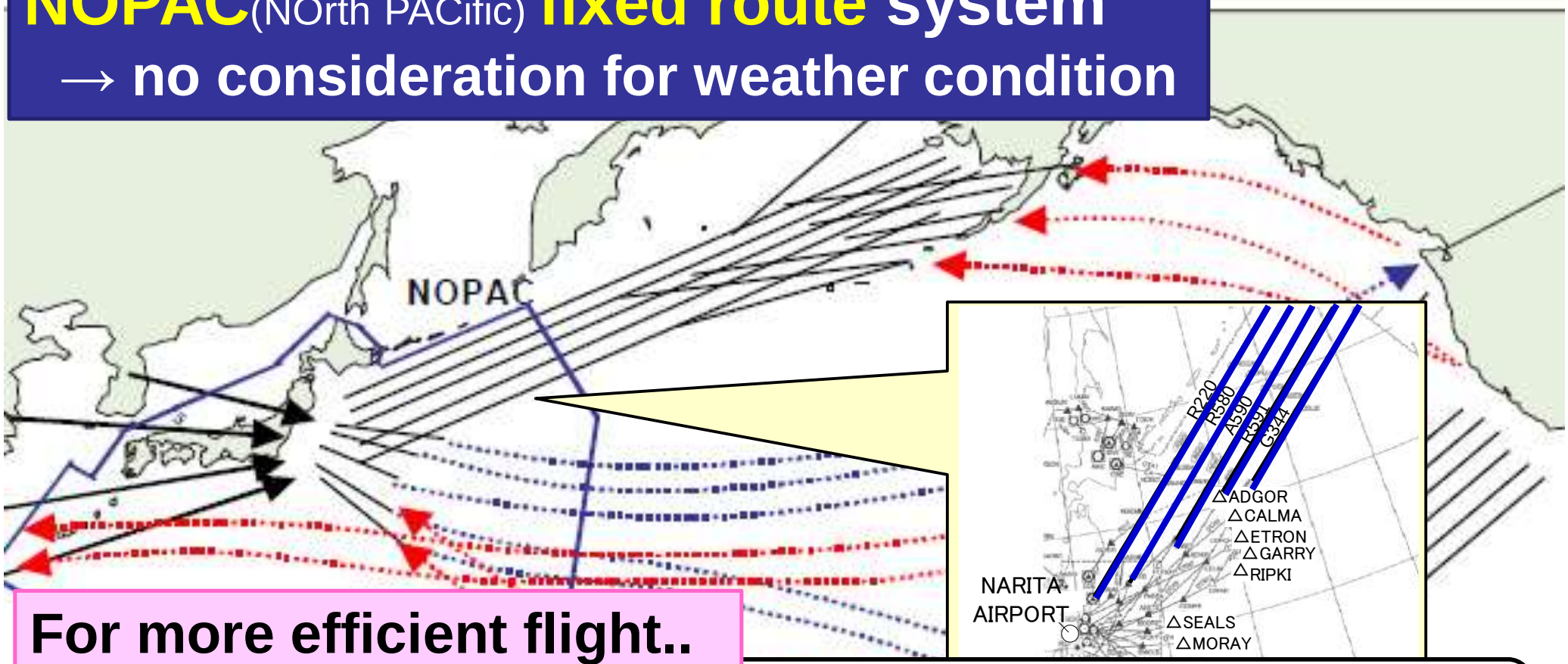
NOPAC(NOrth PACific) **fixed route system**
→ no consideration for weather condition



For more efficient flight..

Flexible oceanic routing procedures enables efficient oceanic flights in response to upper level wind and other conditions

Optimized Oceanic routes

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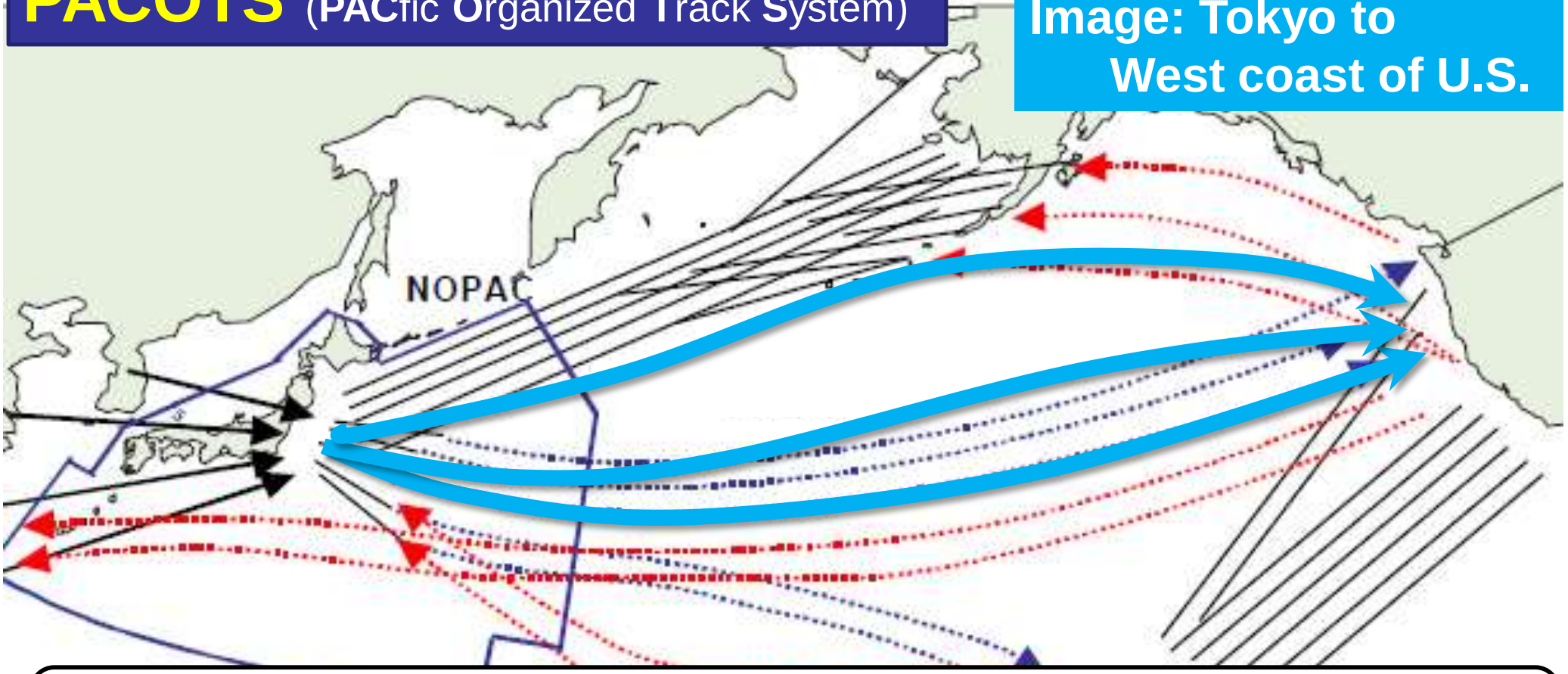
PACOTS (**PAC**fic **O**rganized **T**rack **S**ystem)

Image: Tokyo to West coast of U.S.



Routes established on a daily basis by Air Traffic Controllers considering upper wind forecast and adverse weather area

Optimized Oceanic routes

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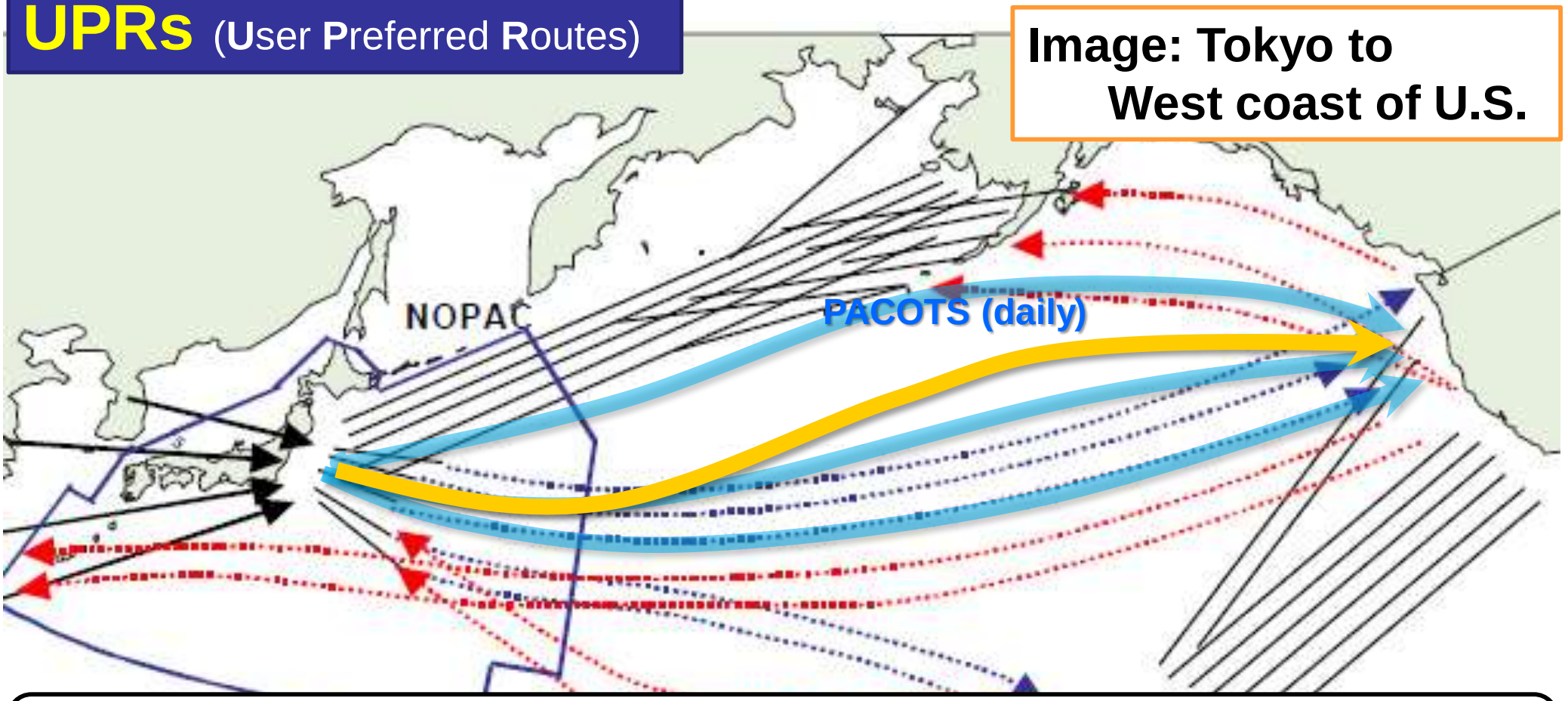
UPRs (User Preferred Routes)



Flexible routes developed for each individual flight by the Airlines considering weather and other operational conditions at the time of departure

Optimized Oceanic routes

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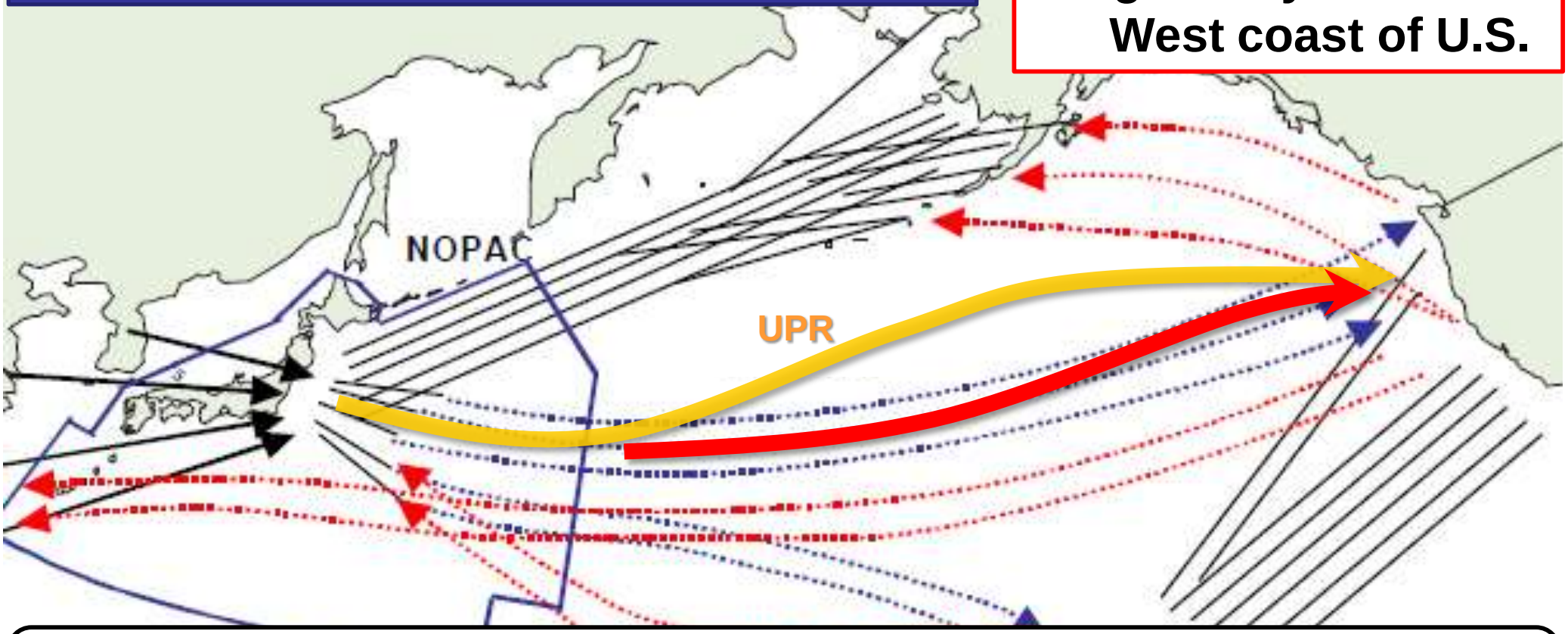
DARP (Dynamic Airborne Reroute Procedures)

Image: Tokyo to West coast of U.S.



Flexible in-flight rerouting for each individual flight calculated by the Airlines taking advantage of updated forecast of upper wind etc.

Development of Future Air Traffic Systems

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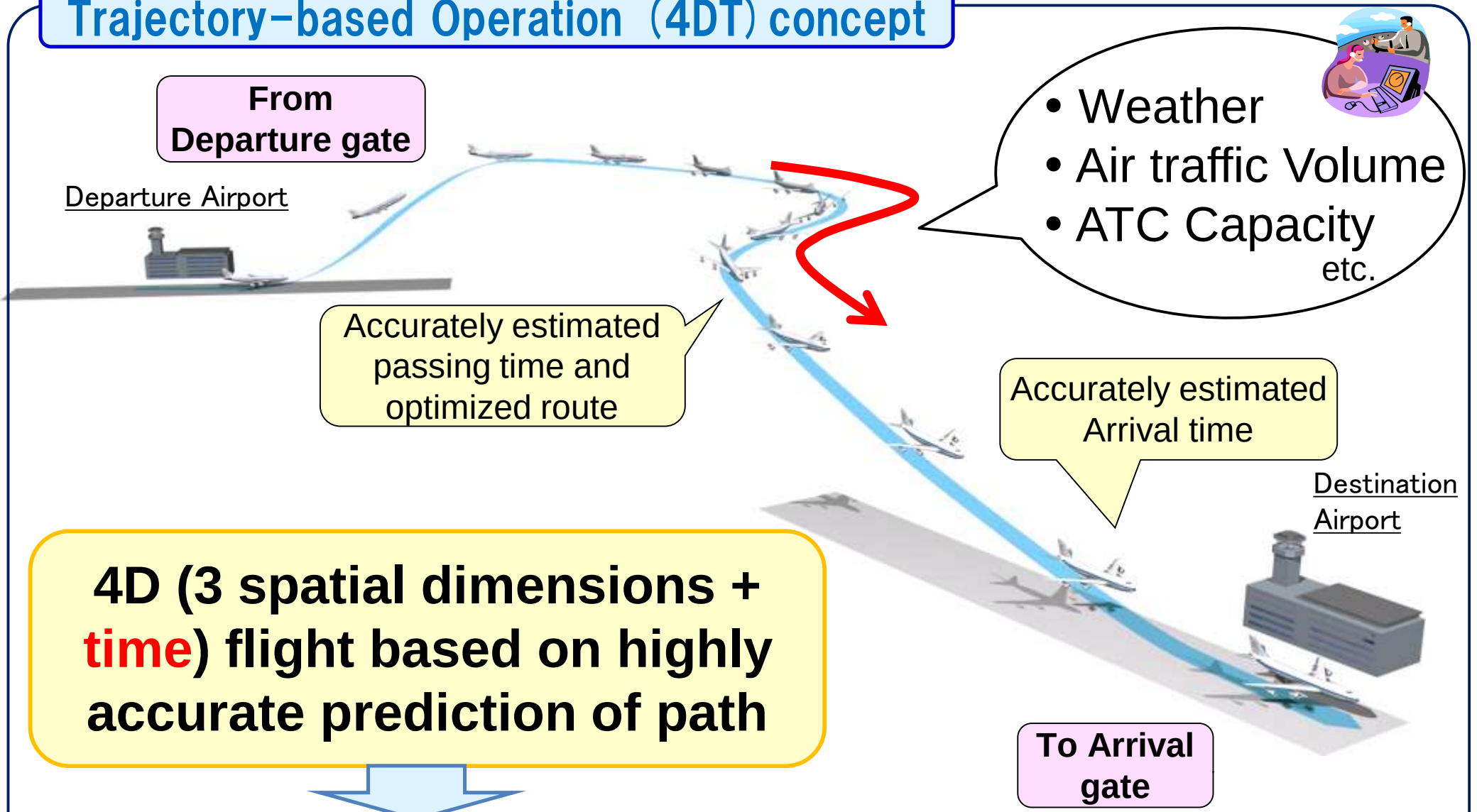
Trajectory-based Operation (4DT) concept



4D (3 spatial dimensions + time) flight based on highly accurate prediction of path

Optimization of overall air traffic

ご清聴ありがとうございました。

Thank you for your kind attention.