

# Resourcesat - 2



**nrsc**

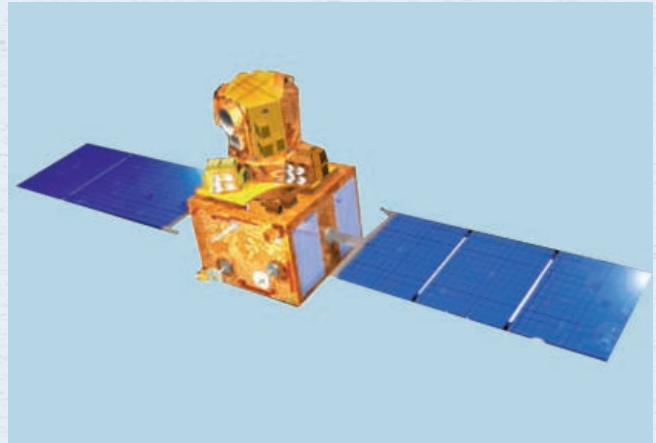
National Remote Sensing Centre  
Indian Space Research Organisation  
Dept. of Space, Govt. of India



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## Overview

The Indian Space Research Organisation's (ISRO) Polar Satellite Launch Vehicle (PSLV-C16) placed three satellites in orbit – India's Resourcesat-2, the Indo-Russian Yuthsat and the X-Sat from the Nanyang Technological University of Singapore on Wednesday, 20th April, 2011. The Resourcesat-2 with enhanced capabilities is a follow on of Resourcesat-1, launched on 17<sup>th</sup> October 2003. It has three cameras mounted on a single platform with high resolution sensors



LISS-IV, medium resolution LISS-III and a coarse resolution AWiFS. It provides continuity of remote sensing data for various national and international projects. The core objective of this mission is to support remote sensing data for integrated land and water resources management at micro level, with improved spectral and spatial coverage. This data also supports many projects in diversified fields of applications like agricultural crop discrimination and monitoring, crop acreage / yield estimation, precision farming, water resources, forest mapping, infrastructure development, disaster management, snow and glacier studies, coastal zone management, urban landscape, locating groundwater potential zones etc.,. It has the capability to capture the data globally through the on-board Solid State Recorder having 400 GB capacity apart from making the data available to the ground stations in real time.

### The improvements over Resourcesat-1 are:

1. LISS-IV MX operation with 70 km swath for Indian foot print and flexibility to operate in 23 km swath.
2. AWiFS data with 12 bit radiometric resolution.
3. LISS-III and LISS-IV data with 10 bits radiometric resolution.
4. Enhanced power to facilitate increased operations per orbit.
5. Improved SSR capacity of 200GB and an extra of 200 GB only for 70 km MX data.

## Orbit and coverage details

Resourcesat-2 is a three axes stabilized body and carries three optical cameras. The main objective of this mission is to provide systematic and repetitive coverage of the earth's surface under nearly constant illumination conditions. The orbit is similar to that of Resourcesat-1 i.e., the satellite operates in a circular, sun-synchronous, near polar orbit with an inclination of 98.69 deg, at an altitude of 817 Km. The satellite takes 101.35 minutes to complete one revolution around the earth and completes about 14 orbits per day. The entire earth is covered by 341 orbits during a 24 day cycle. The Referencing Scheme for Resourcesat-2 is identical to that of Resourcesat-1. The orbital parameters are given in Table-1.

Semi-major axis	7195.12 Km
Altitude	817 Km
Inclination	98.69 deg
No. of orbits per day	14 5/24
Orbit period	101.35 min
Eccentricity	0.001
Repetivity (LISS-III)	24 days
Revist (LISS-IV)	5 days
Repetivity (AWiFS)	5 days
Distance between adjacent tracks	117.5 Km
Ground Trace Velocity	6.65 Km/Sec
Equatorial Crossing Time	10:30 AM $\pm$ 10 min (at descending node)

Table-1

## Payloads

The three payloads are Advanced Wide Field Sensor (AWiFS), Linear Imaging Self Scanning sensor (LISS-III) and a high resolution multi-spectral sensor LISS-IV, along with an on-board solid state recorder (OBSSR). LISS-III and AWiFS sensors acquire data in four identical spectral bands ie VIS-NIR-SWIR range, while LISS-IV is a high resolution sensor with three spectral bands in VIS-NIR range. The payloads can be operated either in real time mode by direct transmission to ground station or in record and playback mode using 400 GB capacity on board solid state recorder. The satellite is premeditated to provide both multi-spectral and panchromatic imagery of the Earth's surface. All the sensors will be working on the 'pushbroom scanning' concept using linear arrays of Charge Coupled Devices (CCDs). In this mode of operation, each line of image is electronically scanned and contiguous lines are imaged by the forward motion of the satellite.

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## AWiFS

The AWiFS sensor on-board Resourcesat-2 has enhanced capabilities compared to the AWiFS of Resourcesat-1 in terms of radiometric resolution (12 bits vs 10 bits) with revisit period of 5 days. The data is acquired in four spectral bands, three in the visible and in NIR (VNIR B2, B3 and B4) and one in the short wave infrared (SWIR B5). The AWiFS camera is realized in two electro-optic modules viz. AWiFS-A and AWiFS-B, providing a combined swath of 740 Km. Each camera consists of four lens assemblies, detectors and associated electronics pertaining to the four spectral bands B2, B3, B4 and B5.

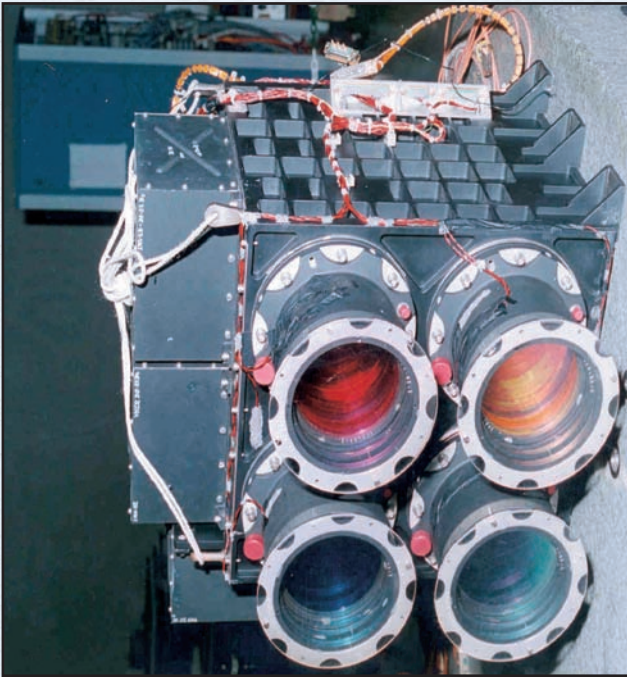


Part of Krishna Basin

Acquired on 04-05-2011



## LISS - III



The medium resolution multi-spectral sensor, LISS-III is similar to that of LISS-III of Resourcesat-1 and operates in four spectral bands - B2, B3, B4 in visible near infrared (VNIR) and B5 in Short Wave Infrared (SWIR) providing data with 23.5m resolution. The LISS-III camera uses refractive optics for all four spectral bands. All bands will provide 100% albedo coverage with 1024 levels of quantization against the limited albedo coverage with 127 radiometric levels and four selectable gains for VNIR bands of Resourcesat-1. The camera electronics is same as in Resourcesat-1 except for 10 bit digitisation as against 7 bit digitisation.

Part of Ahmedabad

Acquired on 02-05-2011

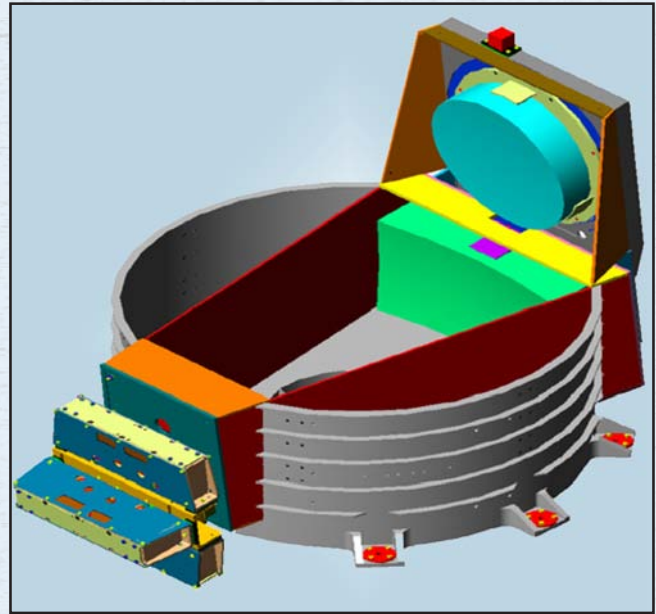


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## LISS - IV

The LISS-IV sensor is a multispectral high resolution camera with a spatial resolution of 5.8 m at nadir. The payload provides multispectral imagery covering a swath of 70 Km as compared to 23 km swath of Resourcesat-1. The LISS-IV camera has the additional feature of off-nadir viewing capability by tilting the camera by +/- 26 degrees using which, 5 days revisit is possible for any given ground area. The data is acquired in three spectral bands namely visible and near infrared (B2, B3 and B4). It has both MX Mode (1/3rd swath) and Mono Mode (full swath) of operation as in Resourcesat-1. 70 Km swath coverage for MX which uses onboard SSR is also designed for Resourcesat-2. Each

spectral band has 12K element linear CCDs, each having a pixel size of  $7\mu\text{m} \times 7\mu\text{m}$ . The Odd and Even pixel rows are arranged in a staggered mode separated by  $35\mu$  (equal to 5 scan lines). The system has 10-bit quantization and covers 100% Albedo with single gain and hence no gain commands are required.



Part of Dubai

Acquired on 08-05-2011



## Sensor Specifications

A comparison of all three sensors of Resourcesat-2 is given in Table-2.

SPECIFICATIONS	AWiFS	LISS-III	LISS-IV
No. of Bands	4	4	1 (mono), 3 (MX)
Spectral Bands ( $\mu$ )	B2 0.52 – 0.59 B3 0.62 – 0.68 B4 0.77 – 0.86 B5 1.55 – 1.70	B2 0.52 – 0.59 B3 0.62 – 0.68 B4 0.77 – 0.86 B5 1.55 – 1.70	B2 0.52 – 0.59 B3 0.62 – 0.68 B4 0.77 – 0.86  B3-default band for mono
Resolution (m)	56	23.5	5.8
Swath (Km)	740	140	70 / 23
Revisit (days)	5	24	5
Data Rate (Mbs per stream)	105	105	105
Quantisation	12-bit	10-bit	10-bit
Gains	100% Albedo No Gain setting	100% Albedo No Gain setting	100% Albedo No Gain setting

Table-2

## Data Products

Owing to the necessities of the user demands and keeping in view the international scenarios, geo-orthokits, geo-referenced data with RPCs and orthorectified products are additionally introduced.

The data products can be broadly classified as standard and value added products. Standard products are full scene (path-row) based geo-referenced as well as geo-orthokit products with RPCs as against the basic geo-referenced products offered in Resourcesat-1 for all the sensors. For all the sensors, scene based products will be supplied as per the user AOI. Photo products are available as scene based geo-referenced products for LISS-III and AWiFS quadrants only. HDF-5 data format has been newly introduced while retaining the geo-tiff data format for digital products.

Scene ortho products are available for all the sensors. Map based (SOI toposheet) ortho products on 1:50,000 scale for LISS-III and on 1:25,000 for LISS-IV MX products are available. In addition to this, bundled co-registered digital data of Cartosat-1/2 and LISS-IV MX, depending upon the availability of Cartosat 1 / 2 data is introduced. The standard processing details like projection, Resampling, Ellipsoid etc., are available for Resourcesat-2 data also. The details of sensor, product type and coverage are given in Table-3.

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Sensor	Product type	Area Coverage KM	Correction Level	Accuracy
AWiFS	Path-Row scene based	370 x 370	Geo-referenced & Geo-Ref + RPC	200 m
			Orthorectified	Better than 50m
LISS-3	Path-Row scene based	140 x 140	Geo-Referenced & Geo-Ref + RPC	150 m
			Orthorectified	Better than 24m
	Geocoded 15' x 15'	28 x 28	Orthorectified	Better than 24m
LISS-IV MX	Path-Row scene based	70 x 70/23 x 23	Geo-Referenced & Geo-Ref + RPC	100 m
			Orthorectified	Better than 05m
	Geocoded 7.5' x 7.5'	14 x 14	Orthorectified	Better than 05m

Table-3

## Data Ordering

Users can browse and order data online through User Order Processing System (UOPS) provided at NRSC web site [www.nrsc.gov.in](http://www.nrsc.gov.in). The data requirements for future dates and geographical areas beyond the visibility circle of Shadnagar Earth Station facility will be serviced through on-board Solid State Recorder. The data will be delivered by electronic mode with 5% discount and no media will be supplied in such case i.e. ftp or by the conventional surface mode.

### For further details please contact:

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