

# 11

## MALAYSIAN SATELLITE SYSTEM

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### 11.1 INTRODUCTION

Satellite defined according to the Oxford English Dictionary [1]. A satellite is any object, man-made or natural, that orbits the Earth. In the context of spaceflight, a satellite is an object which has been placed into orbit by human endeavor. Such objects are sometimes called artificial satellites to distinguish them from natural satellites such as the Moon. System defined according to the Oxford English Dictionary [1]. A set of connected things or parts that form a whole or work together

### 11.2 MALAYSIA EAST ASIA SATELLITE PROJECT (MEASAT)

**MEASAT** (Malaysia East Asia Satellite) is the name of a line of Malaysian communications satellites owned and operated by MEASAT Satellite Systems Sdn. Bhd. (formerly Binariang Satellite Systems Sdn. Bhd.). In 2006, the MEASAT satellite network consists of three geostationary satellites designed and built by Boeing Satellite Development Center (formerly Boeing Satellite Systems). MEASAT-1 and MEASAT-2 were launched in 1996 and MEASAT-3 in 2006[2].

The MEASAT-1 and 2 satellites were designed to provide 12 years of both direct to user television service in Malaysia and general communications services in the region from Malaysia to the Philippines and from Beijing to Indonesia. With the launch of

MEASAT-3, the coverage extends to 70% of the world's population [2].

With the two high-powered Boeing 376HP communications satellites provided regional C-Band coverage and pioneered the use of Ku-Band in the high rain fall South East Asia region. The communication satellite used consist of several applications which is telephony, satellite television and radio, mobile satellite technology, amateur radio, satellite broadband and also military communications. Another function is satellite broadband. It has been used to connect to the Internet via broadband data connections in Malaysia[2].

### 11.3 MALAYSIAN SATELLITE

#### 11.3.1 MEASAT-1

Designation	23765/96002B
Launch date	12 Jan 1996
Country of origin	Malaysia
Mission	Telecommunications
Geostationary orbit	91.5°E
Launch vehicle	Ariane V82

#### Location

Begin	End	Position
L: 12 Jan 1996	Nov 2007	91.5°E
		Moving West

#### Specifications

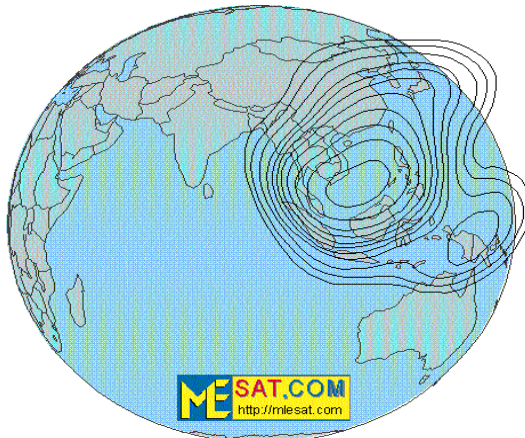
Prime contractor	Hughes
Platform	HS-376HP

Mass at launch	1450 kg
Mass in orbit	650 kg or 886 kg?
Diameter	2.16 m
Height	3.3 m (7.82 m deployed)
Solar array	Gallium arsenide
Stabilization	Spin stabilized
DC power	BOL : 1705 W EOL : 800 W
Design lifetime	12 years

The satellite uses gallium arsenide solar cells instead of silicon. It also features a specially contoured surface that eliminates the need for multiple feed horns. Also its has bipropellant propulsion system for stationkeeping and attitude control[9].

#### C-BAND

Main transponders	12
Backup transponders	3
Power	12 W (SSPA)
Bandwidth	36 MHz
Coverage	Malaysia, Philippines & South-India
EIRP max	39 dBW
G/T max	+3 dB/K
Polarization	Linear
Frequencies	Uplink : 5.925 – 6.425 GHz Downlink : 3.700 – 4200 GHz



**Measat 1 C-band Downlink Beam**

EIRP contours: 40, 39, 38, 37, 36, 35, 34, 33, 31, 29, 27 dBW

**Figure 11.1: MEASAT 1 C-Band Downlink Beam**

**K<sub>u</sub>-Band**

Main transponders	5
Backup transponders	1
Power	112 W (TWTA)
Bandwidth	54 MHz
Coverage	Narrow spots :Malaysia, Philippines & South-India
EIRP max	57 dBW
G/T max	+11 dB/K
Polarization	Linear
Frequencies	Uplink : 14.000 – 14.250 GHz

	Downlink : 10.950 – 11.200 GHz to 11.45 – 11.7 or 12.2 – 12.75 GHz
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K<sub>u</sub>-band transponder frequency chart (GHz)

<b>Vertical Downlink</b>	<b>Transponder</b>	<b>Horizontal Uplink</b>	<b>Beam</b>
10.982	1	14.032	Malaysia + Philippines
11.044	2	14.094	Malaysia + Philippines
11.106	3	14.156	Malaysia
11.167	4	14.218	Malaysia
12.284	5	13.784	South-India
12.346	6	13.846	South-India

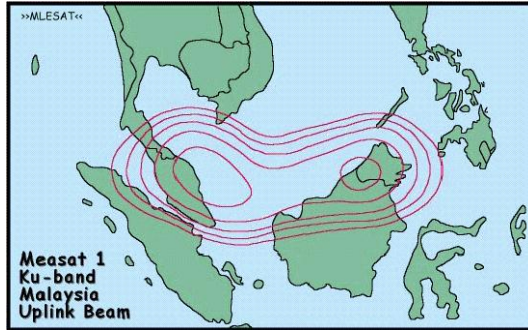


Figure 11.2: MEASAT 1 K<sub>U</sub>-Band Uplink Beam

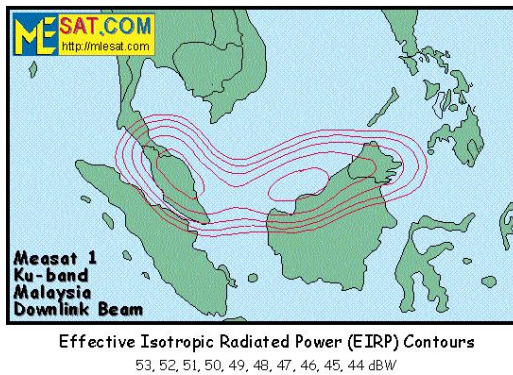


Figure 11.3: MEASAT 1 K<sub>U</sub>-Band Downlink Beam

### 11.3.2 MEASAT-2

Designation	24653/96063B
Launch date	13 Nov 1996
Country of origin	Malaysia
Mission	Telecommunications
Geostationary orbit	148°E
Launch vehicle	Ariane V92

## Specifications

Prime contractor	Hughes
Platform	HS-376HP
Mass at launch	1520 kg
Mass in orbit	650 kg or 886 kg?
Diameter	2.16 m
Height	3.3 m (7.82 m deployed)
Solar array	Gallium arsenide
Stabilization	Spin stabilized
DC power	1705 W
Design lifetime	11 years

The satellite uses gallium arsenide solar cells instead of silicon. It also features a specially contoured surface that eliminates the need for multiple feed horns. Also it has bipropellant propulsion system for station keeping and attitude control [10].

## C-BAND

Main transponders	6
Backup transponders	
Power	12 W (SSPA)
Bandwidth	72 MHz
Coverage	South-East Asia, East Australia and Hawaii
EIRP max	39 dBW
Polarization	Linear
Frequencies	Uplink : 5.925 – 6.425 GHz Downlink : 3.700 – 4200 GHz

K<sub>u</sub>-Band

Main transponders	11
Backup transponders	
Power	8 x 95 W 3 X 62 W
Bandwidth	48 MHz
Coverage	Switchable (by transponder) to : Malaysia, Queensland,/Australia, Philippines, India or Vietnam + Taiwan spot
EIRP max	57 dBW
Polarization	Linear
Frequencies	Uplink : 14.000 – 14.250 GHz Downlink : 10.950 – 11.200 GHz , switchable to 11.45 – 11.7 or 12.2 – 12.75 GHz

K<sub>u</sub>-band transponder frequency chart (GHz)

Vertical Downlink	Transponder	Vertical Uplink	Beam
10.982	1	14.032	
11.044	2	14.094	
11.106	3	14.156	
11.168	4	14.218	
	Further specs. lacking		



### 11.3.3 MEASAT-3

MEASAT-3 was located at 91.5 degrees East longitude and will provide expansion capacity for MEASAT to meet the increasing market demand for satellite services within the region. Boeing is also providing an upgrade to the MEASAT Teleport and Broadcast Center facilities by assisting in the relocation of MEASAT's control station to Cyberjaya, Malaysia near Kuala Lumpur [4].

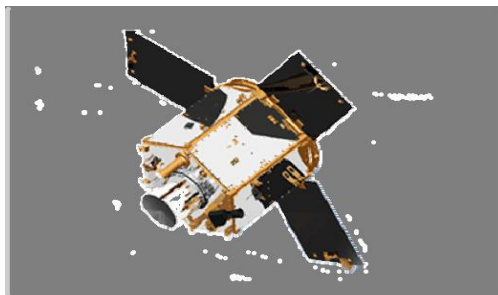
Designation	24648/00057A
Launch date	26 Sep 2000 at 10:05 UT
Country of origin	Malaysia
Mission	Remote Sensing
Geostationary orbit	64.7°
Launch vehicle	Dnepr #2

### Specifications

<b>PAYLOAD</b>	
C-Band	24 active transponders 65-watt TWTAs
K <sub>u</sub> -Band	24 active transponders 120-watt TWTAs
<b>POWER</b>	
Solar	10.8 kW
Beginning of life	9.8 k W
End of life	2 wings, each with 4 panels
Panels	of tripel-junction gallium arsenide solar cells
Batteries	32 cell NiH2
<b>PROPULSION</b>	

Liquid apogee motor	445 N (100 lbf)
Stationkeeping thrusters (bipropellant)	12- 10N (2 lbf)
DIMENSIONS	
In orbit	L, solar arrays: 26.2 m (86.0 ft) W, antennas: 7.7 m(25.1ft)
Stowed	Diameter : 3.8 m (12.5 ft) Height : 7.4 m (24.4 ft)
MASS	
Launch	4,900 kg (10,800 lb) separated mass
In orbit	3,220 kg (7,100 lb) beginning of life

### 11.3.4 RazakSat



**FIGURE 11.4:** RazakSAT Satellite

Malaysian agencies requiring satellite image currently rely upon image data and information provided by satellites manufactured and operated by foreign international companies. Due to the orbit in which such satellites are located, the images provided are neither timely enough nor does it cater to Malaysia's specific use and need. A Medium Aperture Camera Satellite (RazakSAT), Malaysia's own small satellite will be able to provide specific and timely data for its users in Malaysia as well as being able to cater to the needs of countries located on the equatorial belt [5].

The RazakSAT spacecraft is a small LEO satellite. It carries an electro-optical payload, a Medium-sized Aperture Camera (MAC) a pushbroom camera with 5 linear detectors (1 panchromatic, 4 multi-spectral). The RazakSAT satellite will be operated through its ground segment in Malaysia, consisting of a Mission Control Station (MCS) and Image Receiving and Processing Station (IRPS). ATSB™'s engineers are operators at the MCS and they will execute RazakSAT's mission plan, command generation and telemetry receiving, archiving and analysis. The IRPS will receive and archive images for post processing and distribution to the users. The development of the RazakSAT system is a collaborative programme between ATSB™ and Satrec Initiative Co. Ltd, Republic of Korea [5].

## **SPECIFICATIONS**

<b>Subsystem</b>	<b>Specifications</b>
Altitude	600 – 800 km
Inclination	7° ~ 9°
Payload (MAC)	GSD : 2.5 m (PAN), 5 m (MS) Swathwidth : 20 km @ 685 km
Attitude Determination & Control Subsystem (ADCS)	Three-axis stabilization based on four (reactin wheels) Pointing Accuracy : 0.2° Pointing Knowledge : 1 arcmin

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Electrical Power Subsystem (EPS)	GaAs/Ge solar cells on honeycomb substrate NiCd batteries (18 Ahr) Peak Power Tracking (PPT) & constant current control Solar Power : >300 W @ EOL
Command & Data Handling Subsystem (C&DH)	Two on-board computers Telemetry and command interface modules Analog Telemetry channels : up to 90 Digital Telemetry channels : up to 120
Telecommunication Subsystem (TS)	9600 bps/1200 bps S-brand TT&C uplink 38.4 kbs/9600 bps/1200 bps S-brand TT&C downlink
Payload Data Management	32 Gbits On-board solid-state memory 30 Mbps X-brand payload data downlink
Structure & Thermal	Ø1200 x 1200 mm Hexagonal shape Mass : < 200 kg Modular structure Passive & Active thermal control
Mission Lifetime	>3 years

**PAYLOAD SPECIFICATION**

Spectral Brands	1 panchromantic Band 4 Multispectral Bands	510-730 nm 450 - 890 nm
Ground Sampling Distance (GSD)	PAN : 2.5 m MS : 5.0 m	at 685 km
Swath Width	20 km	at 685 km
Signal to Noise Ratio	> 70	
Quantization	> 8 bits	For all bands
Signal Gain	Programmable	
Mass Storage	32 Gbits	(approximately 500 km image strip)
Mission Lifetime	> 3 years	

**11.4 CONCLUSION**

According to research and data gained from the trusted sources, we can concluded that Malaysia have 4 types of satellite which are MEASAT-1, MEASAT-2, MEASAT-3(TIUNGSAT) and RazakSAT which were used for several function such as telephony, satellite television and radio, mobile satellite technology, amateur radio, satellite broadband, satellite image and military communications. With the launch of the country's first two satellites in 1996, Malaysia having anchored itself in the satellite communication services industry. With the satellite system indirectly, it will help to boost our economy, knowledge sharing and it will bring Malaysian update with the latest technology.

## REFERENCES

- [1] Oxford English Dictionary second edition 1989.
- [2] <http://www.measat.com.my/>.
- [3] [http://en.wikipedia.org/wiki/Communications\\_satellite](http://en.wikipedia.org/wiki/Communications_satellite).
- [4] [http://www.measat.com.my/satellite\\_91e\\_measat3.html](http://www.measat.com.my/satellite_91e_measat3.html).
- [5] <http://razaksat.com/razaksat.asp>
- [6] [http://www.measat.com/satellite\\_91e\\_measat3.html](http://www.measat.com/satellite_91e_measat3.html)
- [7] <http://www.mlesat.com/Measat.html>
- [8] <http://www.astronautix.com/project/measat.htm>
- [9] [http://www.tbs-satellite.com/tse/online/sat\\_measat\\_1.html](http://www.tbs-satellite.com/tse/online/sat_measat_1.html)
- [10] [http://www.tbs-satellite.com/tse/online/sat\\_measat\\_2.html](http://www.tbs-satellite.com/tse/online/sat_measat_2.html)
- [11] . [http://www.measat.com.my/satellite\\_91e\\_measat3.html](http://www.measat.com.my/satellite_91e_measat3.html)