Overview of MSAS

MTSAT Satellite-based Augmentation System
For ICG-3

Office of Aeronautical Satellite Systems
ATS Engineering Division
Japan Civil Aviation Bureau
1. Configuration of MSAS

GPS constellation

MTSATs on Geosynchronous Earth Orbit

User

MCS Kobe

MCS Hitachiota

GMS

MCS: Master Control Station
GMS: Ground Monitor Station
MRS: Monitor and Ranging Station
1. A. Space Segment (1/2)
MTSAT-1R @140E
1.A. Space Segment(2/2)
MTSAT-2 @145E

Multi-functional Transport SATellite
1.B. Ground Segments (1/2)
1.B. Ground Segments (2/2)
1.C. Signals – PRN code

MTSAT-1R

Uplink#1

Ku

PRN129

Uplink#2

MCS Kobe

Uplink#2

MTSAT-2

Ku

PRN129&PRN137

L1

PRN137

Uplink#1

MCS Hitachiota
1.C. Signals - specifications

- Signal characteristics are compliant with ICAO SARPs (See paragraph 3.7.3.4.4.)
  - Frequency: L1 1575.42MHz
  - Band width: 2.2MHz
  - 500 BPS FEC
  - Signal strength on the earth surface >=-161dBw

- Planned signals
  - Band width expansion for L1
  - L5 signal
1.D. System time and geodetic reference frame

- MNT (MSAS Network Time)
  - Difference from GPS time is always kept less than 50ns (nano-second).

- WGS-84 is used.
1.E. Performance
-Required & observed-

For Non-precision approach

- **Horizontal Accuracy (95%)**
  - Required: Less than 220m (with SA on)
  - Observed value is less than 2.2m

- **Integrity (Probability of HMI)**
  - Required: Less than $1 \times 10^{-7}$/hour
  - Fault Tree Analysis leads $0.903 \times 10^{-7}$/hour

- **Availability**
  - Required: More than 99.9%
  - Observed: 99.926%
2. Service provision

- Service for air navigation
  - 24 hours a day, 7 days a week
  - Operational Information is provided as NOTAM
    - Service Interruption, degradation of service
  - Use for En-route through Non Precision Approach phase of flight
    - Performance improvement plan is now under consideration
2. Service Provision

- System is operated and maintained by certified specialists
  - MSAS and MTSATs
  - JCAB has a direct responsibility for entire operation of MSAS and MTSATs
3. Compatibility & Interoperability

• Compatibility and interoperability are achieved by those activities;
  – Participating and discussing on the ICAO Navigation System Panel meeting (NSP).
4. GNSS Spectrum Protection Activities

• A. National-level spectrum regulation is achieved by other ministry.
• B. Interference detection and mitigation work also.
End of presentation