Ministry of Land, Infrastructure, Transport and Tourism
***JAPAN CIVIL AVIATION BUREAU***

# OVERVIEW OF SYSTEM BACKUP for Contingency Management

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# Contents of this presentation

- How accommodate contingency situations?

- Case study for assumption of a disaster such as a huge earthquake or Full system down in Japan.
    - System backup
    - Operational backup

- Conclusion.

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# Start with…

- Contingency management is a difficult issue for everyone.
- Because we do not know what kind of crisis will hit and when it will strike.
- Not knowing what kind of crisis will strike means that we do not know what the impact will be.
- However, the main theme of this workshop was to somehow manage and respond to the contingency situations…

# How accommodate contingency situation?

- Redundancy
- Assumptions and Learning from the Past
- Examples from other countries are gold
- Imagination
- Support by neighboring countries and regions

# Redundancy

- Redundancy can be an important measure against contingency management.
- However, redundancy requires investment, and when backups are used, the system must be consistent with previous operations.
- Taking the necessary redundancy for air navigation services is an important part of addressing a contingency situations.
- Especially, to ensure the safety of aircraft in-flight, a system that supports the ATCO's operational capacity is necessary, which means redundancy or back up system can continue operation.

# Assumptions and Learning from the Past

- We do not know what type of contingency will come in the future.

- To reduce the impact of crisis and ensure safe operations, it is necessary to anticipate and respond to many high-impact events in advance.

- Fortunately, we can learn from past contingency situations. The best practical solution is to prepare for crises by referring to past contingency situations.

# Examples from other countries are gold

- We should all be able to learn from our own country's past cases.

- However, nothing would be more valuable than to learn from cases from other countries, the facts of their experiences and responses, and the lessons learned from them.

- A place to share the many lessons learned about contingency management is a valuable treasure.

# Imagination

- We believe that the best way to create a baseline for contingency management is to build on what we have learned here and expand our imagination to include what could happen in our country or region in the future.

- This area could potentially be left to chat GPT or other generative AI in the future. However, we will still have the advantage.

# Support by neighboring countries and regions

- As mentioned above, we should prepare for a variety of scenarios, but it is difficult to invest a large amount of money in something as low-probability as contingency management.
- In such cases, it should be noted that collaboration, or cooperation with neighboring countries, makes it possible to do things that cannot be done by one's own country alone.
- Collaboration is not limited to neighboring countries; collaboration with industry, airport operators, and airlines will also be necessary.
- In fact, if a situation becomes beyond the control of a single country alone, it will have to ask for help.
- It is important to establish a system for mutual cooperation in advance.
- One such framework is a regional contingency plan or framework.

# Case study

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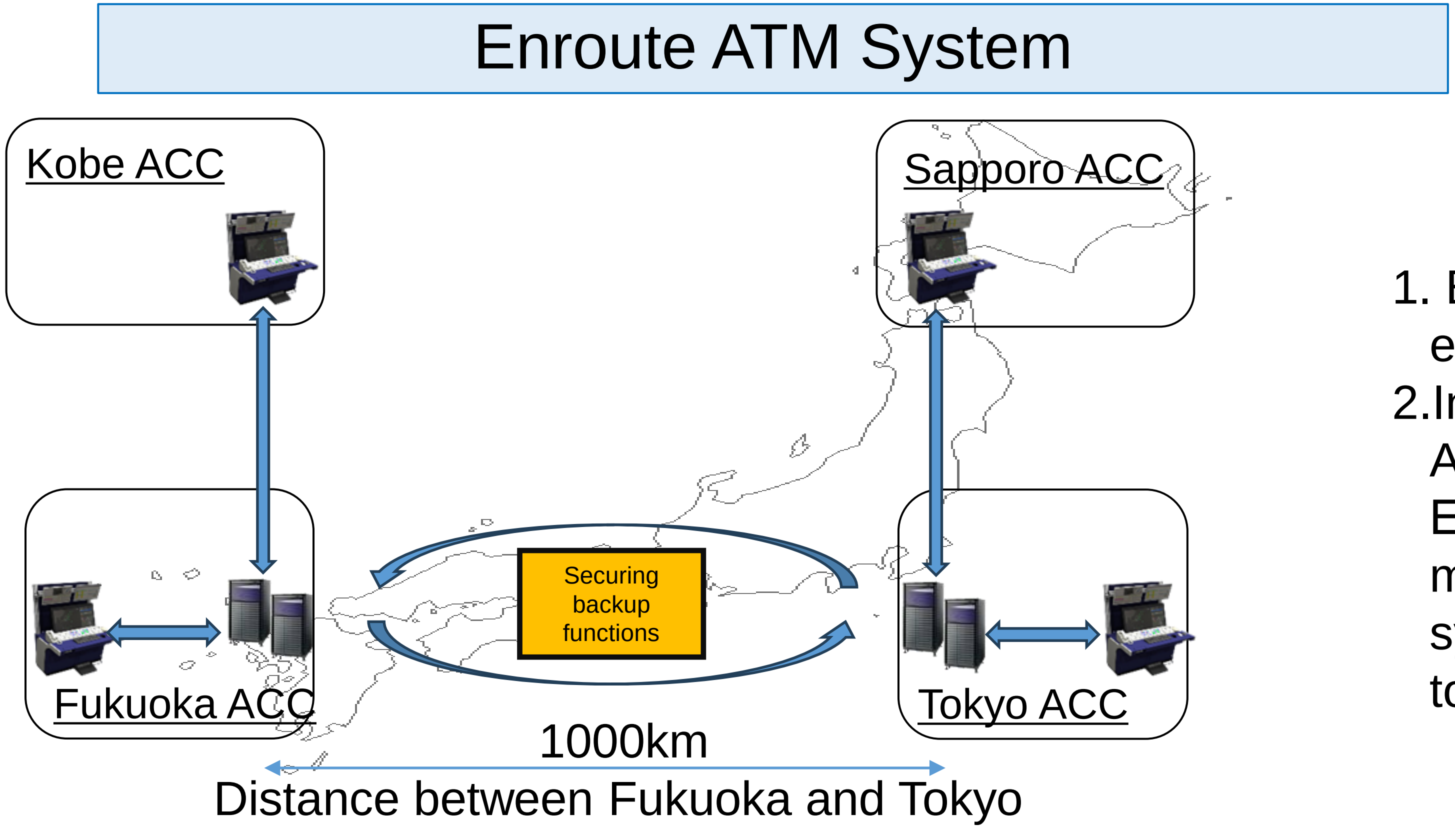
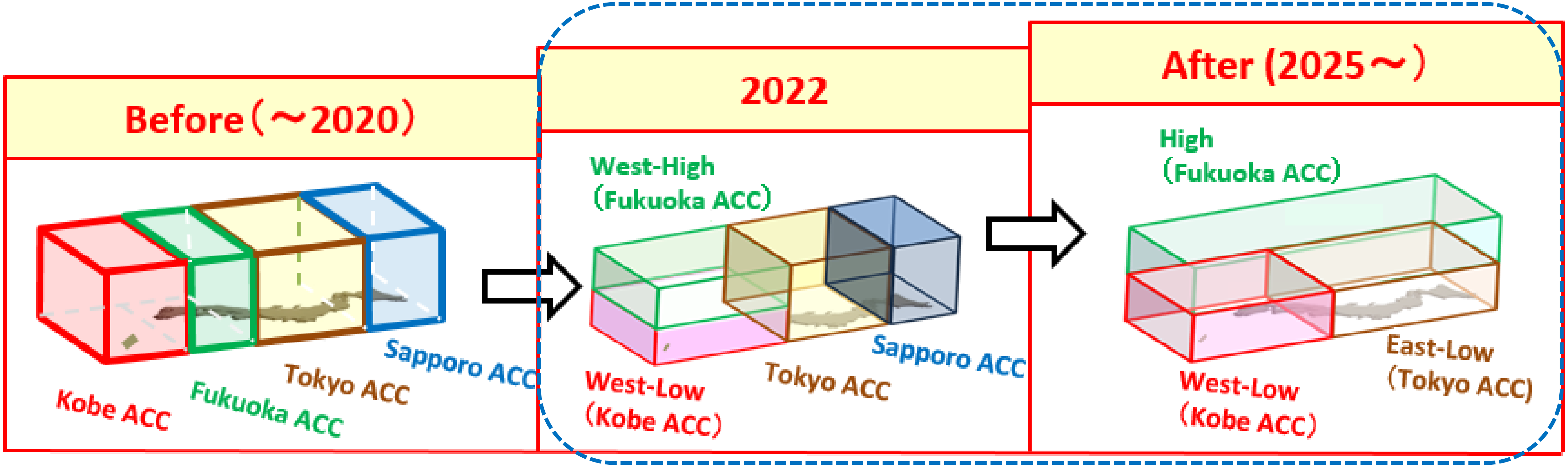
# System back up example




1. Each enroute ATM system equipped Fallback system.
2. In case of all HMI of ATCOs unable to connect Enroute ATM system's main server, Fallback system provide information to HMI.

1. Sufficient scalability and flexibility to respond to advances in aviation technology by utilizing the latest technology.
2. Ensuring the safety of data by ensuring the backup function between the two bases and by completely separating the program and the database.
3. Flight Data Processing system is installed at two sites, one in Fukuoka and the other in Tokyo, and is always synchronized, so that if one site fails, only one has the capacity to handle the entire Japan.
4. Enroute ATM system's main servers are also located in Fukuoka and Tokyo and are constantly synchronized, so that if one fails, only one has the capacity to handle the entire Japan.

# Preparation for Operational Back up (Reconfiguration in progress)



# Establishment of “upper and lower mutual backup system”

Expand the backup system and strengthen the initial response system in the event that the control department malfunctions due to an earthquake directly hitting the Tokyo metropolitan area, etc.

■ Mutual backup of upper and lower control units

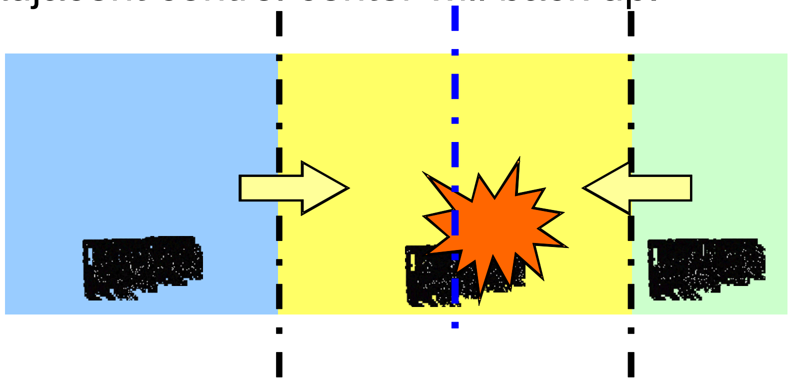
⇨ <u>Capable of backing up the entire domestic airspace</u>

■ Adjacent ACC controllers who understand airspace characteristics will ensure reliable operations immediately after the disaster.

⇨ Secure a certain amount of traffic immediately after the disaster

【BEFORE】

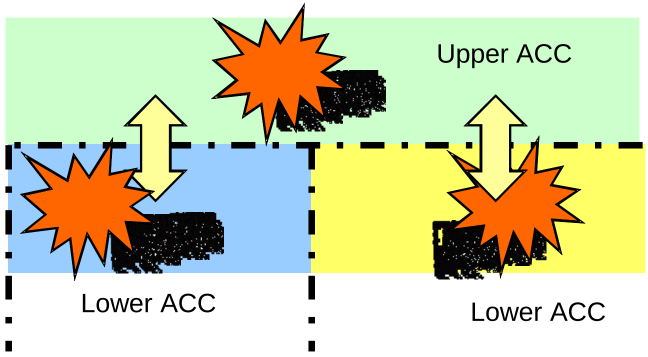
Only when the Tokyo control center is damaged, the adjacent control center will back up.



Backup by expanding the airspace horizontally.

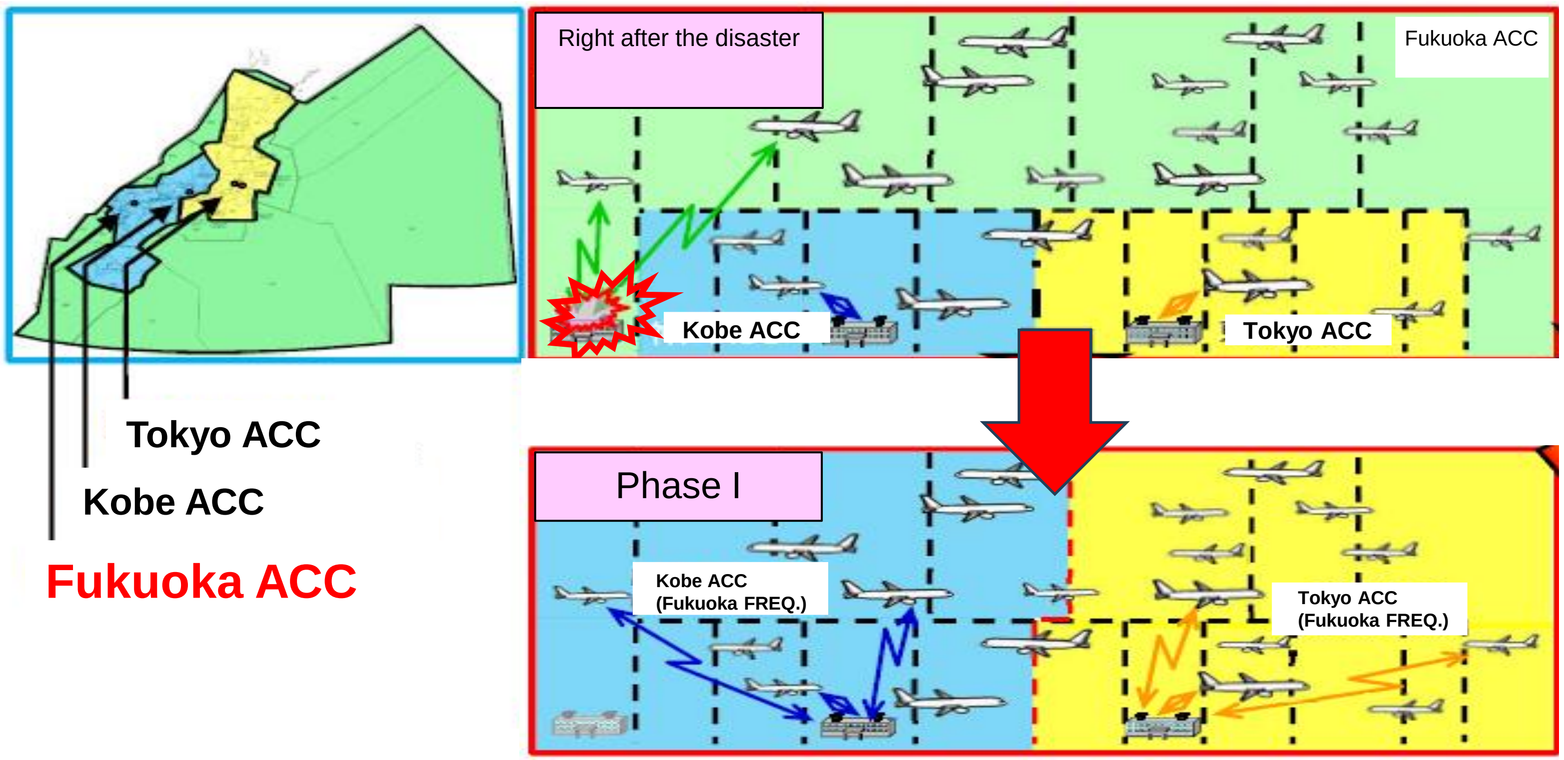
【AFTER】

Mutual backup is possible even if one of the control units is damaged.




Backup by expanding the airspace vertically.

# Enroute ATM system for High altitude: Fukuoka ACC disaster

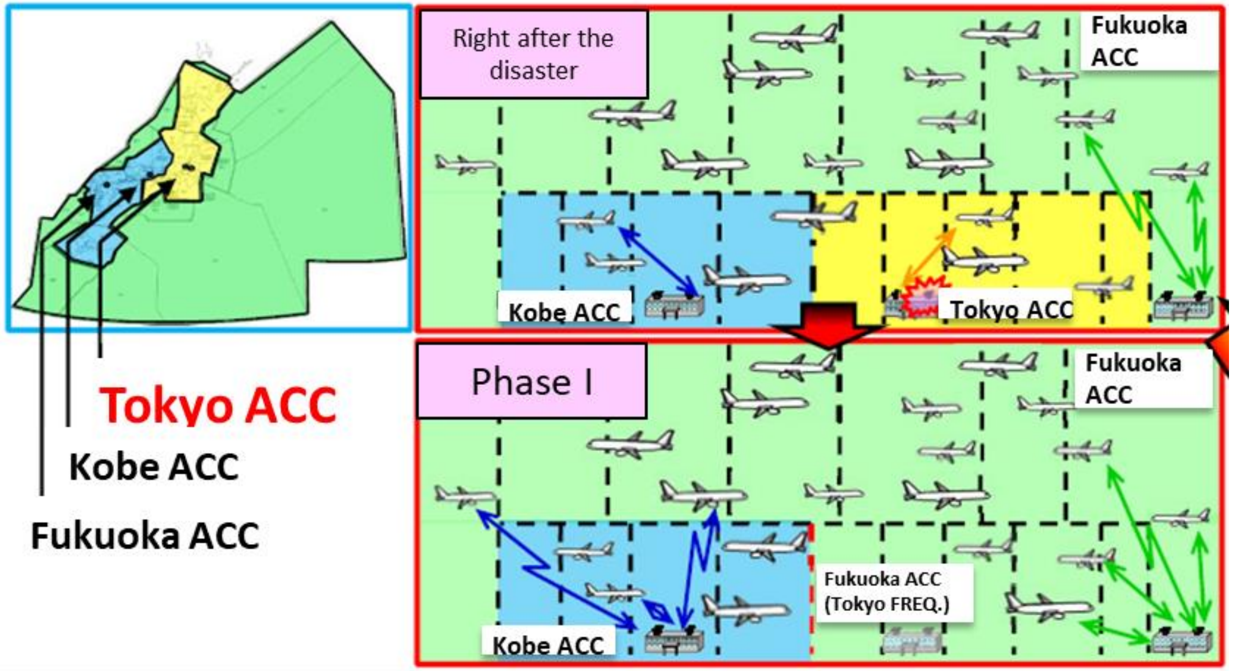


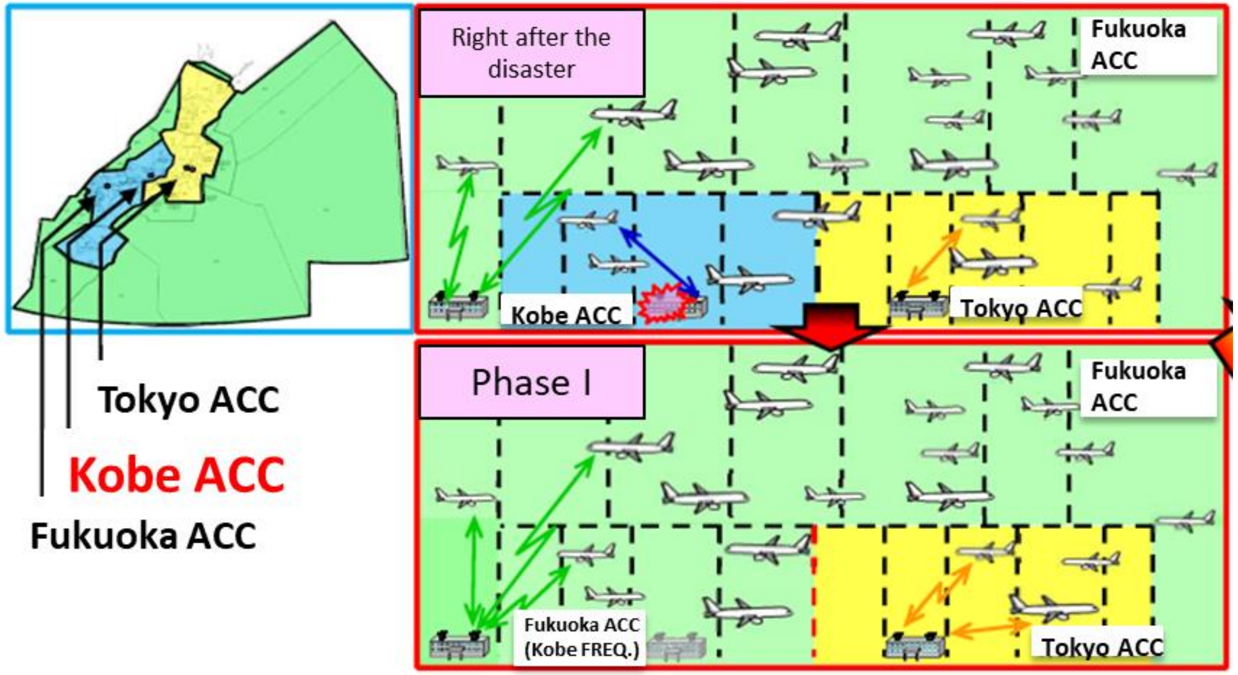

Phase I (Ensuring the safety of in-flight aircraft)

★Period
Start as soon as possible after confirming that the Fukuoka ACC is inoperable.
★Control service carried out
ATC controllers of Lower ACC urgently (Tokyo and Kobe) use the frequencies of each sector of Fukuoka ACC to instruct to change frequencies.

*Internally categorized into three phases.

# Enroute ATM system for Low altitude: Tokyo or Kobe ACC disaster



# 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

# Discussion

There are still many difficulty for contingency management.

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# Key words

**Preparation** and **Collaboration**

**Better than nothing**

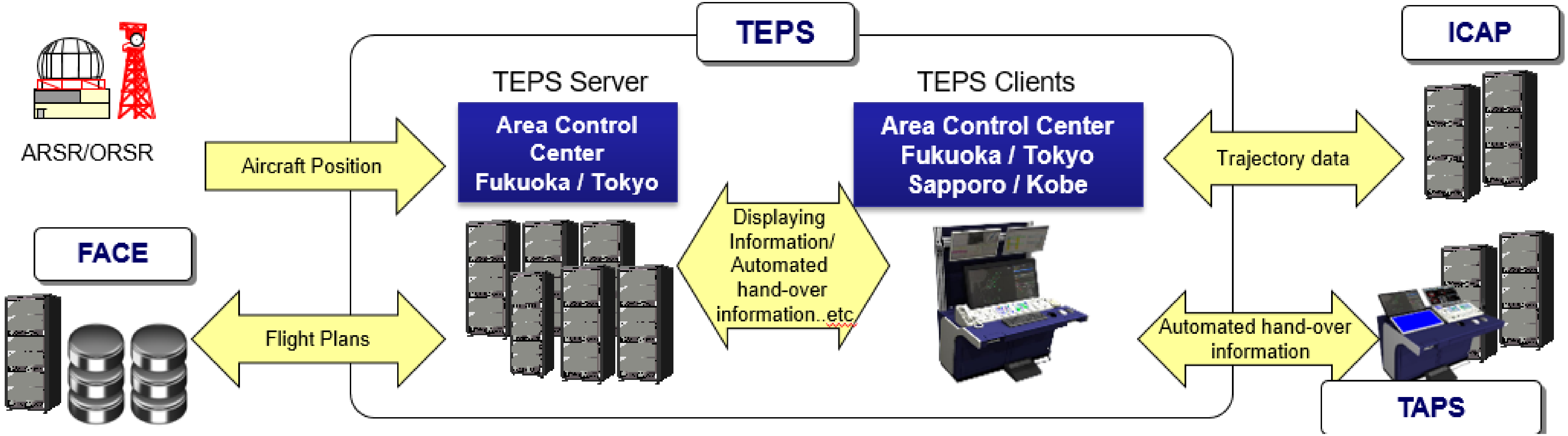
Any Question?

Thank you

# REFERENCE

# Overview of Trajectorized En-route Traffic Data Processing System（TEPS）

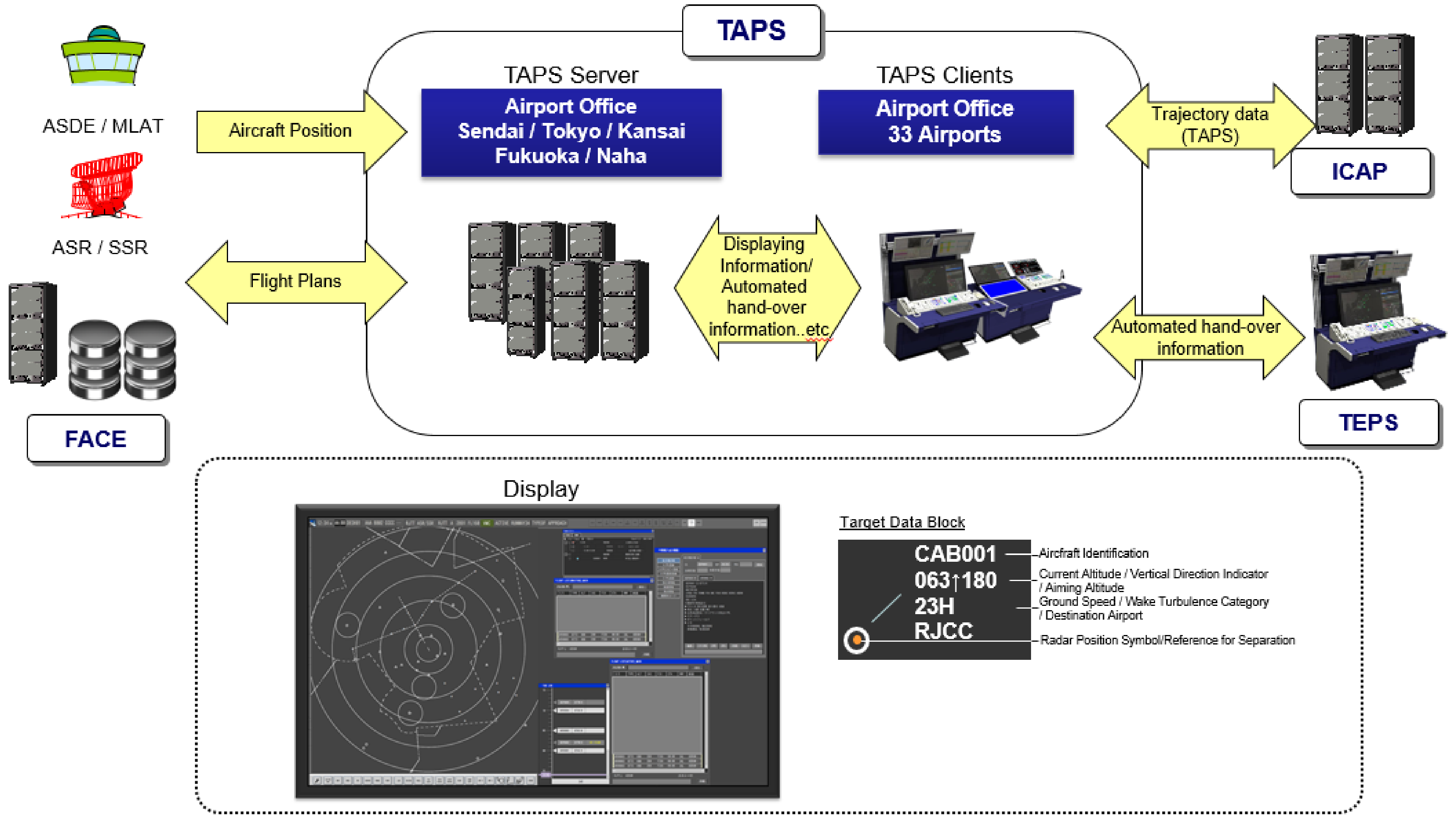
**TEPS** (**T**rajectorized **E**n-route Traffic Data **P**rocessing **S**ystem **)**
TEPS processes information on aircraft operating in national airspace (flight number, altitude, type of aircraft, predicted location, etc.) by comparing aircraft position information from radars and flight plan information from FACE.




＊Descriptions of other systems can be found in the latter slides as reference.

# Overview of Trajectorized Airport Traffic Data Processing System(TAPS)

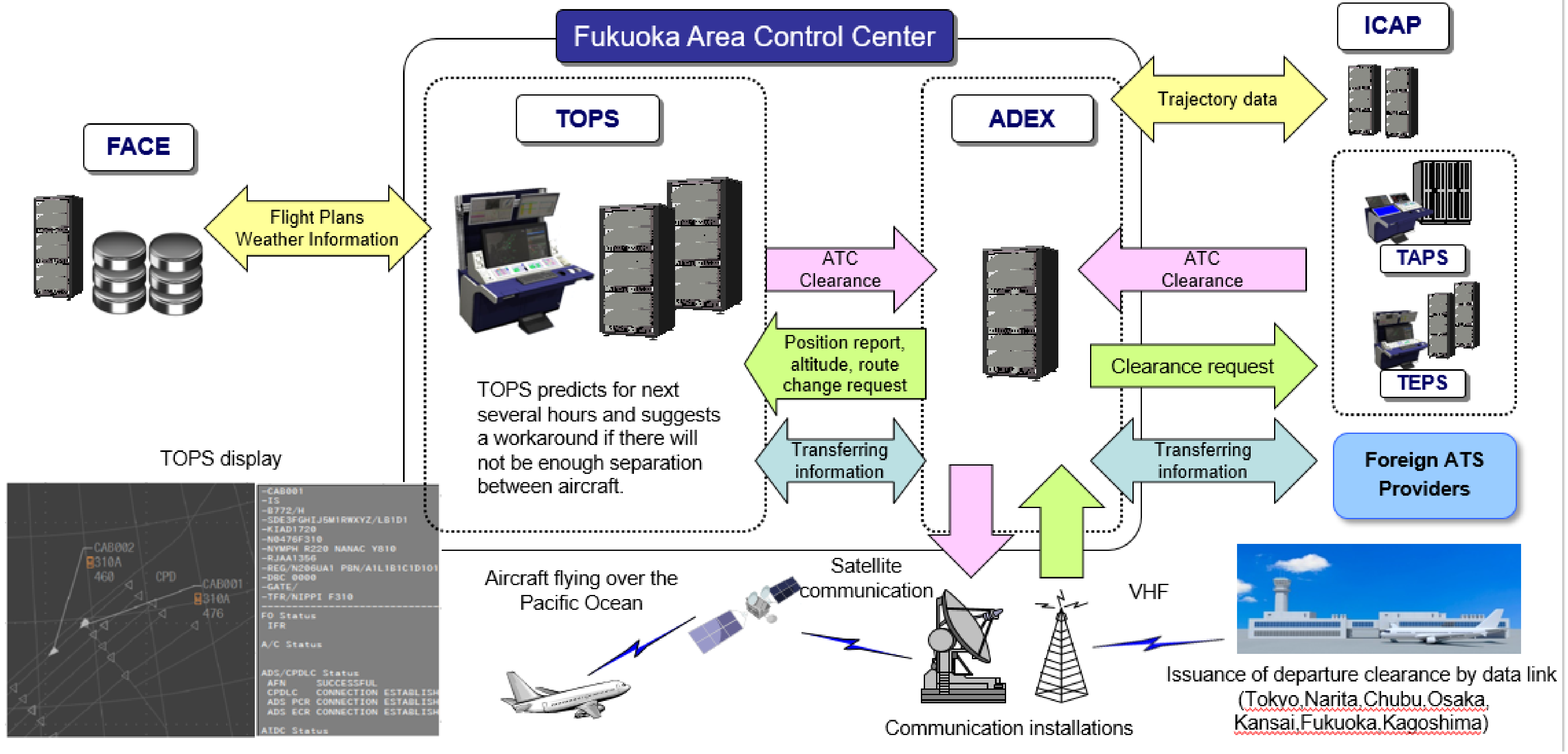
**TAPS (Trajectorized Airport Traffic Data Processing System)**
TAPS processes information on aircraft operating at airport (flight number, altitude, type of aircraft, predicted location, etc.) by comparing aircraft position information from radars and flight plan information from FACE.



# Overview of Trajectorized Oceanic traffic data Processing System(TOPS)
# Overview of ATC Data E X change system(ADEX)

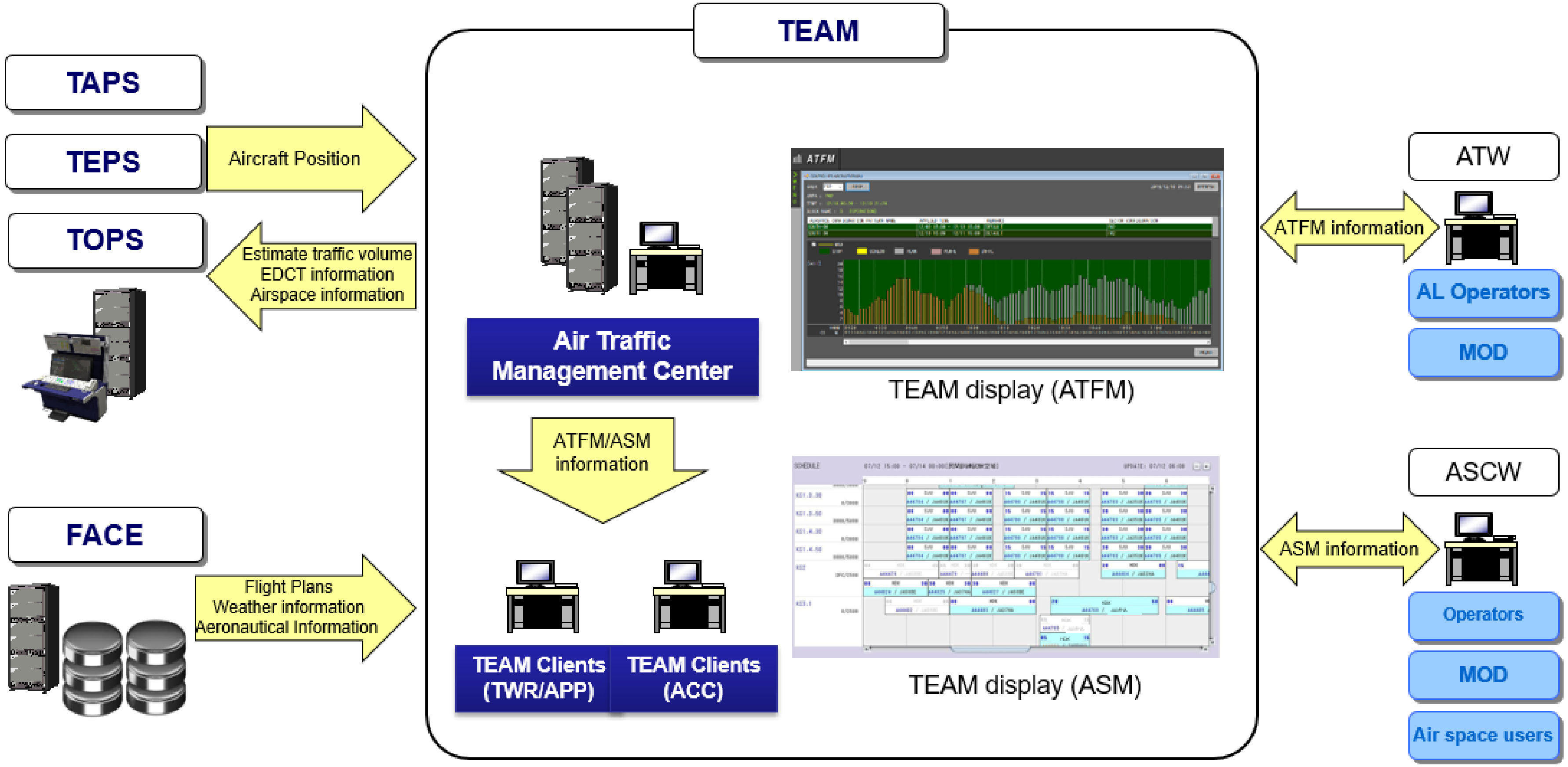
**TOPS (T**rajectorized **O**ceanic Traffic Data **P**rocessing **S**ystem)
TOPS processes information of aircraft over the Pacific Ocean (flight number, altitude, type of aircraft, estimated aircraft position etc.) by collating reported data from ADS and flight plan received from FACE in order to support Oceanic control service.

**ADEX (A**TC **D**ata **EX**change System)
ADEX processes data communication for departure clearances between aircraft and ATC, and for aircraft information (such as transferring point, altitude, crossing time etc.) between domestic and foreign ATS providers.



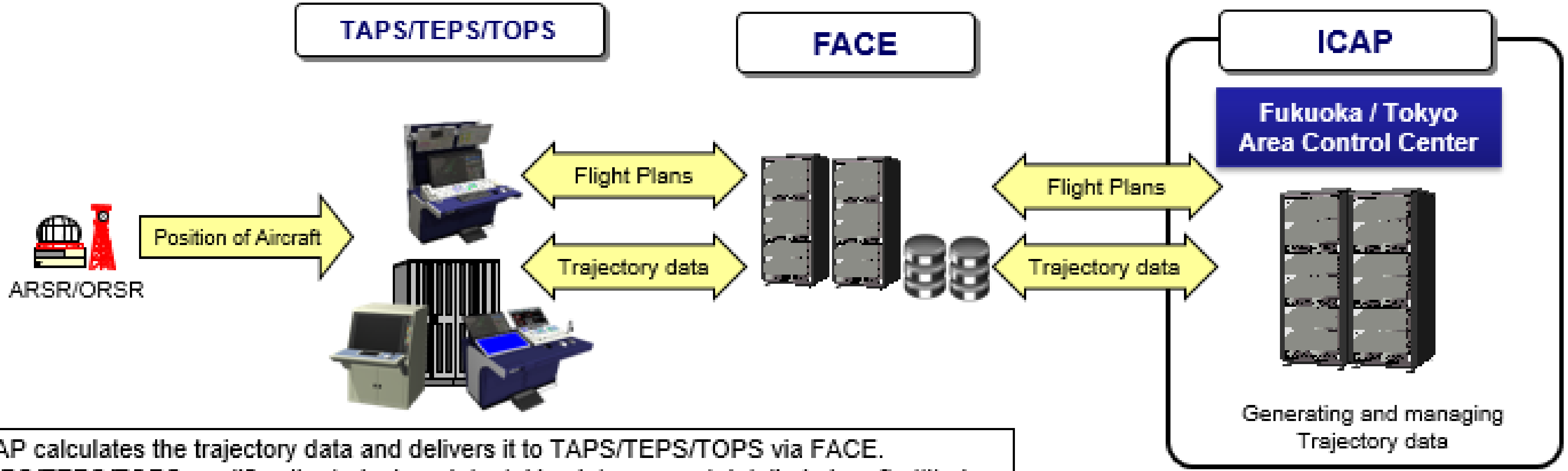
# Overview of Trajectorized Enhanced Aviation Management System (TEAM)

**TEAM（Trajectorized Enhanced Aviation Management System)**
TEAM supports air traffic management, airspace management and air traffic information management. In order to prevent excessive congestion on/at specific air routes or airports, TEAM estimates traffic volume and takes ATFM measures by utilizing position information from TAPS and others, flight schedules from FACE and plans for the use of training area applied from airspace users.



# Overview of Integrated Control Advice Processing System（ICAP）

**ICAP（Integrated Control Advice Processing System）**
ICAP generates aircraft trajectory data based on flight plan information, meteorological information, and radar data (positional information) to support strategic decision-making by air traffic controllers.

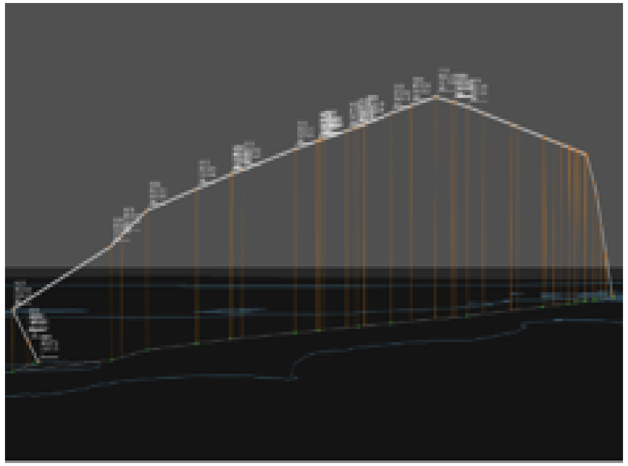



・ICAP calculates the trajectory data and delivers it to TAPS/TEPS/TOPS via FACE.
・TAPS/TEPS/TOPS modifies the trajectory data, taking into account detailed aircraft attitude, status and weather information, and transmits the trajectory data to ICAP via FACE.
.・ICAP compiles the revised trajectory data, updates it to be more accurate, and shares it.

**Trajectory**

Trajectory data is four-dimensional data consisting of point information (latitude and longitude, altitude, etc.) and time, which defines the trajectory of the aircraft.

ICAP provides information for strategic decision-making, because air traffic controllers need to be able to predict the future.



Trajectory data [visualization image]

# Standby Power Supply Equipment

Due to the natural disasters such as typhoons, earthquakes, lightning strikes, and snowfall, commercial power supplied from electric power companies or the like has various risks such as power outage and instantaneous voltage fluctuations.
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

Diesel engine generator that supplies power to air navigation facilities, etc. in the event of a power failure.

## Uninterruptible power supply equipment

Facility that supplies stable power to air traffic control system that are not tolerable for momentary power failures and voltage fluctuations.

## Transportable power generation equipment