



MSAS current status

Japan Civil Aviation Bureau



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Overview of MSAS

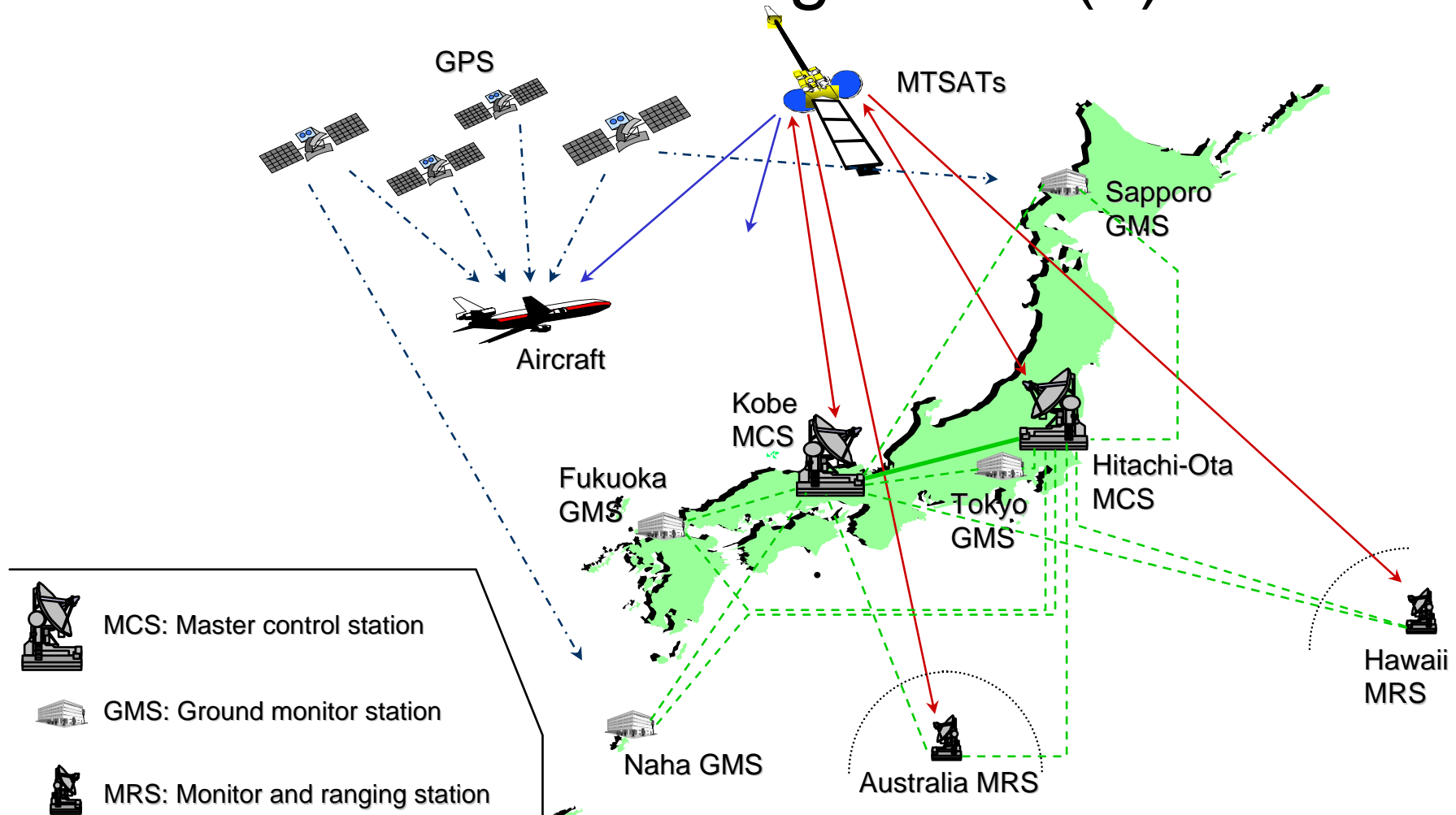


Overview of MSAS

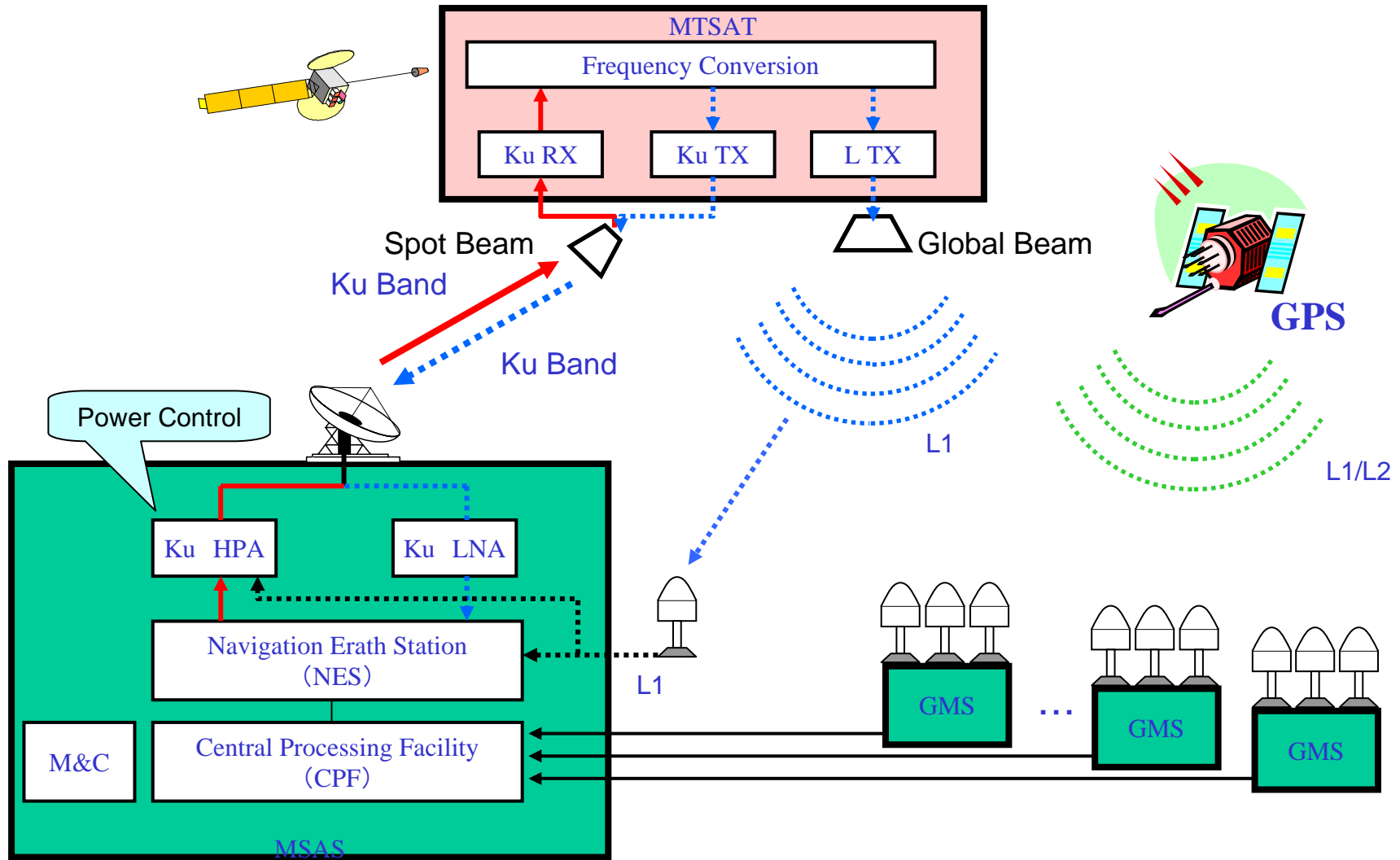
<MSAS : MTSAT Satellite Based Augmentation System>

- **Functions**
 - **Ranging**
 - Provide an additional pseudo-range signal from a SBAS satellite
 - **Satellite status**
 - Determine and transmit the GNSS satellite health status
 - **Basic differential correction**
 - Provide GNSS satellite ephemeris and clock corrections (fast and long-term)
 - **Precise differential correction**
 - Determine and transmit ionospheric corrections
- **Carrier frequency**
 - 1575.42 MHz (L1)
- **MSAS PRN Code**
 - 129 and 137
- **MSAS Test signal broadcasting as not-for-safety use**
 - Since July, 2005
 - <http://www.kasc.go.jp/MSAS/index.htm>

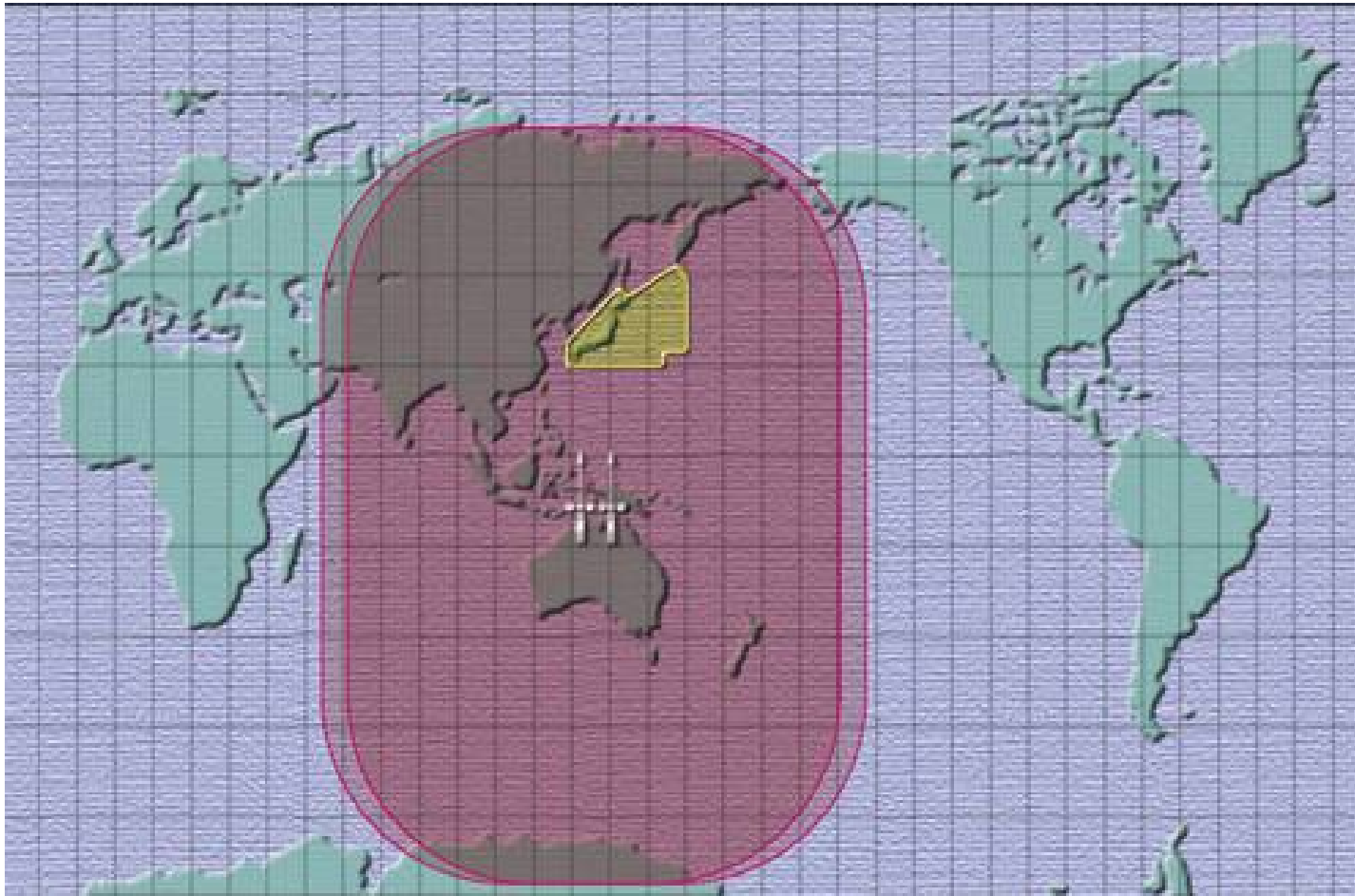
MSAS Configuration(1)



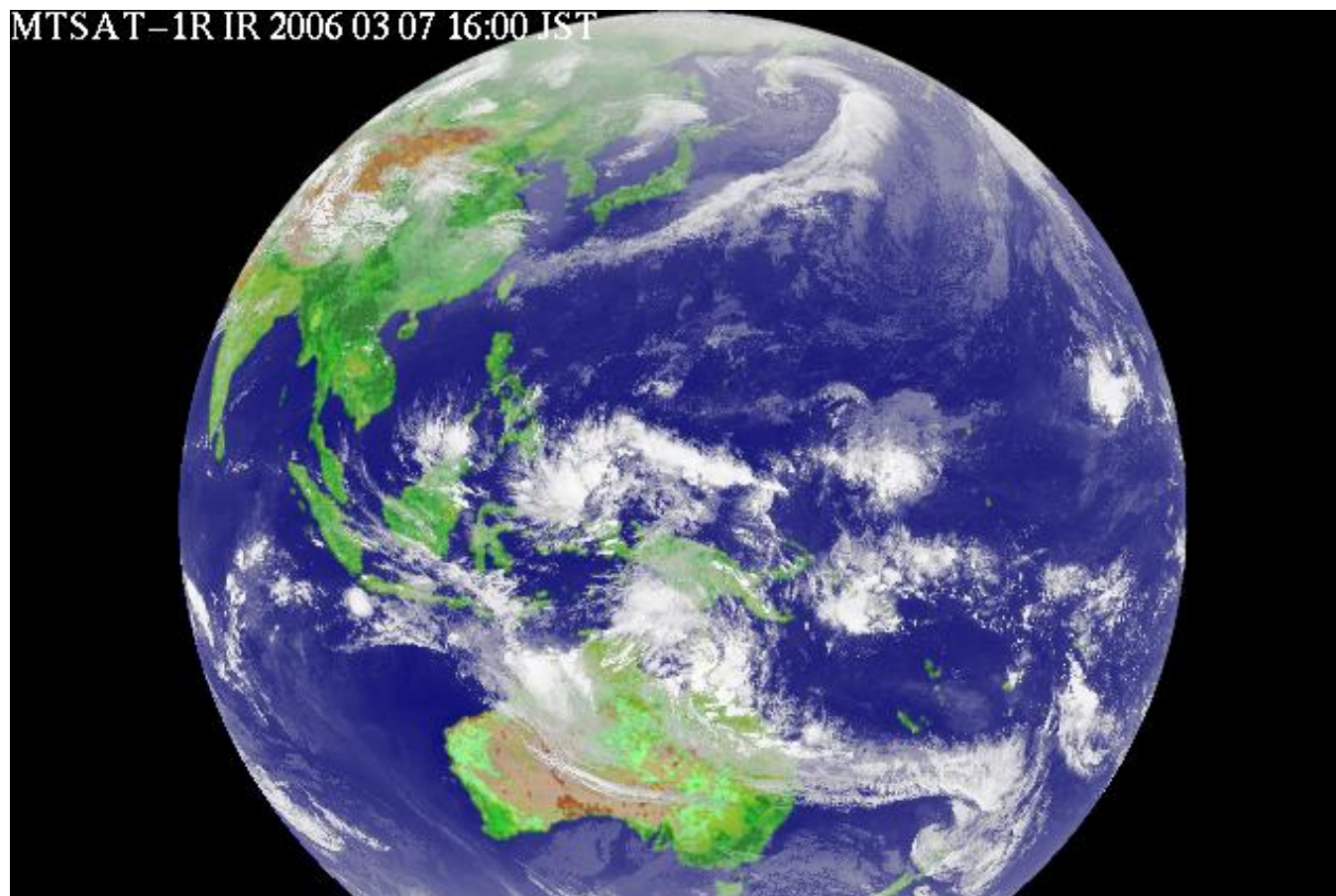
MSAS Configuration(2)



Service Area of MSAS

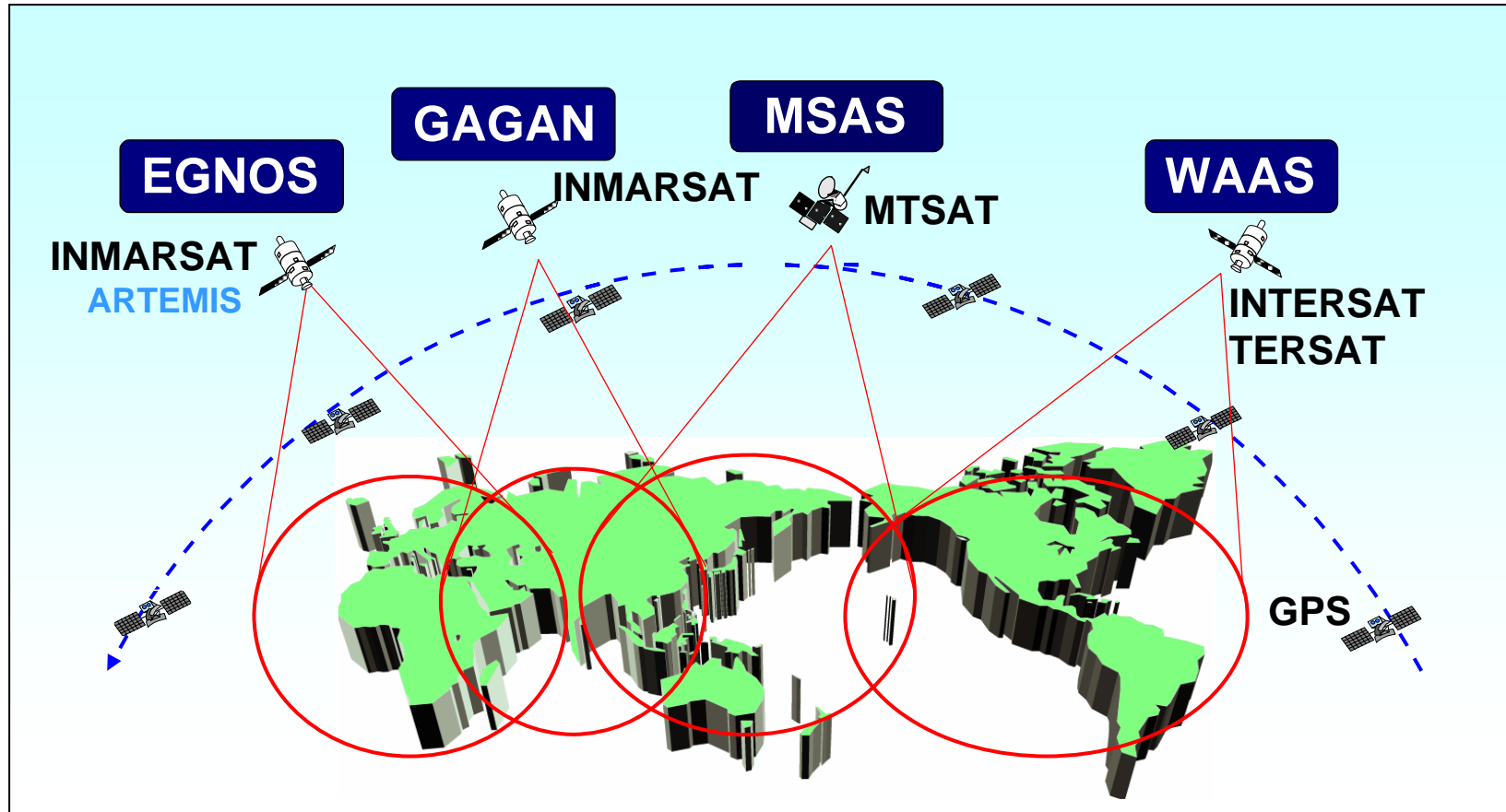


Satellite Missions



- Meteorological mission had commenced on June 2005.
- AMSS (Communication Service) had commenced on June 2006.

Service Area of MSAS & other SBASs





MSAS Status

MTSAT History

- MTSAT-1R

- Date

- 26 February 2005
- 18:25 (JST)

- Launcher

- H-IIA No.7



- MTSAT-2

- Date

- 18 February 2006
- 15:27 (JST)

- Launcher

- H-IIA No.9



MSAS Status (1)

- MTSAT-1R was launched in 2005
 - Located at 140E
- Meteorological Mission by MTSAT-1R has been operated since 28 June, 2005
- MTSAT-2 was launched in February 2006
 - Located at 145E
- MSAS Total System Integration with Two MTSATs was Completed
- Operational Test & Evaluation was Completed



MSAS Status(2)

- MSAS Test Signal Transmission
 - Type-0 message from MTSATs is now available prior to commissioning
 - PRN 129 by Kobe and PRN 137 by Hitachi-ota
 - Transmission Schedule is available on Kobe Aeronautical Satellite Center Web Site

http://www.kasc.go.jp/MSAS/index_e.html
- MSAS Initial Operational Capability (IOC) with dual MTSAT coverage will be achieved in September 2007.



Implementation Schedule

Calendar Year	2003			2004			2005			2006			2007		
Japanese Fiscal Year	FY2003			FY2004			FY2005			FY2006			FY2007		
MTSAT Launch						▲ MTSAT-1R			▲ MTSAT-2						
System Integration for MT-1R										→ Test Signal(Type0)					
System Integration for MT-2										→ Test Signal(Type0)					
Safety assurance	—————														
Operational Test & Evaluation															
MTSAT signal Power and quality tests													—		
Static testing													—		
Flight testing													—		
Degraded operations tests													—		
Shake down test														—	
Commissioning															▲



Process for MSAS Commissioning



Process for MSAS Commissioning(1)

- System Integration with Two MTSATs
- Safety Assurance
 - HMI (Hazardously Misleading Information) analysis for GEO portion
- Operational Test & Evaluation
 - MTSAT signal power and quality Test
 - Static Test
 - Flight Test
 - Degraded Operation Test



Process for MSAS Commissioning (2)

- Shake Down Test
 - Check Readiness to commence MSAS Operation
 - Confirm Documentation, Installation, Personnel Safety, Configuration, Periodic Maintenance, Collective Maintenance, Personnel Training, Logistics, Security
 - Check Operational Procedures and Operations
 - Confirm Operations based on Reference Values
- Commissioning
 - MSAS will commission with Two MTSATs



Results of OT&E

Static Test

— Typical operation and Performance requirement —

- Required performance by ICAO SARPs Annex10 Vol.1 (Standards And Recommended Practices)

Typical operation Performance requirement	NPA	APV-I
Availability	0.99~0.99999	0.99~0.99999
Accuracy horizontal 95%	220m	16m
Accuracy vertical 95%	N/A	20m
Horizontal alert limit	556m	40m
Vertical alert limit	N/A	50m

Static Test

— Accuracy (95%) —

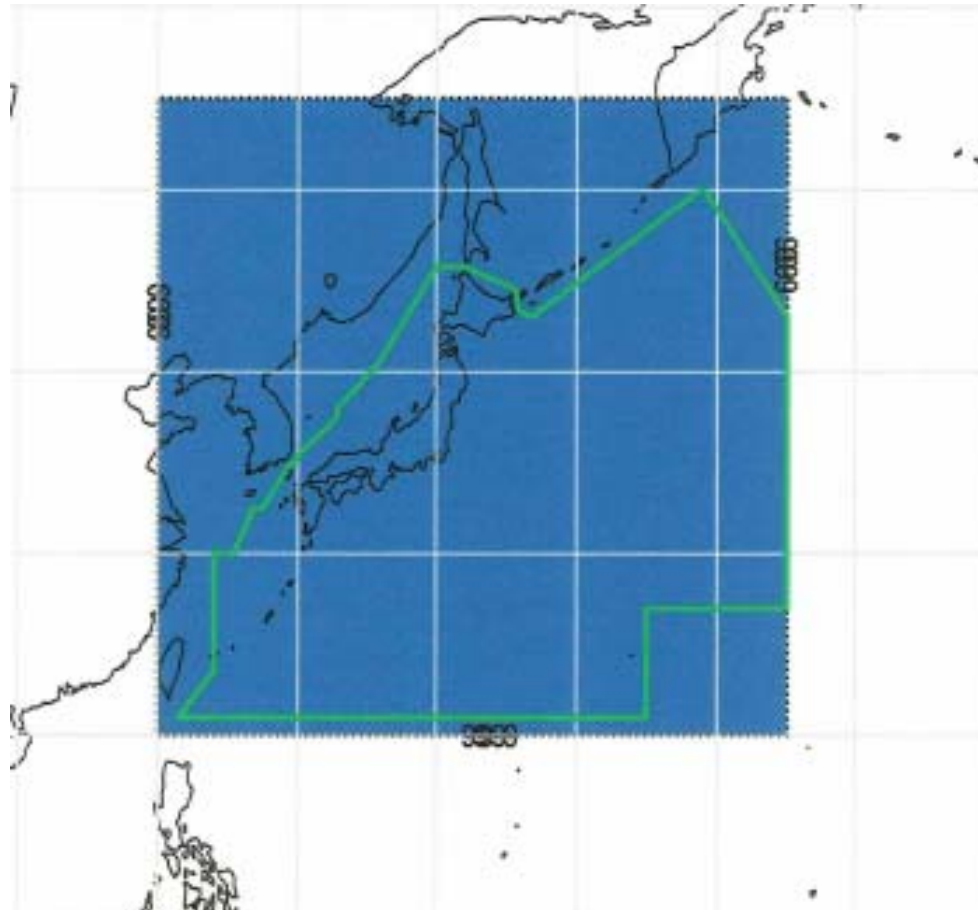
(m)

	ER/NPA (Without MSAS) HPE	ER/NPA (Using MSAS) HPE	APV-I HPE	APV-I VPE
Sapporo	5.31	1.01	0.97	1.28
Tokyo	5.10	0.94	0.91	1.37
Fukuoka	5.60	0.96	0.83	1.26
Naha	7.66	2.27	-	-
Kobe	5.22	0.83	0.76	1.15
Hitachi-ota	4.97	0.79	0.75	1.19
Sendai	2.96	0.88	0.80	1.58

【2006/10/16～2006/11/14】

(note) Average of 95% accuracy over 30days

ER/NPA Service Availability



The dark blue color indicates that NPA availability is at least 99.99%.

Results of OT&E

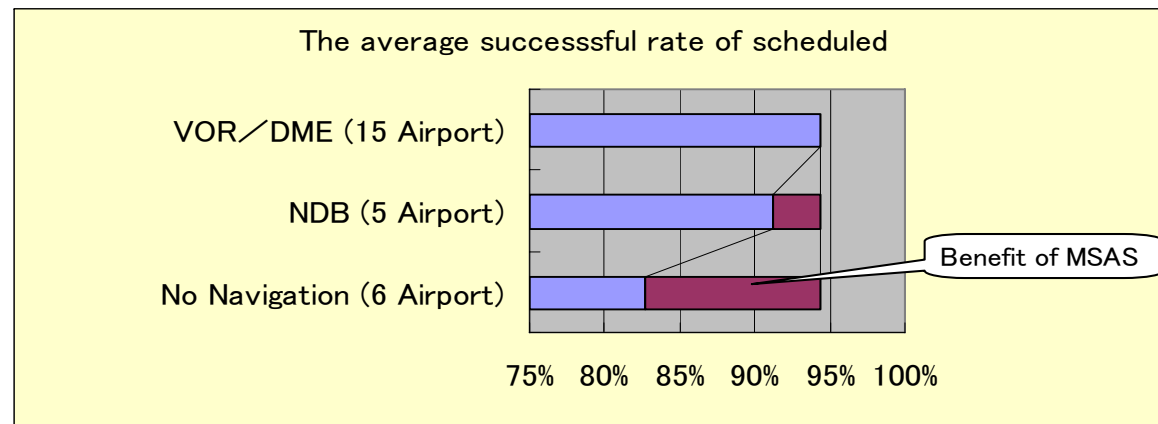
- No major problems were found during TRT's review of OT&E test results
 - Performance was within expectations
- Results of OT&E Tests support a recommendation that MSAS be commissioned for ER/NPA operations as IOC



Current Activities on MSAS

Current Activities on MSAS (1)

- Development with remote island airport
 - For NPA
 - Navigation aids is not set up in many of remote island airport
 - The average successful rate of scheduled flight of these airports is significantly low
 - MSAS can increase average successful rate of scheduled flight



Current Activities on MSAS(2)

- Study on MSAS Evolution
 - For APV and LPV
 - New Algorithm for Ionospheric Error Estimation is being developed
 - Simulation and Evaluation using Service Volume Model is continuing
 - Three Key Factors to make the Decision
 - Technical Feasibility
 - Cost Benefit
 - User Preference



Summary

- MSAS System Integration was Completed
- MSAS Operational Test & Evaluation was Completed
- MSAS Test Signal is being transmitted
- MSAS will be commissioned on 27 Sep. of 2007
- MSAS IOC will be from en-route to NPA.