Titel:/Title:/Titre:

MOS-1 Project in Japan

Autor(en)/Author(s)/Auteur(s):

Yukio Hakura

National Space Development Agency of Japan

Zusammenfassung:/Abstract:/Sommaire:

The MOS-1 (Marine Observation Satellite-1) is under development in Japan with target date of its launch in FY 1984. The satellite is to install three kinds of sensors: a pair of visible and near infrared radiometers (MESSR: multispectral electronic self-scanning radiometer), a visible and thermal infrared radiometer, and a microwave scanning radiometer (MSR) This paper outlines the present status of MOS-1 development, and some of basic studies being made for the follow-on MOS and LOS (Land Observation Satellite) programs.

MOS-1 PROJECT IN JAPAN

Yukio Hakura
National Space Development Agency of Japan

1. Introduction

As a result of the great success of Landsats, Seasat, and other remote sensing satellites launched by the United States National Aeronautics and Space Administration, much of the world has recognized the benifits which can be derived through observation of the earth from space. Several countries including Canada, ESA, France and India have announced plans to develop their own earth observation satellites.

In Japan, the Space Activity Commission, in March 1978, formulated the outline of its space development policy indicating the long range frame work and guideline that should be set for space development in Japan over the next 15 years. According to this policy , earth observation field will be in the main frame work of Japanese space development. In September 1978, the Remote Sensing Promotion Council of the Science and Technology Agency formed the plan of Japanese earth observation satellite development, the Marine and Land Observation Satellites (MOS and LOS).[1,2] The first satellite of this series, MOS-1 (Marine Observation Satellite-1), is now under development by the National Space Development Agency of Japan (NASDA) with target date of its launch in FY 1984. This paper outlines the present status of MOS-1 development, and some of basic studies being made for the follow-on MOS and LOS programs.

2. Description of MOS-1

The mission objectives of MOS-1 are to establish fundamental technologies for the earth observation satellites, to observe the states of sea surface and atmosphere using visible, infrared, and microwave radiometers, and to verify the performance of these sensors [3,4]. At present, the satellite is in a basic design phase and its onboard sensors are now under engineering model development.

The satellite will be launched in the sun-synchronous orbit by a N-II vechicle. The planned orbital parameters are as follows:

Altitude	909 Km
Inclination	about 99.1 degrees
Recurrent period	17 days
Local time of decending node	10 - 11 a.m.

The satellite is to install three kinds of radiometers: a pair of visible and near-infrared radiometer (MESSR: multispectral electronic self-scanning radiometer), a visible and thermal infrared radiometer (VTIR), and a microwave scanning radiometer (MSR). In order to perform experiments concerning data collection system (DCS), the satellite will carry an equipment receiving the signals from data collection platforms (DCP's).

The MOS-1 is a three axis stabilized spacecraft which weighs about 750 Kg. It will be launched from Tanegashima Space Center in FY 1984.

3. Characteristics of Sensors

The anticipated characteristics of the sensors aboard

Table 1 MOS-1 are summarized in Table 1.

MESSR

The sensor is composed of two optical elements. Each element has two visible and two near-infrared channels. Charge-coupled devices (CCD's) having 2,048 elements are used for sensing element. The size of an element on CCD array is about 14 μm x 14 μm which corresponds to 50 m x 50 m picture element on the ground surface. A parallel operation of two optical elements yields scanning width of about 200 Km on the ground. Fig.1 shows the spectral wavelength intervals of MOS-1 sensors in comparison with those of MSS (multispectral scanner) aboard Landsat-3, TM (thematic mapper) to be installed on Landsat-D, CZCS (coastal zone color scanner) aboard Nimbus-7, and HRV (high resolution in visible) to be installed on French satellite, SPOT. The wavelength intervals of MESSR resemble to the visible and near-infrared bands of MSS aboard Landsat-3. Thus, MESSR data is expected to be utilized in all the application field of Landsat MSS data. As a marine observation satellite, utilization for the monitoring of water pollution and sea ice, the location of fishery grounds, the basic study of ocean dynamics, etc. are especially expected. The band 2 of MESSR corresponds to the band 4 of CZCS which could measure chlorophyll concentration in the vegetal plankton.

Fig.1

VTIR

VTIR has a visible channel and three infrared channels. Si-PIN diodes are used for the visible band sensing element, while Hg Cd Te are used for detecting infrared signals. Each channel has two detector elements in order to increase

reliablity. The scanning is made by rotating a reflecting mirror with the rotation speed of 7.3 rps. The thermal information from this sensor in addition to the color information from MESSR will provide a powerful tool to exploit the oceans surrounding our country.

MSR

MSR is composed of two Dicke type radiometers on frequencies of 23.8 and 31.4 GHz. The scanning is made by rotating an offset parabolic reflecter (diameter 50 cm) with the rotation speed of about 19 rpm. The 23 GHz band, near the absorption band of water vapor, is to observe water content of the atmosphere, using the fact that the emissivity of sea surface is rather low. The 31 GHz band may be used to compensate the effect caused by liquid water in cloud and to observe the sea ice.

Data Transmission

For transmitting the MESSR and the VTIR data with the data rate of about 9 Mbps, 8 GHz band will be used, while the MSR data will be transmitted by 2 GHz link.

4. Preparation for Follow-on Programs

The main purposes of MOS-2 and -3 which follow MOS-1 are to observe marine physical phenomena by active microwave sensors, such as altimeter, scatterometer, synthetic aperture radar (SAR), etc. In FY 1978, the Science and Technology Agency (STA) made a study on the objectives and technical problems of MOS-1 follow-on program taking user's demands into account and drafted a basic plan of MOS-2[5]. R & D of altimeter, scatterometer and SAR have been conducted by NASDA with assistance of industries and universities, as

a preparatory work for the MOS series satellites.

In parallel with the MOS-series, a series of land observation satellites are to be developed. The STA is conducting a mission research and feasibility study for the LOS satellites in 1979 FY [6].

References

1. Policy in relation to the promotion of research, development, and utilization of remote sensing technology, the Remote Sensing Promotion Council of the Science and Technology Agency, September 1978.

2. A. Suzuki, Earth observation program in Japan, Uchu No.13 a special issue for remote sensing, pp. 1- 16, 1979.

3. J. Tabata, On the development of Marine Observation Satellite-1 (MOS-1), Uchu No.13 a special issue for remote sensing, pp. 17 - 23, 1979.

4. S. Niwa, Y. Ishizawa, and R. Kuramasu, Development of Marine Observation Satellite-1 (MOS-1), the paper presented at the 30th IAF meeting held in München in 1979.

5. Study on marine observation satellite technology, the Remote Sensing Technology Center (RESTEC) for the Science and Technology Agency (STA), March 1979.

6. Study on land observation satellite technology, RESTEC for STA, 1980.

ITEM \ SENSOR	MESSR	VTIR		MSR	
MEASUREMENT OBJECTIVES	sea surface color	sea surface temperature		water content of atmosphere	
WAVELENGTH (μm)	0.51-0.59 0.64-0.72 0.72-0.80 0.80-1.10	0.5-0.7	6-7 10.5-11.5 11.5-12.5		
FREQUENCY (GHz)				23.8	31.4
GEOMETRIC RESOLUTION	50 m	0.9 km	2.7 km	47 km	38 km
S/N	39 dB-15 dB	55 dB (alb.=80%)			
RADIOMETRIC RESOLUTION			<0.5 K at 300 K	<1.5 K at 300K	<1.5 K at 300K
SWATH (km)	100 x 2	>500		320	
SCANNING METHOD	electrical	mechanical		mechanical	
SCANNING PERIOD	7.6 msec	13.7 msec		3.2 sec	
DATA RATE	8.78 Mbps			2 kbps	

Table 1 Characteristics of MOS-1 sensors

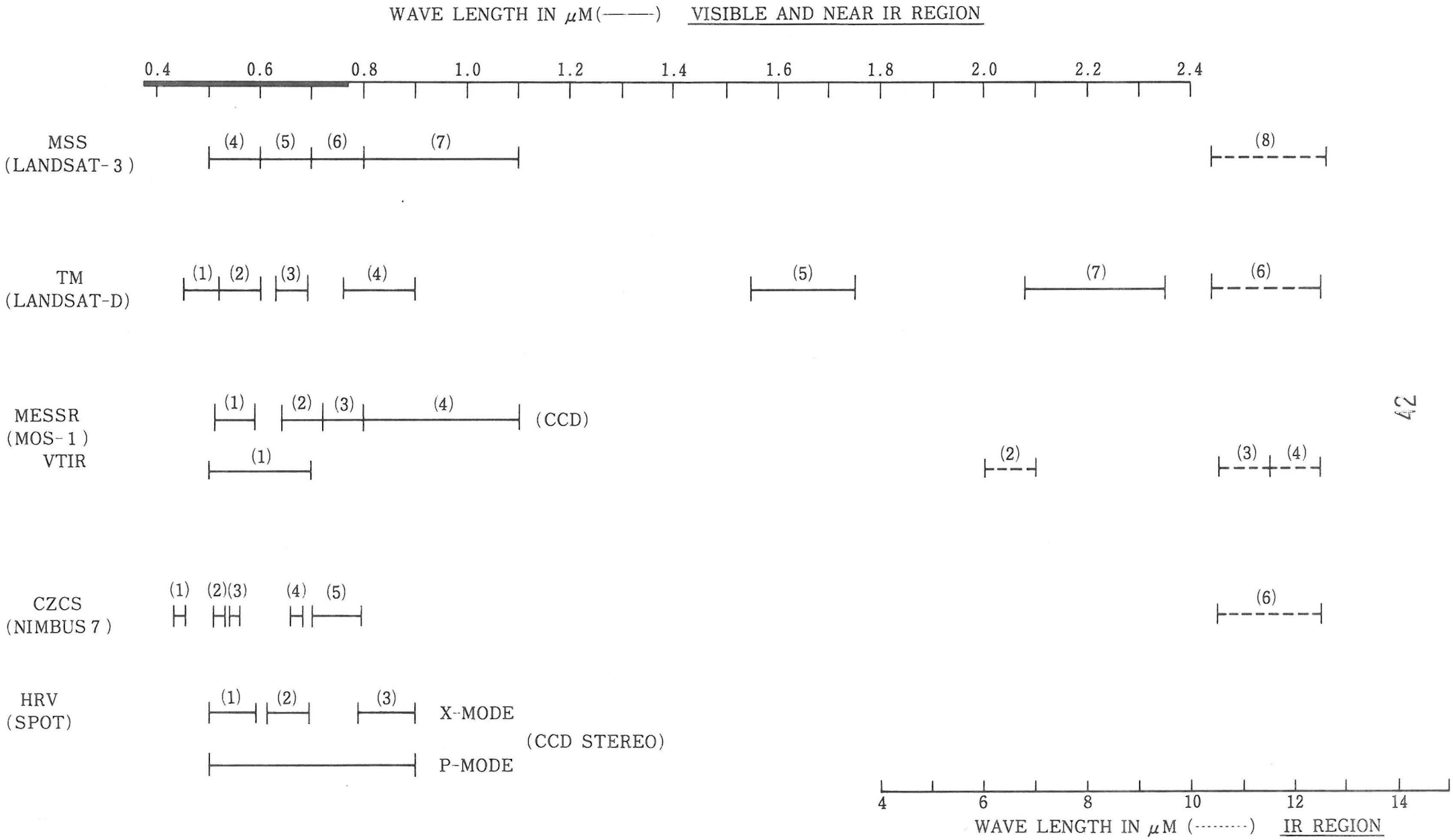

Fig. 1 Spectral wavelength intervals of optical sensors aboard Landsats, MOS-1, Nimbus-7, and SPOT.