

## **STATUS OF FOLLOW-ON SATELLITES TO MTSAT-2 AND RELATED PLANS**

This document reports on plans for Himawari-8 and Himawari-9 – the follow-on satellites to MTSAT-2.

JMA plans to launch Himawari-8 in summer 2014 and commence its operation in 2015, when MTSAT-2 is scheduled to complete its period of operation. The Agency also plans to launch Himawari-9 in 2016.

In July 2009, JMA completed contract arrangements for the manufacture of Himawari-8 and -9, which have identical specifications. Currently, their production is in the design phase.

Himawari-8 and -9 carry Advanced Himawari Imager (AHI) units comparable to the Advanced Baseline Imager (ABI) on board GOES-R to enable enhanced nowcasting, NWP and environment monitoring.

JMA plans to use two ground stations to establish site diversity in the interests of mitigating the rain attenuation effect on the Ka-band to be used for the imagery data downlink. Downlinked data will be delivered to the Meteorological Satellite Center, which generates satellite products and delivers them to users.

## STATUS OF FOLLOW-ON SATELLITES TO MTSAT-2 AND RELATED PLANS

### 1 INTRODUCTION

The Japan Meteorological Agency (JMA) has operated the GMS and MTSAT series of satellites at around 140 degrees east to cover the East Asia and Western Pacific regions since 1977, and makes related contributions to the WMO's World Weather Watch (WWW) Programme. As a follow-on to the MTSAT series, the Agency plans to operate next-generation satellites called Himawari-8 and Himawari-9 (*himawari* means "sunflower" in Japanese). This working paper introduces the status of these satellites and related plans.

### 2 SCHEDULE

Currently, MTSAT-2 (also called Himawari-7) is operational, while MTSAT-1R (also called Himawari-6) is on standby in orbit. MTSAT-2, which took over the earth observation mission of MTSAT-1R on July 1, 2010, is scheduled to complete its observation operation in around 2015 (see JMA-WP-02 for the status of the MTSAT series and related plans).

In order to provide continuous observation, JMA plans to launch Himawari-8 in 2014 and begin its operation in 2015. To ensure the robustness of the satellite observation system, the launch of a second follow-on satellite, Himawari-9, into in-orbit standby is also scheduled for 2016. JMA will continue to operate Himawari-8 and 9 at around 140 degrees east covering the East Asia and Western Pacific regions, as with the GMS and MTSAT series.

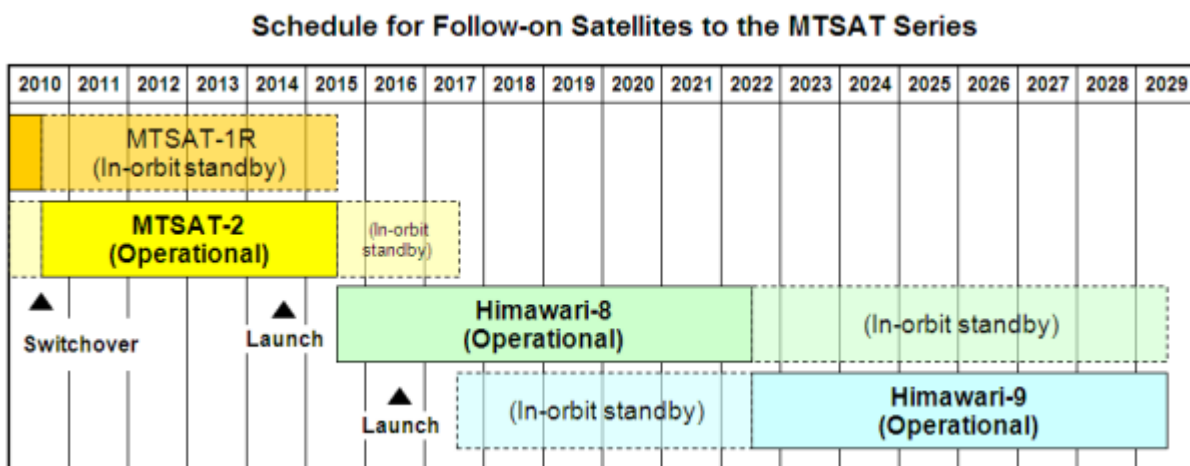


Figure 1 Schedule for the follow-on satellites to the MTSAT series

### 3 SPACE SEGMENT

Table 1 lists the major specifications of Himawari-8 and -9. JMA completed contract arrangements for the manufacture of these satellites in July 2009. The PDR (Preliminary Design Review) stage is now finished, and production is in the detailed design phase. The two units have identical specifications, and will be operated in the same geostationary orbiting position at around 140 degrees east.

Himawari-8 and -9 will have a dedicated meteorological mission, whereas MTSAT performs both meteorological and aeronautical functions. They will carry a new unit called the Advanced Himawari Imager (AHI). Table 2 shows JMA's requirements for the imager, which has capabilities comparable to those of the ABI imager on board GOES-R. The functions and specifications are notably improved from those of the imager on board MTSAT, and enable better nowcasting, improved numerical weather prediction accuracy and enhanced environmental monitoring. JMA-WP-07 introduces plans for new products created from Himawari-8 and -9 observation data.

New frequency bands will be introduced for communication between the satellites and ground stations. The Ka-band will be used for downlinking of meteorological data, and the Ku-band will be used for telemetry and command operations.

The satellites will each carry a transponder to relay environmental data from data collection platforms (DCPs) to sustain the data collection system (DCS) currently operated by MTSAT.

JMA plans to provide all imagery data from Himawari-8 and -9 using the Internet as the primary dissemination method. It is also researching the feasibility of other dissemination methods and technologies (see CGMS-35JMA-WP-07 for data dissemination methods of the follow-on satellites to MTSAT).

**Table 1 Major specifications of Himawari-8 and -9**

Geostationary position	Around 140°E
Attitude control	3-axis attitude-controlled geostationary satellite
Imaging sensor	Advanced Himawari Imager (AHI)
Communications	1) Raw observation data transmission Ka-band, 18.1 – 18.4 GHz (downlink)
	2) DCS International channel 402.0 – 402.1 MHz (uplink) Domestic channel 402.1 – 402.4 MHz (uplink) Transmission to ground segments Ka-band, 18.1 – 18.4 GHz (downlink)
	3) Telemetry and command Ku-band, 13.75 – 14.5 GHz (uplink) 12.2 – 12.75 GHz (downlink)
Contractor	Mitsubishi Electric Corporation
Launch vehicle	H-IIA rocket (planned)

**Table 2 JMA’s requirements for the Himawari-8 and -9 imager**

Imaging channels		
Band	Central wavelength (µm)	Spatial resolution (km)
Visible	0.46	1
	0.51	
	0.64	
Near-infrared	0.86	1
	1.6	2
	2.3	
Infrared	3.9	
	6.2	
	7.0	
	7.3	
	8.6	
	9.6	
	10.4	
	11.2	
	12.3	
13.3		

Observation	
Scan capability	Full disk: normal operation Area: definable schedule and location
Imaging rate	< 10 min (full disk)

Lifetime of meteorological mission	
	8 years of in-orbit operation out of a 15-year in-orbit period

**4 LIST OF FREQUENCIES TO BE USED BY FOLLOW-ON MTSAT MISSIONS  
(In response to CGMS Action 38.15)**

Tables 3 and 4 show basic information on the frequencies to be used by the follow-on MTSAT missions (called Himawari-8/-9).

Table 3: Frequencies from earth to space to be used by the Himawari system

Satellite	Frequency (MHz)	Direction	Emission <sup>1</sup>	Application	DBIU <sup>2</sup>
Himawari-8/-9	402.0 – 402.4	E-S	2K00G1D 4K00G1D 6K00G1D	DCP reports	2014/2016
Himawari-8/-9	13750 – 14500	E-S	TBD	TC, ranging	2014/2016

Table 4: Frequencies from space to earth to be used by the Himawari system

<sup>1</sup> In accordance with Appendix 1 of the radio regulations

<sup>2</sup> DBIU: Date of bringing into use

Satellite	Frequency (MHz)	Direction	Emission	Application	DBIU
Himawari-8/-9	18100 – 18400	S-E	TBD	Raw data	2014/2016
Himawari-8/-9	18100 – 18400	S-E	TBD	DCP reports	2014/2016
Himawari-8/-9	12200 – 12750	S-E	TBD	TM, ranging	2014/2016

## 5 GROUND SEGMENT

JMA plans to use two ground stations to establish site diversity in the interests of mitigating the rain attenuation effect on the Ka-band to be used for the imagery data downlink. The primary ground station will be located in the Kanto region (in the middle of Japan), and the secondary one will be placed in the Hokkaido region (in the north of Japan).

The imagery and DCP data collected at the ground stations will be sent to the Meteorological Satellite Center in Tokyo via dedicated lines for processing to generate satellite products for users.