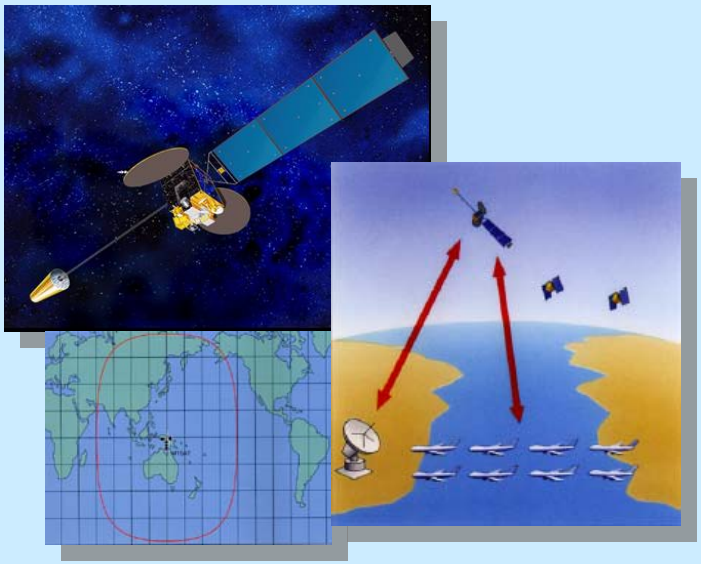
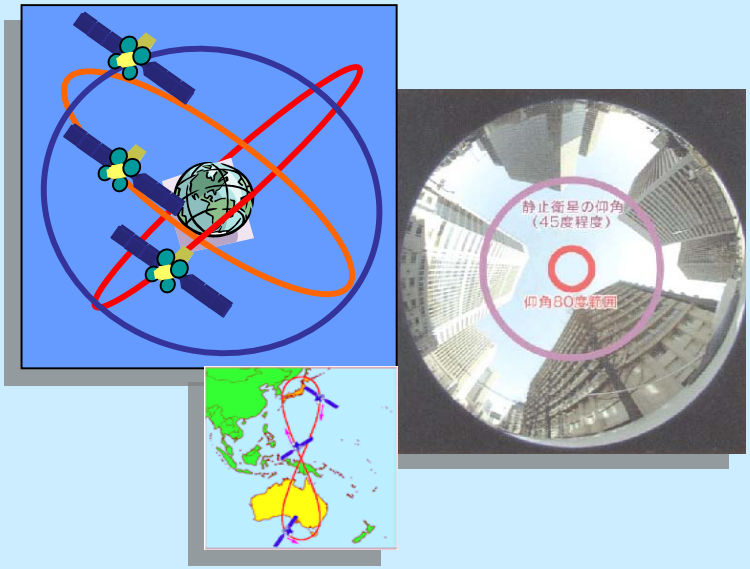
Status of Japanese GNSS augmentations



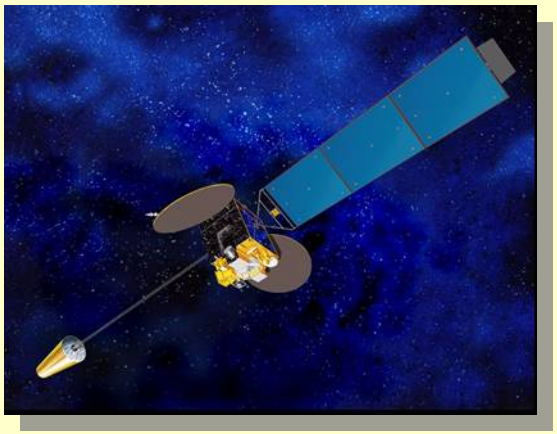


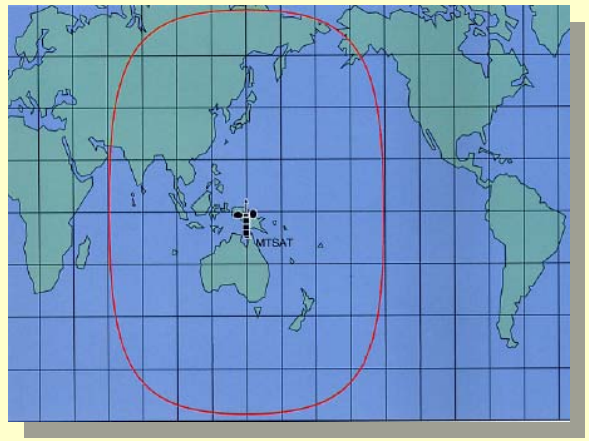
Kota TANABE
Permanent Mission of Japan
to the International Organizations in Vienna

Contents

MSAS

<MTSAT Satellite-based Augmentation System>





MSAS Overview

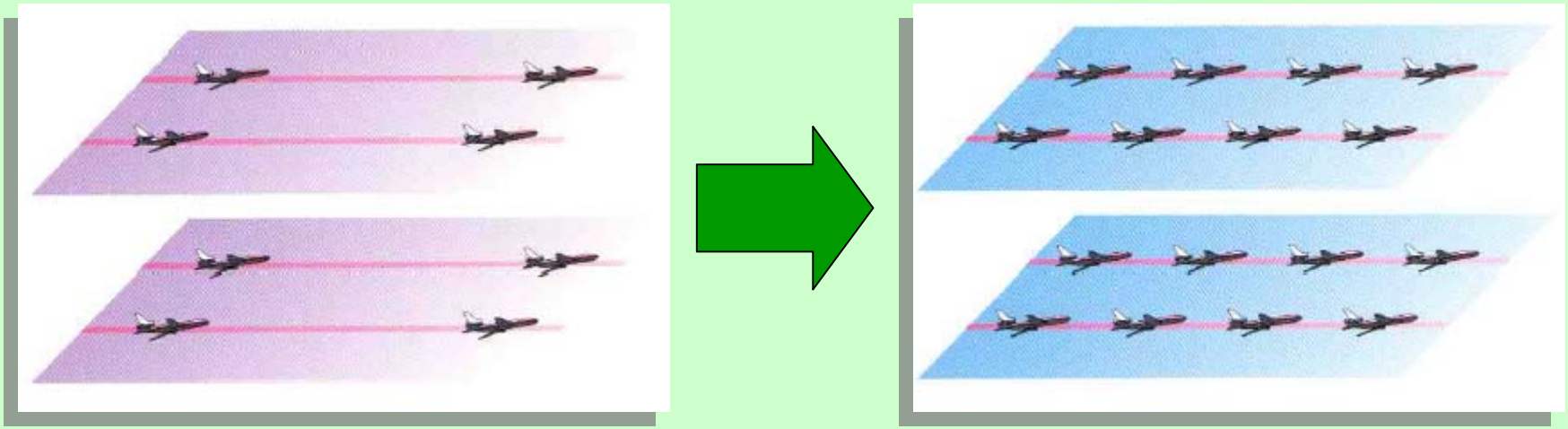
- MSAS (MTSAT Satellite-based Augmentation System) is Japanese SBAS compliant with ICAO SARPs
- Augmentation data is broadcasted by MTSAT (Multi-functional Transport Satellite)
- Dual GEO (two MTSATs) coverage will ensure high Reliability and Availability
- MSAS has a capability to provide augmentation service to other nations within MTSAT coverage if required Ground Monitor Stations are installed

Effects of MTSAT/MSAS

- Reduction of Separation Minima

Current System

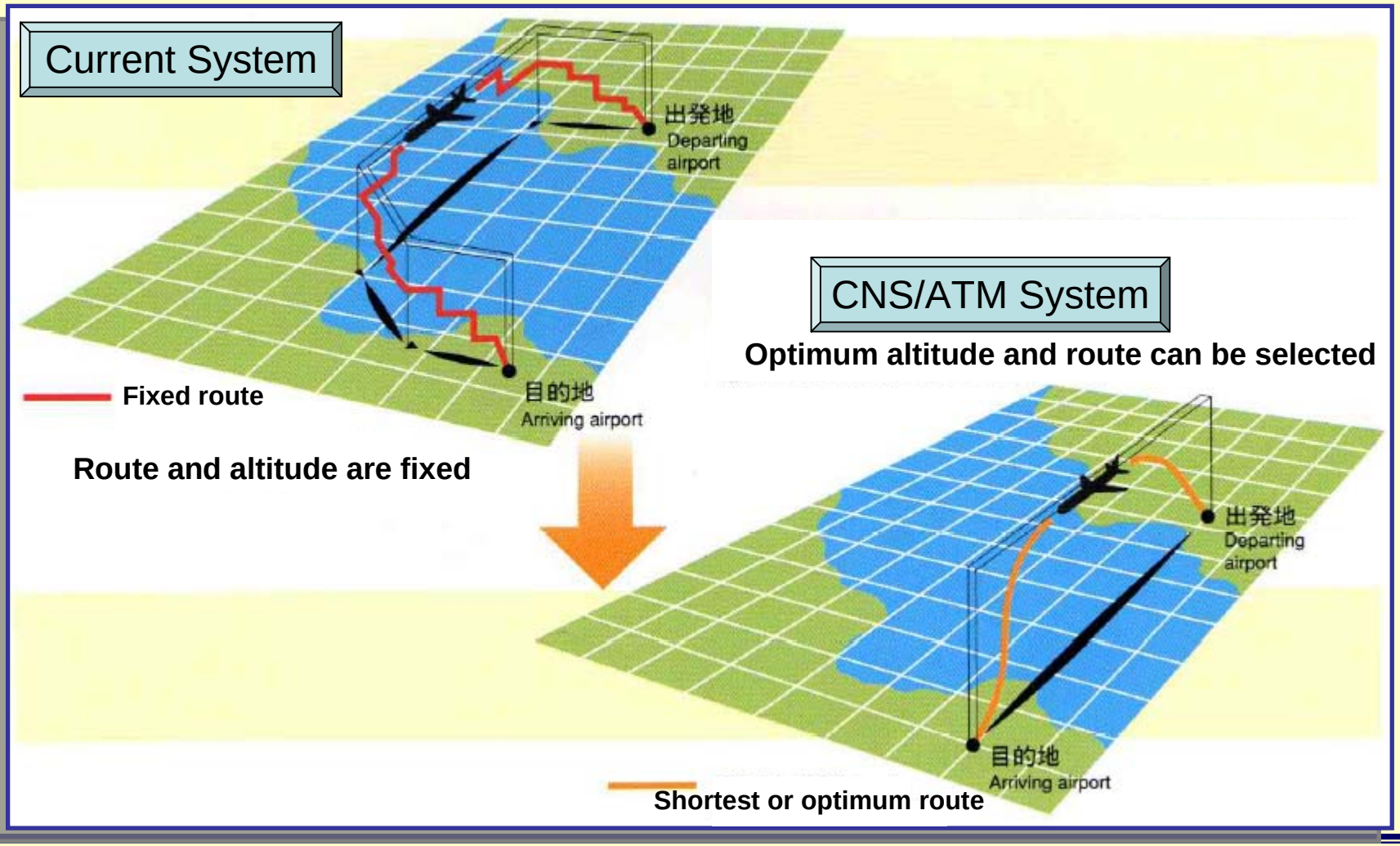
CNS/ATM System



*CNS/ATM: Communications, Navigations, Surveillance and Air Traffic Management

Effects of MTSAT/MSAS

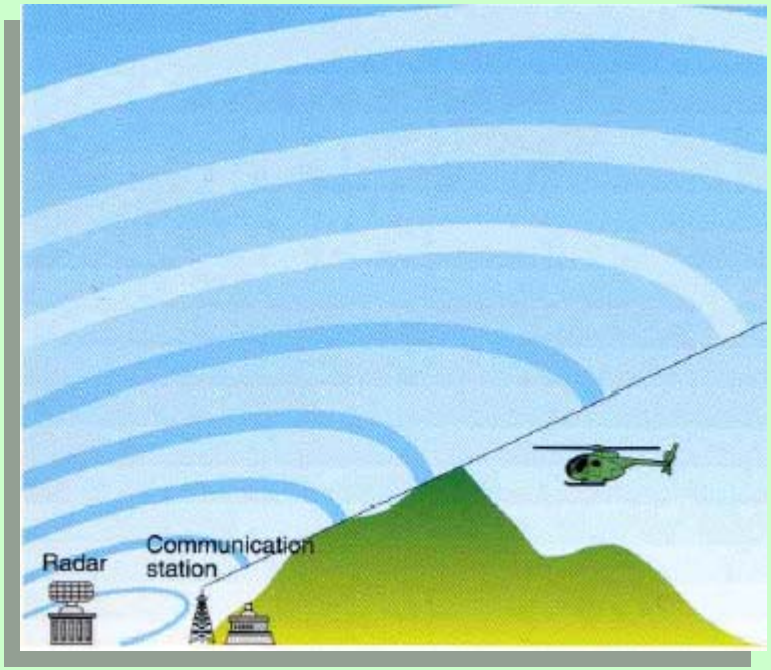
◆Flexible Flight Profile Planning



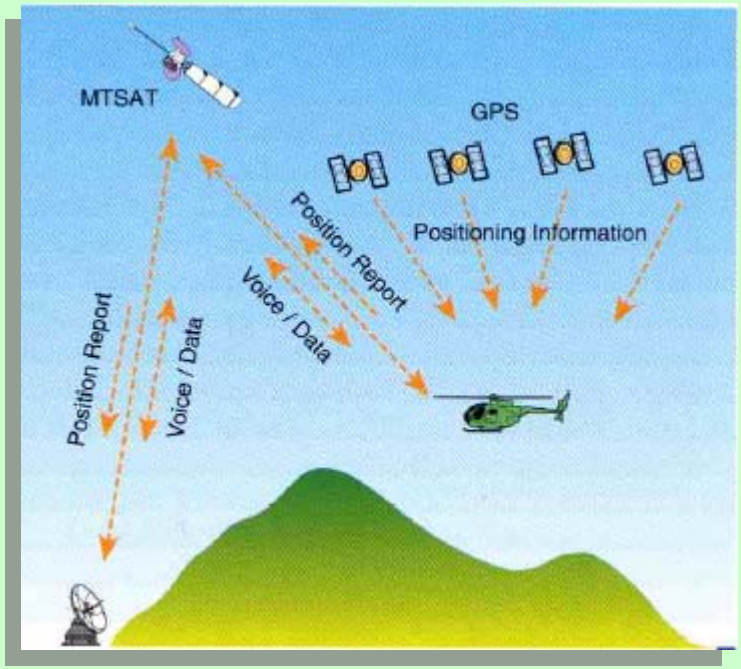
Effects of MTSAT/MSAS

- High Quality Communications
- Safety Enhancement --especially at low altitude--

Current System

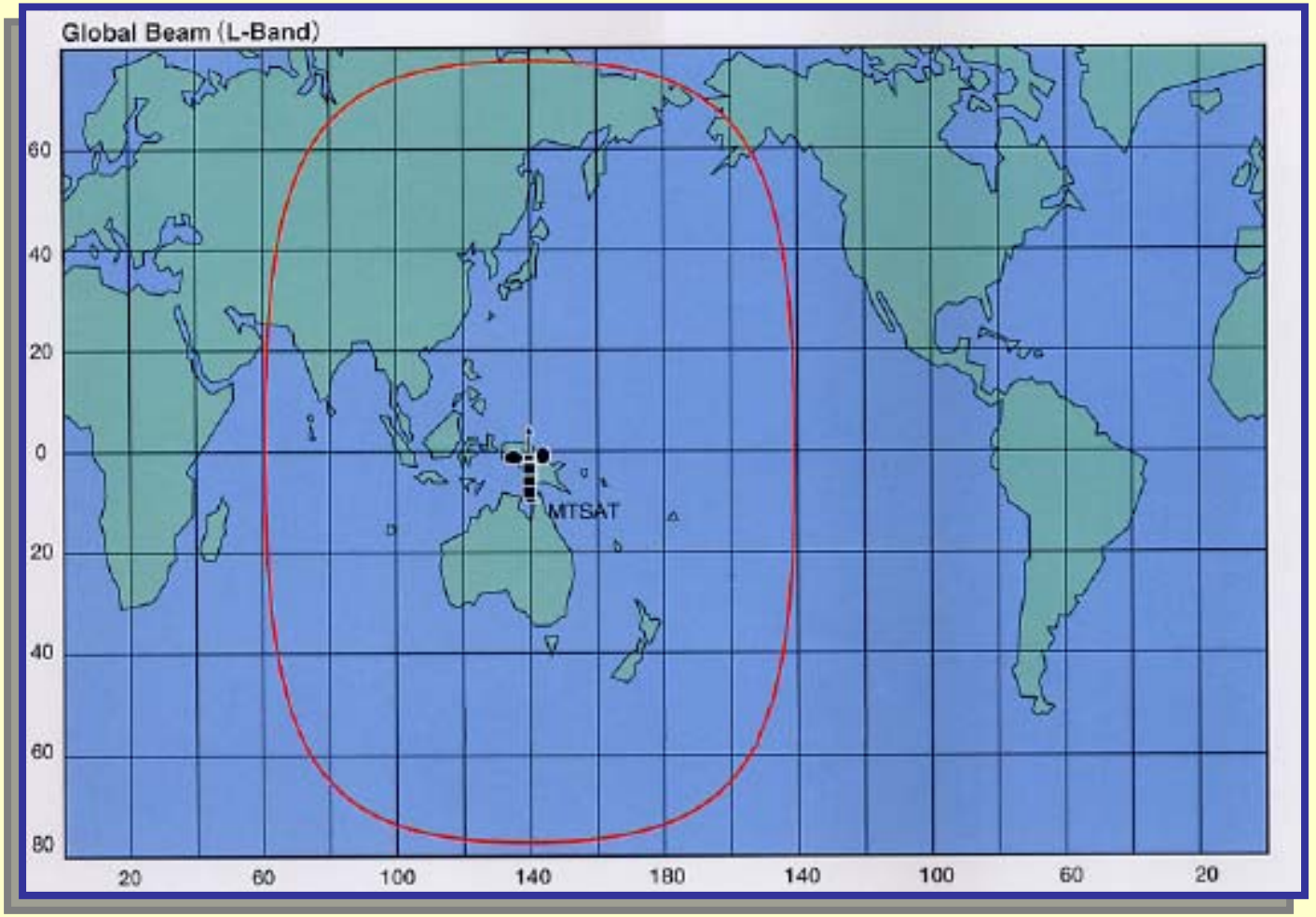


CNS/ATM System

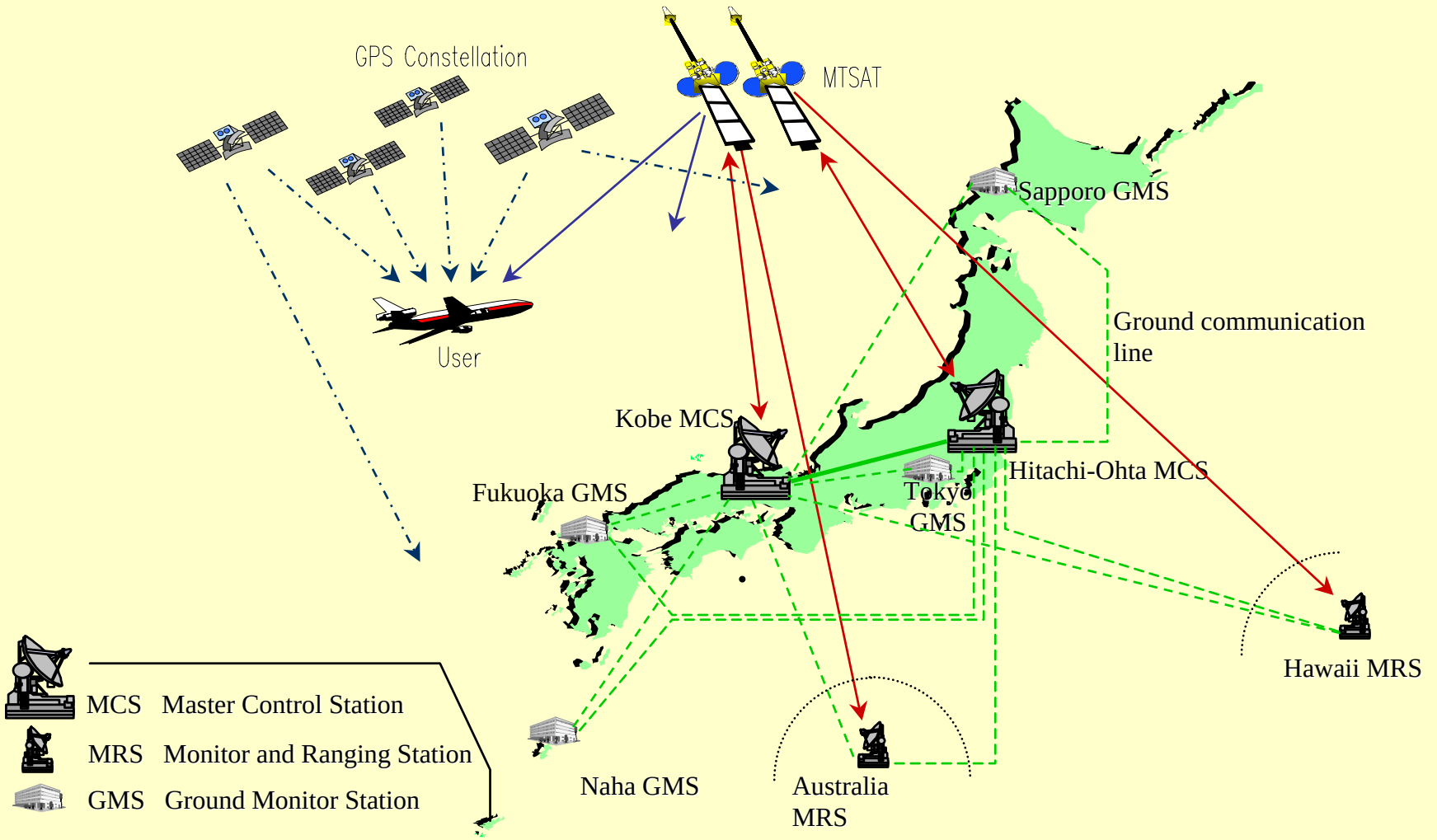


MTSAT Coverage

- Global beam covers most of Asia/Pacific airspace



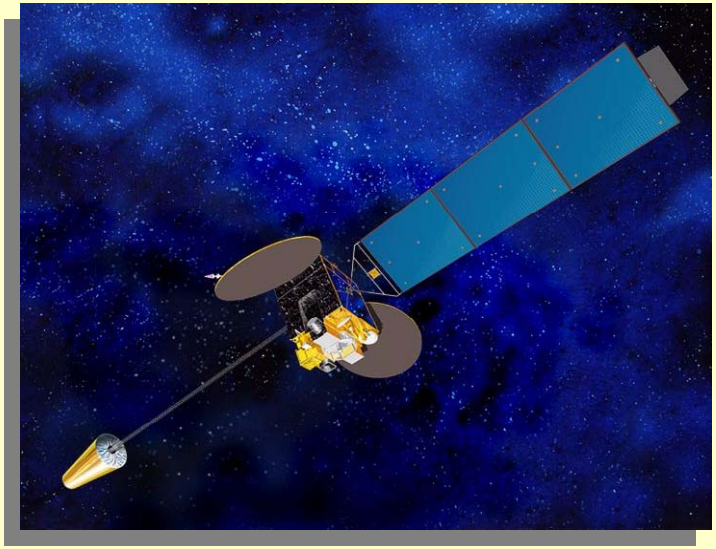
MSAS System Configuration

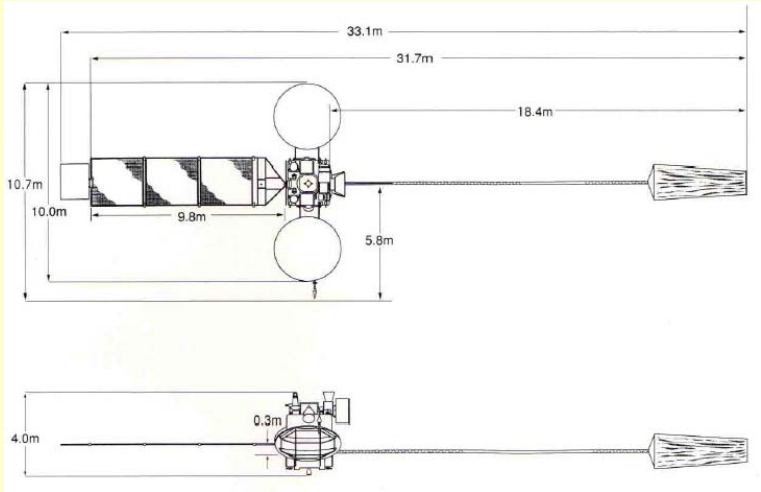


MSAS System Components

MTSAT Specification Summary

Type	**3 Axis Attitude Control Geostationary Satellite**
Life	**More than 10 years** **–Aeronautical: 10 years** **–Meteorological: 5 years**
Orbit Position	**Longitude 140 degrees East**
Frequency bands	**Aeronautical Mission** ***Ku(4 spot beams), Ka(3 spot beams) and L(1 global & 6 spot beams)*** **Meteorological Mission** ***S and UHF*** **TT&C** ***Ku, S and Unified S(USB)***
Weight	**3,300 kg (@launch), 1,400 kg (dry)**





MSAS System Components

Master Control Station (MCS) (Aeronautical Satellite Center)

Kobe Aeronautical Satellite Center

Hitachi-Ohta Aeronautical Satellite Center

Operation room

MSAS System Components

Monitor & Ranging Station (MRS) & Ground Monitor Station (GMS)

Hawaii MRS

Australia MRS

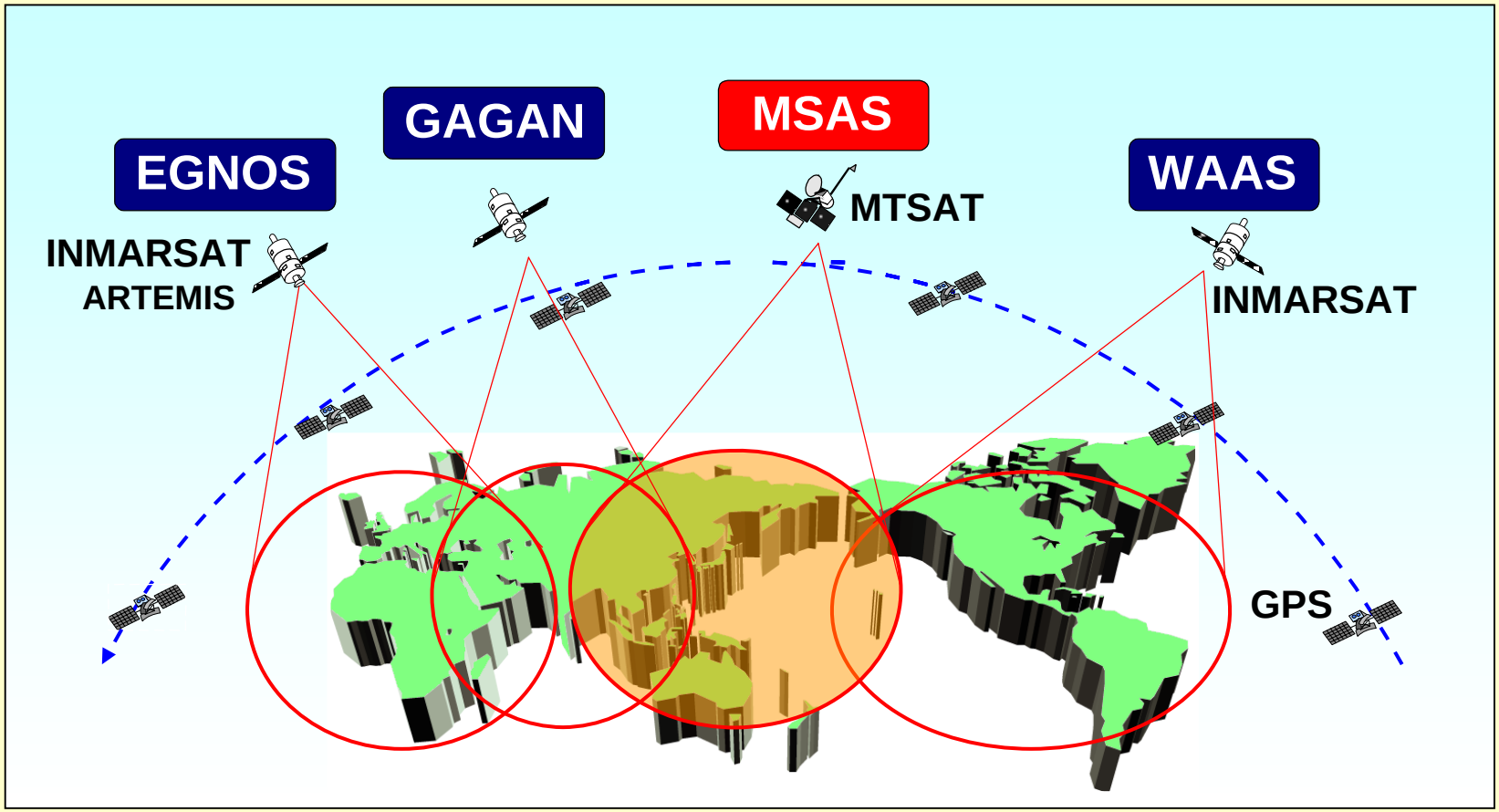
GPS Antenna

GMSs in Japan

- Sapporo GMS
- Tokyo GMS
- Fukuoka GMS
- Naha GMS

Interoperability among SBASs

- MSAS is interoperable with WAAS, EGNOS and GAGAN.



MTSAT/MSAS Program History

1991 ICAO approved FANS Plan

1993 Electric Navigation Research Institute (ENRI) started the research on GNSS Integrity Channel

1994 MTSAT Program started

1995 MSAS development started

1999 Launch of MTSAT-1 failed

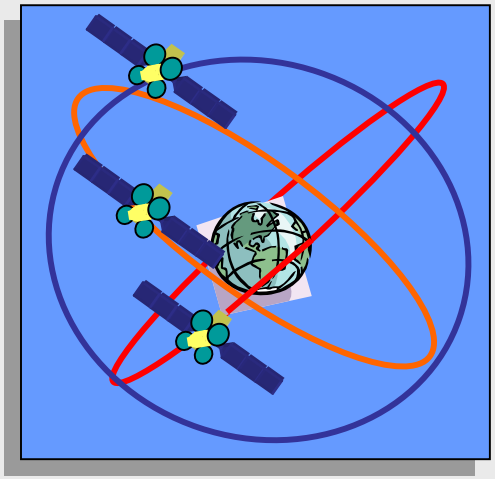
2001 GPS data collection using ground system started

2004 MTSAT-1R will be launched

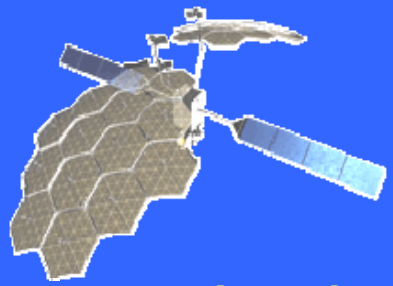
2005 MTSAT-2 will be launched (MSAS Initial Operation)

QZSS

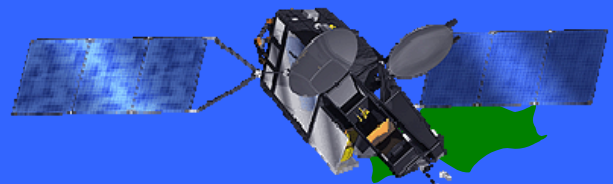
<Quasi-Zenith Satellite System>



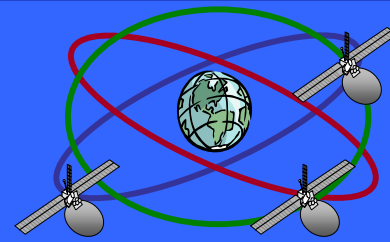
Background i-Space *Space information infrastructure*



ETS-VIII (2004)
Engineering Test Satellite-VIII



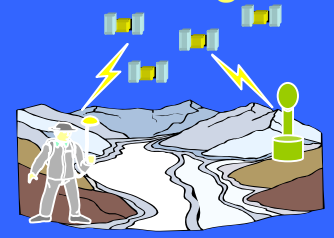
WINDS (2005)
Wideband InterNetworking Engineering Test and Demonstration Satellite



QZSS (2008)
Quasi-zenith Satellite System

Overcoming Digital Divide

High Accuracy Positioning



Tele-Medicine

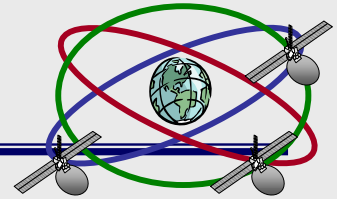
Tele-Education

Disaster Management

Satellite Mobile Communications

Satellite IP Multicasting

Background

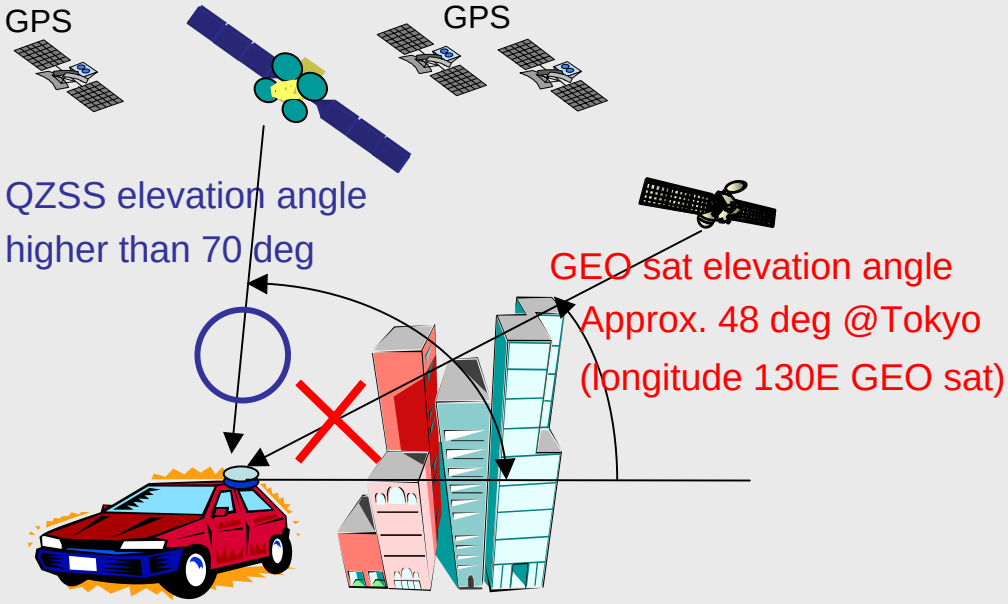


	Current Conditions	Future Condition with QZSS
Communications	◆Due to shadowing by buildings and mountainous features, GSO satellite systems can only service urban and mountainous areas with 30% coverage. ◆The private sector predicts a huge growth in the broadband mobile communications market.	◆High speed broadband mobile communications services will be able to provide coverage everywhere, including urban canyon and mountainous areas.
Positioning	◆Japan's geographic features can reduce the number of visible GPS satellites and cause user positioning error. Availability can also be compromised. ◆R&D in GPS augmentation is needed for applications which require high accuracy positioning such as ITS, precise agriculture, machine control for construction.	◆Continuous, stable and highly accurate positioning services will be provided. ◆Marked improvement in continuity, integrity, availability and accuracy for GPS users.

Objectives

Research & Development for

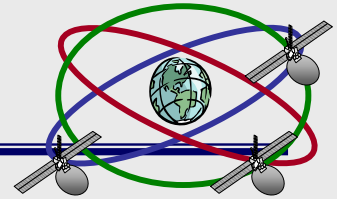
- **Satellite Positioning** --- ***High accuracy navigation service by complement and augmentation of the GPS***
- **Mobile Communications** --- ***High speed communication service***

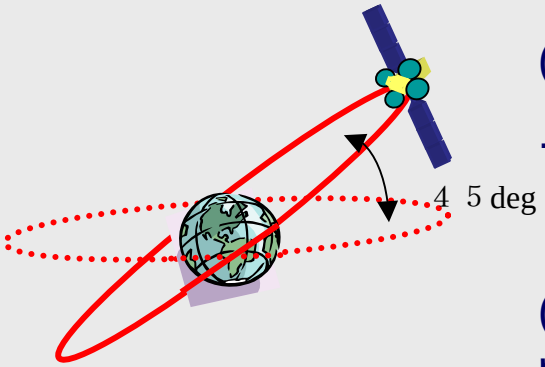


Advantages of the high elevation angle

- ➢Easier to provide broadband mobile communication services with
  - ✓Simplification of antenna tracking mechanism
  - ✓Utilization of the antenna with higher gain at the zenith
- ➢Less shadowing by buildings or mountains
- ➢Less multi-path interference

QZSS Overview -Orbital Characteristics-



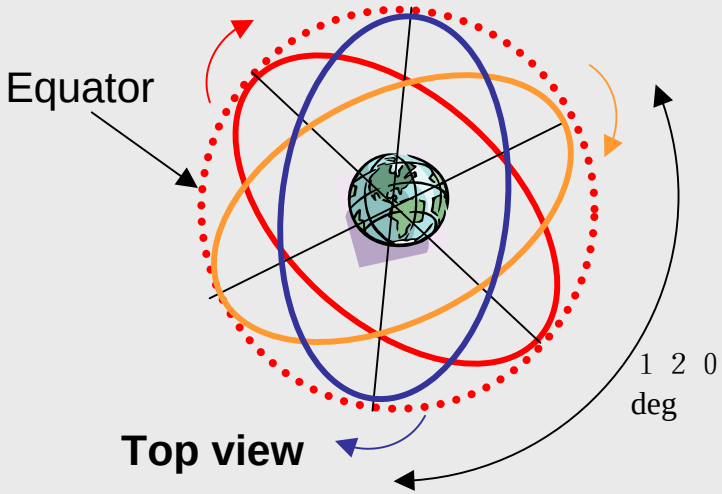


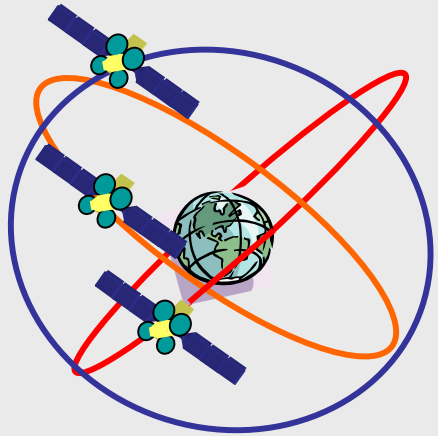
(1) Inclined orbital plane at approximately 45 deg from GSO

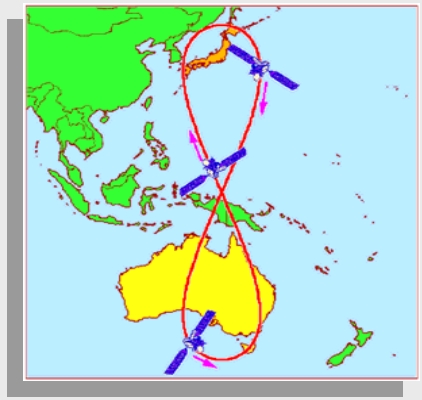
→ Ground track draws a figure “8” centered on the equator

(2) 3 satellites on the 3 orbit planes operate so that the right ascension of the nodes are each 120 degrees apart

→ Every 8 hours each of the 3 satellites passes over the same point on the figure “8” ground track

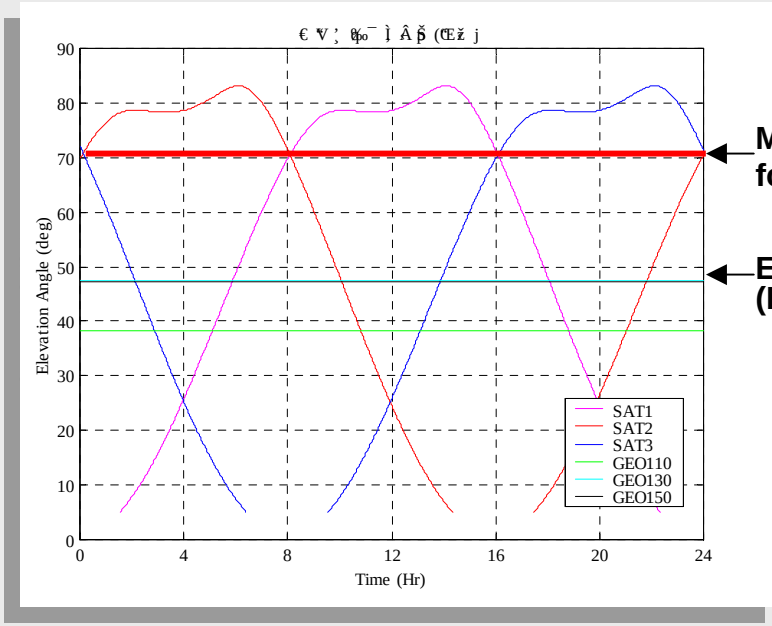






QZSS Overview -Orbital Characteristics-

Satellite visibility ensured with high elevation angle of more than 70 degrees.



Minimum elevation angle for QZSS (approx. 70 deg)

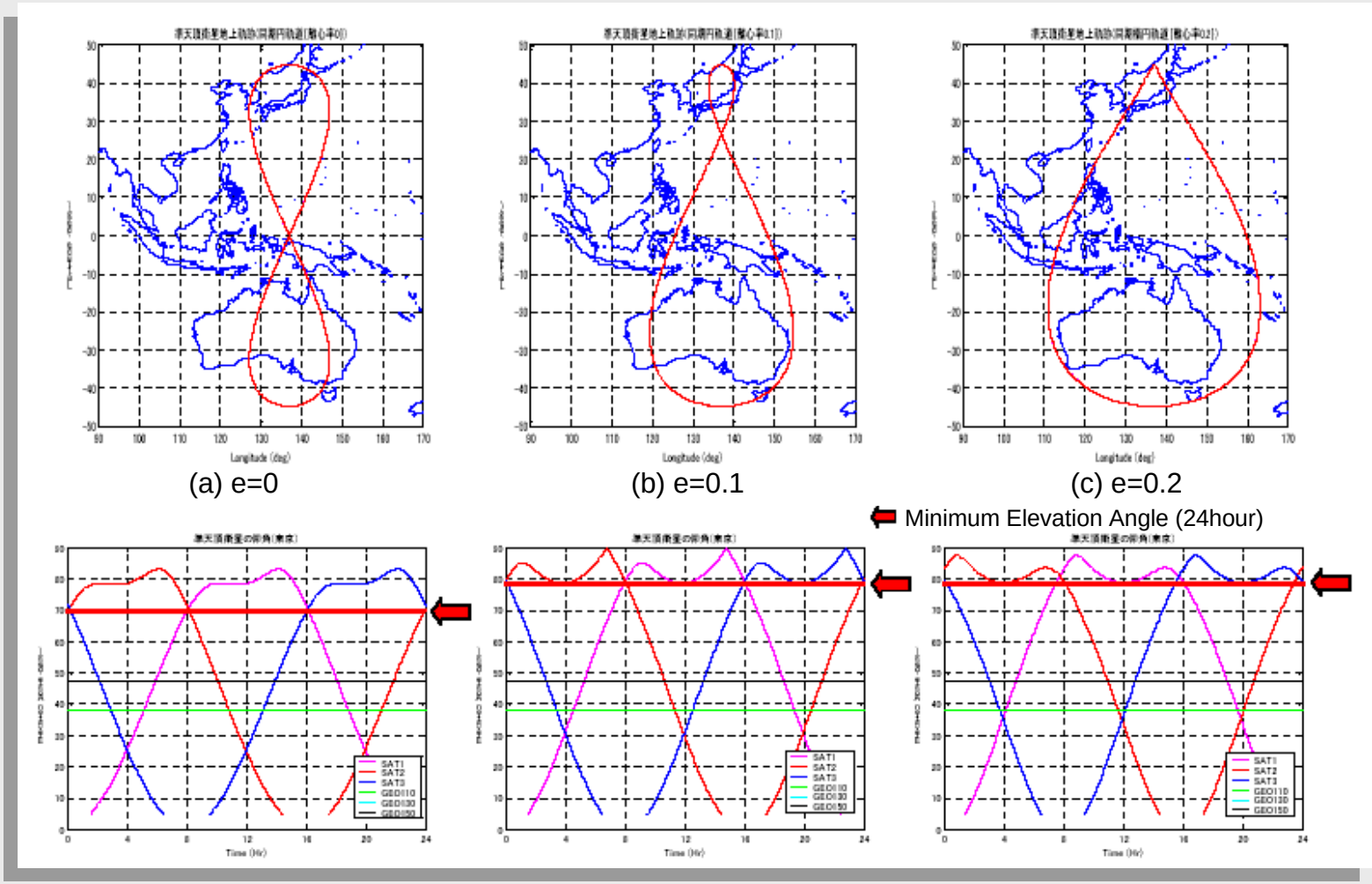
Elevation angle for GSO sat (E130deg) Approx. 48 deg

Elevation angle at Tokyo (24hour)

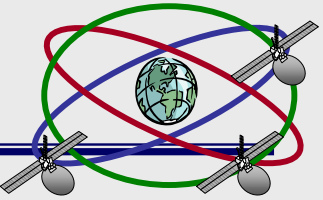
The urban canyon picture (Shinjuku area)

QZSS Overview -Orbital Characteristics-

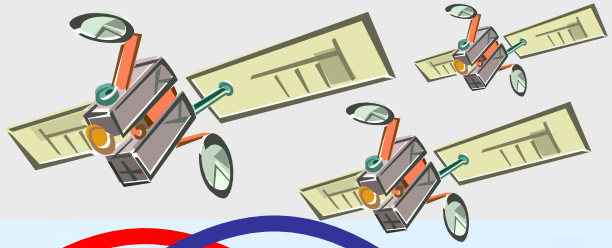
The Possible Orbital Variations of QZSS

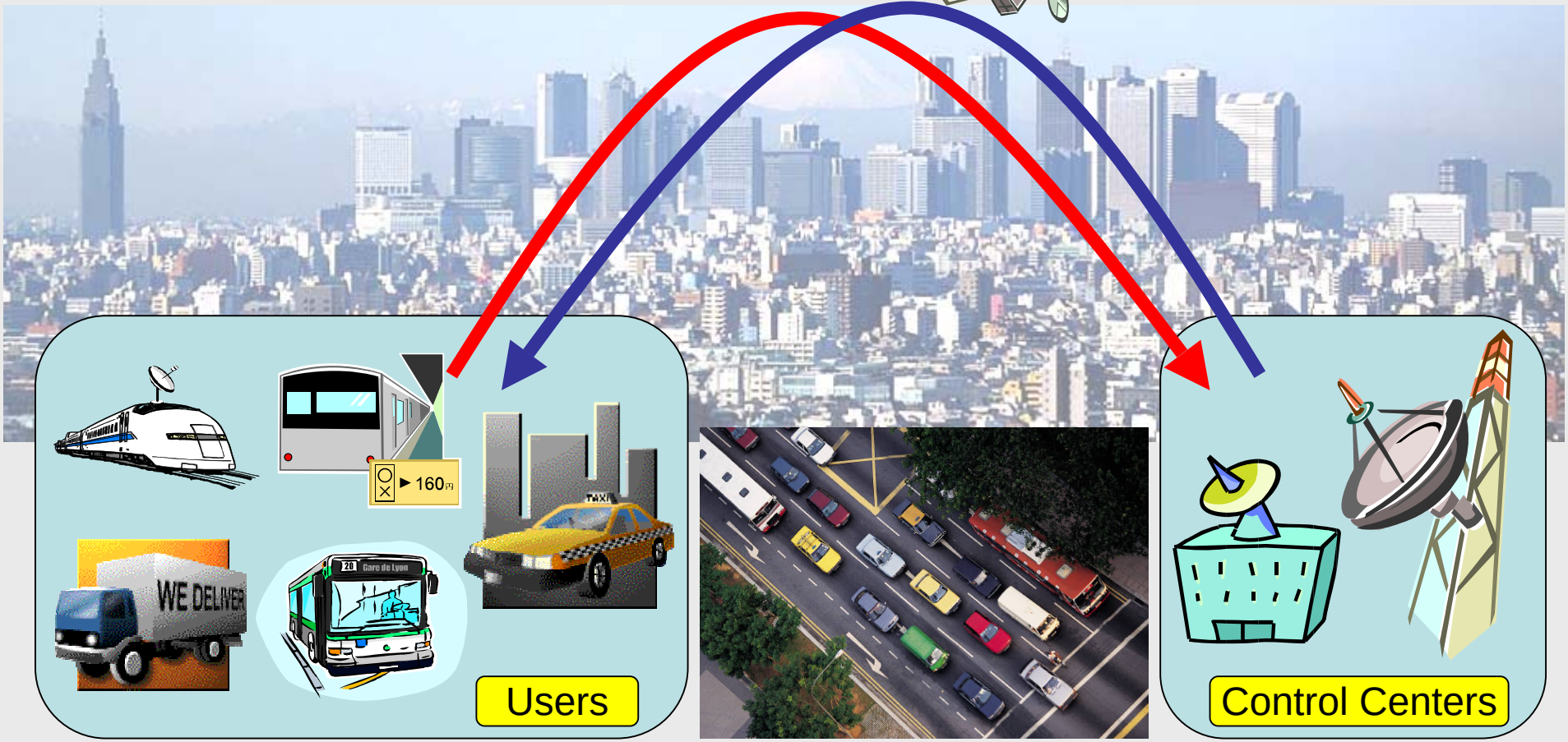


Expected Applications

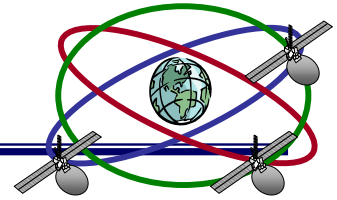


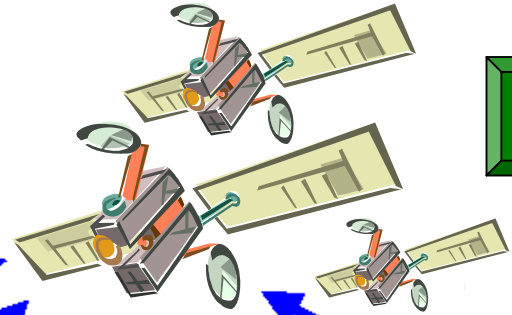
Traffic Management & Control System





Expected Applications





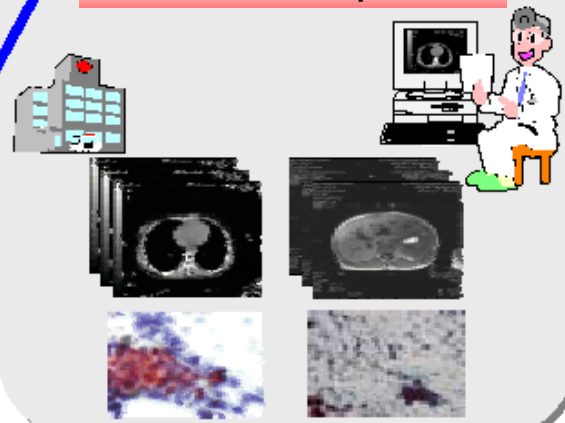
Medical Services

Mobile Hospital

Disaster

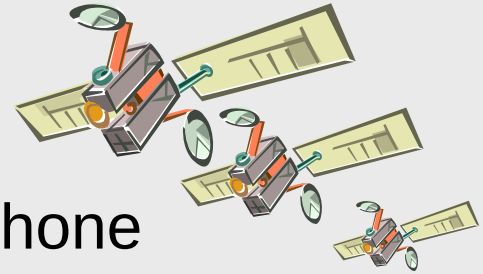
Emergency/Rescue

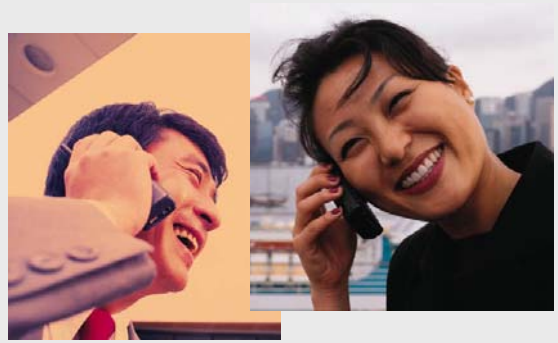
Local Hospital



City Hospital

Expected Applications

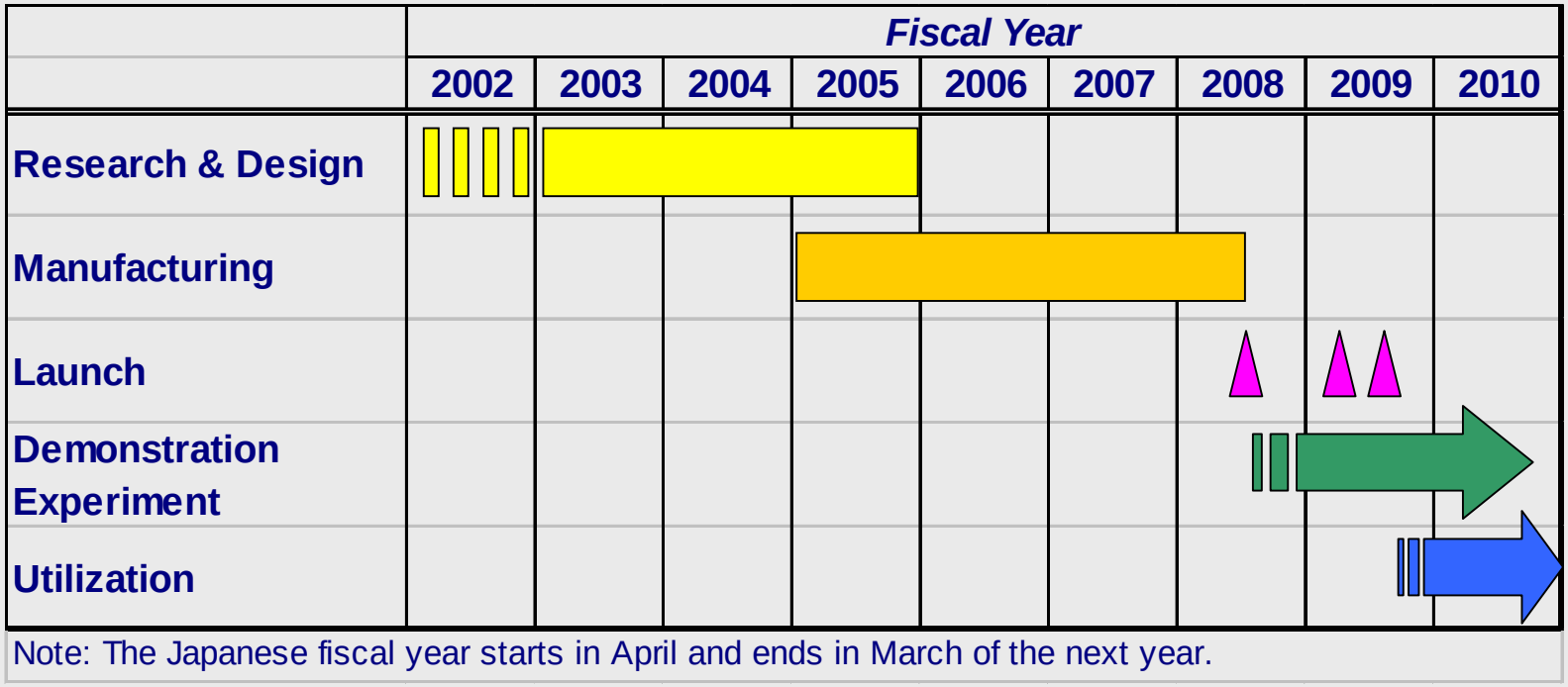




- Broadcasting
  - ✓TV, Car-TV, Mobile Phone
  - ✓Traffic Information
  - ✓Emergency/Disaster Information
- Search and Rescue
- Field Education
- - - - - - - - - - -
- - - - - - - - - - -
- - - - - - - - - - -

Development Schedule (Tentative)

QZSS Development Schedule (tentative)

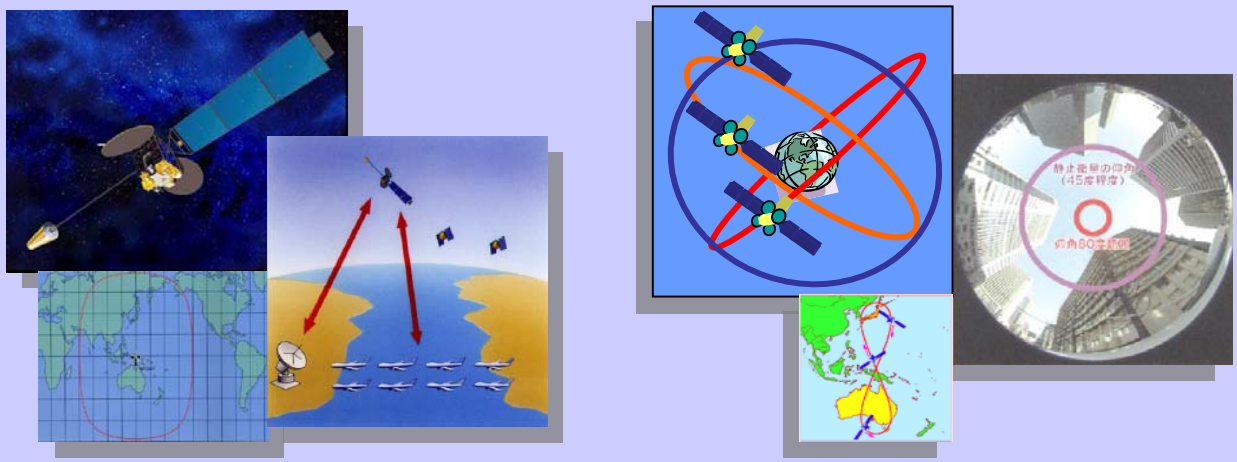


Note: The Japanese fiscal year starts in April and ends in March of the next year.

Summary

Japanese GNSS augmentations could make useful contributions to the world's space infrastructure.

- MSAS
  - Japan is focused on developing the MSAS system. In future, it should aid in the realization of safe and high quality aviation services for the Asia Pacific region.
  - Based on ICAO standards, the system is interoperable with the other SBASs.
- QZSS
  - A brand-new and unique system under development in Japan which could provide a variety of utilizations and applications.



Thank you ...

Kota TANABE

Special Adviser

Permanent Mission of Japan

to the International Organizations in Vienna

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