ELEVENTH AIR NAVIGATION CONFERENCE

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Agenda Item 7 : Aeronautical air-ground and air-to-air communications

STATUS OF MULTI-FUNCTIONAL TRANSPORT SATELLITE (MTSAT)

(Presented by Japan)

SUMMARY

This paper provides status of JCAB's multi-functional transport satellite (MTSAT) system and its aeronautical mobile satellite services (AMSS) function. JCAB is implementing the new CNS/ATM systems for Japan centering on MTSAT, which will provide, among others, AMSS function available not only for ATS providers but also for airline users in the Asia/Pacific Region.

1. INTRODUCTION

1.1 In 1994, the Council for Civil Aviation, a consultancy body for the Minister of Transport, forecasted that air traffic in the North and Central Pacific (NOPAC and CENPAC) in 1992 would double by 2000 and triple by 2010. The Council considered that the existing air navigation systems could not cope with the increasing NOPAC and CENPAC traffic, and that new air navigation systems, based on satellite technology as endorsed by the 10th Air Navigation Conference in 1991, should be implemented to cater to the future traffic in Japan and the adjacent airspace. The Council also considered that in order to make the air navigation systems safer and more reliable, sufficient system redundancy was required. The Council recommended, therefore that a new aeronautical satellite should be launched and air navigation systems should be implemented centering on such a new satellite in order to ensure the systems safer and more reliable.

1.2 According to the recommendations made by the Council, the Japan Civil Aviation Bureau (JCAB) has decided to launch a new aeronautical satellite, integrating aeronautical mission into the meteorological observation mission of the geo-stationary meteorological satellite (GMS), which is being utilized for providing meteorological information to the Asia/Pacific States since the 1970s. JCAB considered that a new satellite should be designed to be widely utilized not only by air traffic services (ATS) providers but

also by aircraft operators in the Asia/Pacific Region in addition to the existing satellite system. This new satellite is known as multi-functional transport satellite, MTSAT.

2. MTSAT SYSTEM AND ITS CURRENT STATUS

2.1 As stated above, MTSAT has two missions, i.e. meteorological mission and aeronautical mission. The aeronautical mission of MTSAT will contribute to each element of the ICAO communications, navigation, and surveillance/air traffic management (CNS/ATM) systems, i.e. communication, navigation and surveillance. The MTSAT system will provide direct controller-pilot communication in voice (SATVoice) and data (controller-pilot datalink communication: CPDLC), global positioning system (GPS) augmentation information, and automatic dependant surveillance (ADS) capabilities. The MTSAT system will not only be capable of handling oceanic ATS communications within the Japanese flight information regions (FIRs), but will also be offered to the civil aviation community in the Asia/Pacific Region as common aviation infrastructure, which could facilitate implementation of their ICAO CNS/ATM systems.

2.2 MTSAT-1 was launched in November 1999 from the Tanegashima Space Center in Japan. The launch of MTSAT-1 was, unfortunately, not successful due to an engine failure in the launch vehicle. The MTSAT-1 was regrettably not able to reach the orbit. Since JCAB considers MTSAT as a key element of the ICAO CNS/ATM Systems for Japan, the Ministry of Transport has decided to continue pursuing the JCAB MTSAT programme and the arrangements for launching an alternate satellite has commenced. The alternate satellite (MTSAT-1R) is being manufactured and will be launched in early 2004. Following the system evaluation and staff training, the AMSS function of MTSAT-1R will become operational in late 2004.

2.3 MTSAT-2 is also being manufactured and will be launched in early 2005. The aeronautical mission of each MTSAT is designed to have a service life of ten years, and future MTSATs will be launched with certain interval to replace existing MTSATs. Consequently, the MTSAT system will be maintained in a dual operation, including ground systems, for the foreseeable future.

3. ASSURANCE OF HIGHLY REDUNDANT AND RELIABLE AMSS NETWORK

3.1 There will be two satellites described above, that is, MTSAT-1R and MTSAT-2 in 2005 in the MTSAT system. Whereas MTSAT-1R will be launched at the location of 140 degrees east, MTSAT-2 will be launched at the location of 140±5 degrees east. Both satellites will be located so close that the aircraft earth station (AES) cannot differentiate each satellite because of its broad antenna pattern. With the use of this characteristic, both satellites will simultaneously act as if one satellite is being operated from AES.

3.2 There are also two aeronautical satellite centers that are located about 500 km apart in Japan, i.e. Kobe (approximately 500 km west of Tokyo) and Hitachi-Ohta (approximately 100 km northeast of Tokyo) in order to provide continuous services even in natural disasters. At each aeronautical satellite centre, there are two aeronautical ground earth stations (GES), one is pointing to MTSAT-1R and the other is pointing to MTSAT-2. To achieve high equipment reliability, GES except for antenna sub-system is designed to have the redundant configuration.

3.3 The MTSAT system does not require AES to re-logon when any anomaly arises, since AES will identify two satellites as a single satellite as described in 3.1. In addition, the information that is very important to the AMSS operation such as AES log-on tables will be maintained and shared among four GESs. Moreover, two active GESs will share traffic load, that is, one of them manage a half of logged-on AESs. Current specifications of AESs and special functions of the MTSAT system enable instantaneous switch over before AESs become aware of satellite or GES failure.

3.4 The MTSAT system is configured with two operational satellites up in the space and four GESs in two aeronautical satellite centres on the ground to gain the full redundancy in case of equipment failure. The instantaneous switch over between two satellites and four GESs is fully assured especially for the safety communication, that is, ATS communication.

4. ASSURANCE OF FULL ICAO COMPLIANCE AND INTEROPERABILITY WITH EXISTING AMSS NETWORK

4.1 The AMSS function of MTSAT system is fully compliant with the Standard and Recommended Practices (SARPs) of Annex 10 — *Aeronautical Telecommunications* in ICAO and fully supports all the aeronautical communications defined by ICAO. There are four types of communications in ICAO, the air traffic services (ATS), the aeronautical operational control (AOC) defined as safety communication, and aeronautical administrative communications (AAC), air passenger communications (APC) defined as non-safety communications.

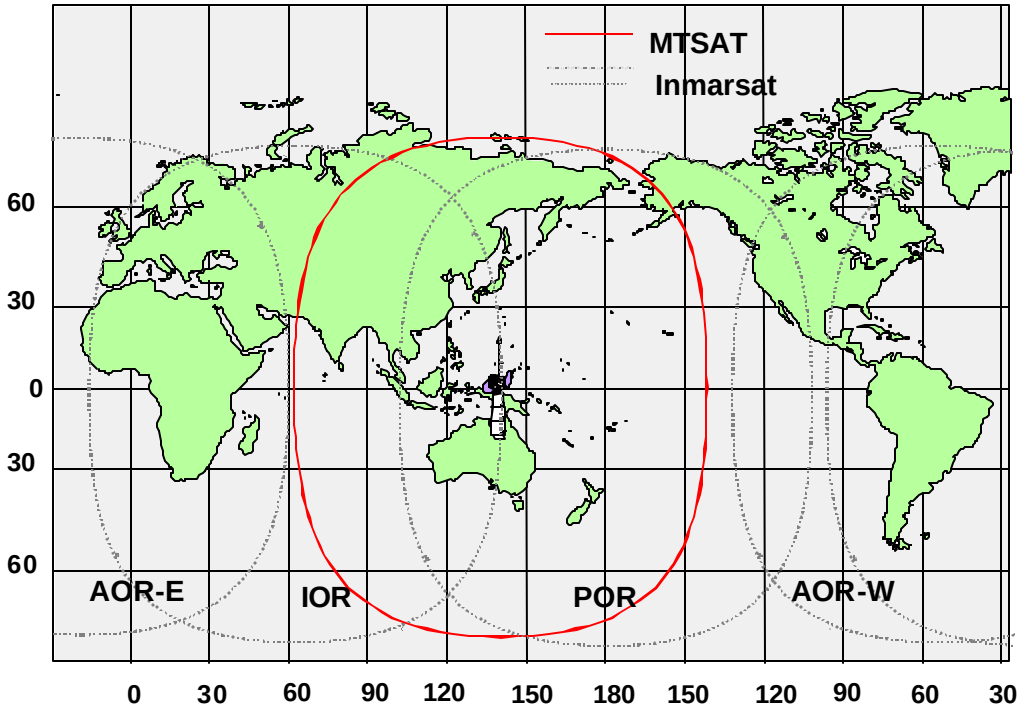
4.2 The ATS messages through MTSAT system in Japanese FIR will be handled by JCAB in the same manner as very high frequency (VHF) and high frequency (HF) voice communications in the current ATS environment. Whereas, the AOC, AAC and APC messages will be handled separately by a service provider. JCAB has recently selected Societe Internationale de Telecommunications Aeronautiques (SITA) to handle those messages as the service provider for MTSAT. It is expected that all four types of messages will be delivered through the MTSAT system not only to ATS providers but also airlines, home and offices smoothly with full of integration and reliability by JCAB in cooperation with SITA.

4.3 While the AMSS function of MTSAT system is fully compliant with the SARPs of Annex 10 in ICAO described above, JCAB made an operational agreement with Inmarsat who is currently providing the AMSS services worldwide in order to assure the full interoperability between two systems. Therefore, the AES currently operating in Inmarsat system will smoothly adopt the MTSAT system without any modification to aircraft systems by simply adding MTSAT data to their satellite data unit (SDU).

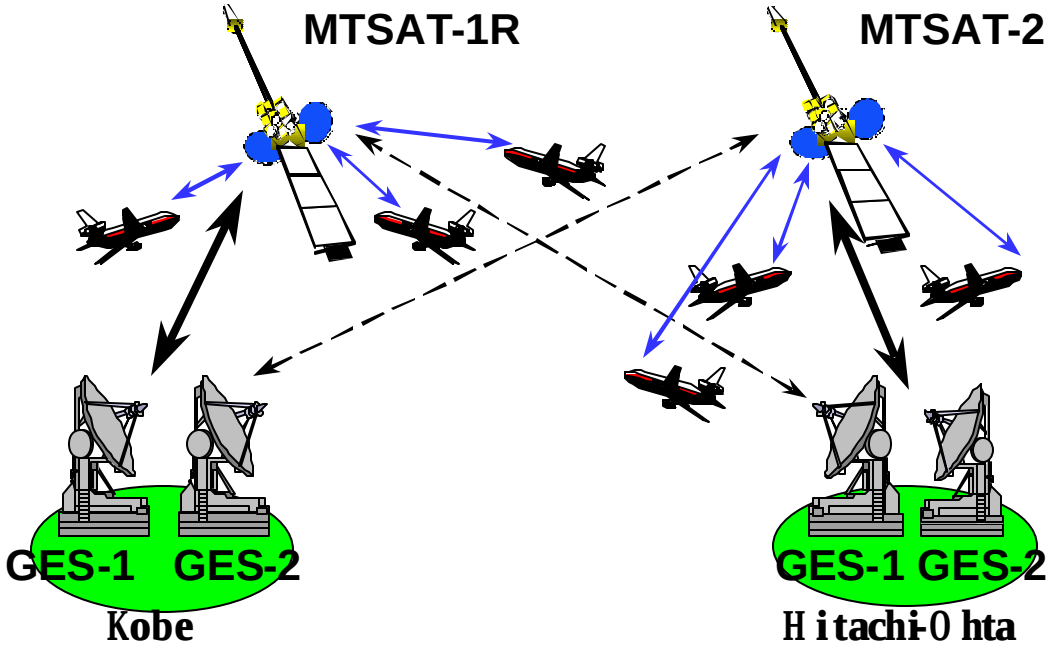
5. CONCLUSION

5.1 JCAB believes that the launch of MTSAT will increase the availability and reliability of the global satellite services in the Asia/Pacific Region, and it will help ATS providers to transit from HF voice communication to AMSS based on the concept of ICAO CNS/ATM.

5.2 JCAB offers MTSAT system to the Asia/Pacific States as common aviation infrastructure in order to achieve global, seamless, safer and more reliable air navigation systems in this region. JCAB offers the use of MTSAT system to the Asia/Pacific Region on a not-for-profit basis, and does not intend to seek economic profit from MTSAT services.



Coverage of MTSAT and Inmarsat Satellites



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