International Civil Aviation Organization

SATELLITE DATA-LINK COMMUNICATION SEMINAR AND SECOND SATELLITE DATA LINK OPERATIONAL CONTINUITY MEETING (SOCM/2)

(Bangkok, Thailand, 8-10 February 2012)

Agenda Item 2: **Review planning and implementation programs involving satellite communications (SATCOM) data-link services (Update since SOCM/1)**

NEAR FUTURE PLAN OF MTSAT SYSTEM

(Presented by Civil Aviation Bureau of Japan)

SUMMARY

This paper provides the supplementary information on near-term future plan of MTSAT System, which was presented to the Fifteen Meeting of CNS/MET in July 2011, and also suggests pertinent issues to be shared among AMSS stakeholders.

1. INTRODUCTION

1.1 The MTSAT System consists of two satellites and four ground earth stations. Each satellite has ability to handle all the aircraft that is registered as MTSAT user. Ground earth stations are interconnected and switch-over from one ground station to the other is made in the matter of milliseconds. This configuration constitutes robust air-to-ground communication infrastructure. The satellite and ground stations are administered and operated by JCAB. The unification of administration and operation of the MTSAT System has proved to be both efficient and effective in handling the emergency events.

1.2 In 2010, with the EOL of MTSAT-1R nearing, JCAB conducted a comprehensive study on next generation satellite system by analyses of technical, operational and regulatory aspects of existing and future aeronautical satellite systems in the APAC region including MTSAT System. The result led JCAB to a decision that MTSAT-1R was going to leave its orbit in 2015 and MTSAT-2 alone would continue to offer AMSS until 2020, which is four years after the year of original EOL of MTSAT-2 in 2016. The study, however, was unable to bring clear guidance as to the next generation satellite system because of the lack of grounds for a determination.

2. DISCUSSION

2.1 New configuration from 2015

MTSAT-1R is anticipated to use up its fuel in 2015. The initial estimated EOL of MTSAT-2 was 2016, but the latest analysis of the fuel remaining indicates that the satellite can be used for four more years.

After the EOL of MTSAT-1R, MTSAT-2 alone will handle all the traffic logged on to MTSAT Systems until around 2020, when the MTSAT System will be re-configured to one satellite and two ground earth stations. Figure 1 shows the transition of configuration.

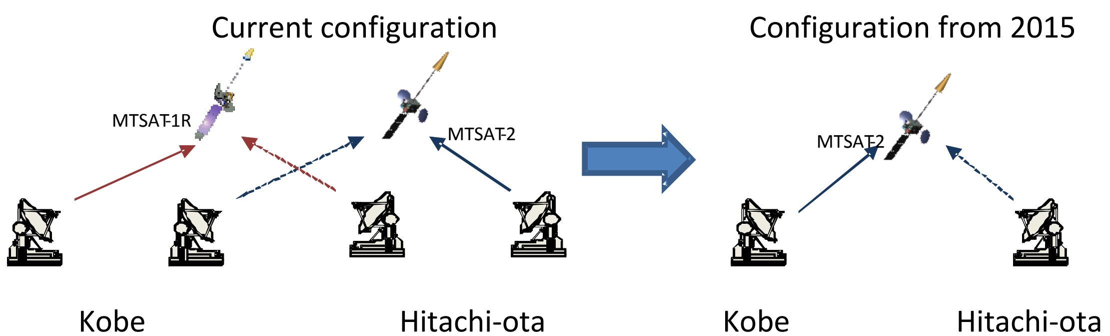

Figure 1: Transition of configuration

2.2 Study results on the new configuration

2.2.1 Reliability of new configuration

NASA's study for Future Communications Study[1] shows that the average availability/mission life of Inmarsat 4th generation satellite is 0.9999. This figure was derived from statistical analysis of anomaly of communication satellites. The same can be applied to other communication satellites including MTSAT since the satellites covered by this analysis were general communication satellites. Although the mathematical chance of failure is very low at such a communication satellite, should a failure happen in a single satellite environment, adverse impact on oceanic ATC operation can be enormous. So, a compensation approach to avoid such risk is proposed later in this paper.

The ground stations are separated with the distance of nearly 600km, which forms space diversity in the ground segment of the System. The effectiveness of space diversity was proved at the earthquake which struck mainly the Pacific side of North-Eastern Region of Japan in March 2011. Two ground stations in Hitachi-Ota Aeronautical Satellite Center near epicenter sustained severe damage and stopped working for several days, but the MTSAT services could continue, being backed up by the ground stations in Kobe Aeronautical Satellite Center.

2.2.2 Availability of relevant standards

There was no globally applicable standard for data link operation of oceanic ATC in the period of development of MTSAT in the mid 1990s. In order to achieve 30NM or less longitudinal separation in the oceanic airspace, JCAB decided to implement switch-over time of MTSAT in the order of milliseconds, which was in general analogous to main frame computer system.

Since the mid 1990s relevant standards for data link operation such as SPOM have been developed through regional or global framework to introduce seamless operation among different FIRs. GOLD, which will be globally adopted as a guidance material for oceanic ATC, prescribes that unplanned outage duration limit is at least less than 10 minutes for 30NM longitudinal separation operation. That means communication failure only has to be resolved in the order of minute, up to 10 minutes. With proper reporting procedure of communication failure, it would pose no threat for Air Traffic Controllers to safely continue the services by satellite data link. Besides, it is evident now that reduction of the separation to less than 30NM is hardly anticipated within the lifetime of current MTSAT System.

2.2.3 Improvement of aeronautical satellite communication environment in the APAC region

The quality of Classic Aero services provided by Inmarsat 3rd generation satellites has been improved in recent years thanks to Inmarsat's continuous effort on this matter. Iridium has been proved to be eligible for oceanic ATC by FANS Over Iridium. ATC is going to be provided by Inmarsat SBB in the near future. It may be true that there are concerns over the future satellite communications in the APAC region such as the sustainability of Classic Aero by Inmarsat 3rd generation satellite and MTSAT, continuously stable provision of AMSS which meets RCP requirement, as of now overall situation is improving in a sense that airspace users are now able to enjoy stable AMSS through multiple satellite communication providers.

2.2.4 Utilization of the interoperability between Inmarsat and MTSAT

Inmarsat and MTSAT have been providing interoperable platform for the AMSS Classic Aero services by complying with ICAO AMSS SARPs and organizing operational framework. For instance, an AES can be configured to select Inmarsat as primary satellite and MTSAT as secondary one, and vice versa. By doing so, when one satellite system fails, AES can blindly switch to the other satellite system. As the duration of Log-on Storm has been significantly decreased thanks to the revamp of log-on procedure, this configuration improved the availability of ATC data link communication.

It should be noted that since contracts with DSPs bind airlines on specific ground stations and terrestrial networks, certain aircraft cannot register MTSAT as a secondary satellite. So it is proposed to discuss this matter from institutional aspect as appropriate.

2.2.5 Uncertainty of future aeronautical satellite communication services

There are uncertainties over the application of performance requirements that are described in the documents such as GOLD to the existing and future AMSS systems. For instance there is no officially-established practical method other than normative one in RTCA DO-270 to derive the availability of the future satellite system. It is necessary to establish a guidance material for the practical application of performance requirements as regional and global agenda.

2.3 **The study outcomes and the way forward**

All things considered in the JCAB study on future AMSS systems, it decided to continue the service by the use of MTSAT-2 after the EOL of MTSAT-1R. Given the manufacturing lead time of satellite and the time needed for budgetary request, it is necessary for JCAB to determine the future AMSS services and systems in Japanese air navigation systems by 2014.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

(a) note the information contained in this paper;

(b) consider the utilization of interoperable satellite systems such as Inmarsat and MTSAT as a short-term solution to the assurance of AMSS data link continuity;

(c) recognize the necessity of establishing operational environment which enable seamless AMSS operation for AESs, and architecting AMSS Systems with appropriate redundancy both at satellite and ground segment; and

(d) recognize the necessity of timely development of SARPs and other relevant standards for future satellite communication systems in order to effectively implement terrestrial and aircraft components in concert on a long-term basis.

4. REFERENCES

[1] Glen Dyer, ITT - ADVANCED ENGINEERING & SCIENCES DIVISION, “Identification of Technologies for Provision of Future Aeronautical Communications”, July 21 2006

5. LIST OF RELEVANT PAPERS

[1] Japan, “Near-term future plan of MTSAT systems”, CNS/MET SG/15 IP-33, July 25 2011

[2] ICAO Secretariat, “Evolving satellite communication service provision and performance”, SOCM/1 WP-2, August 26 2009.

[3] Japan, “MTSAT status and plans”, SOCM/1 WP-3, August 26 2009

— — — — — — — — — — — —