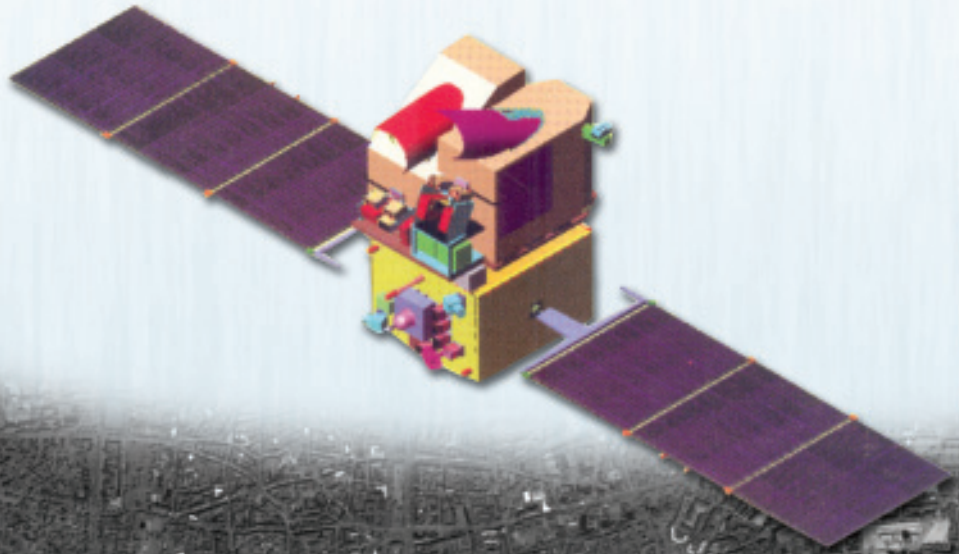
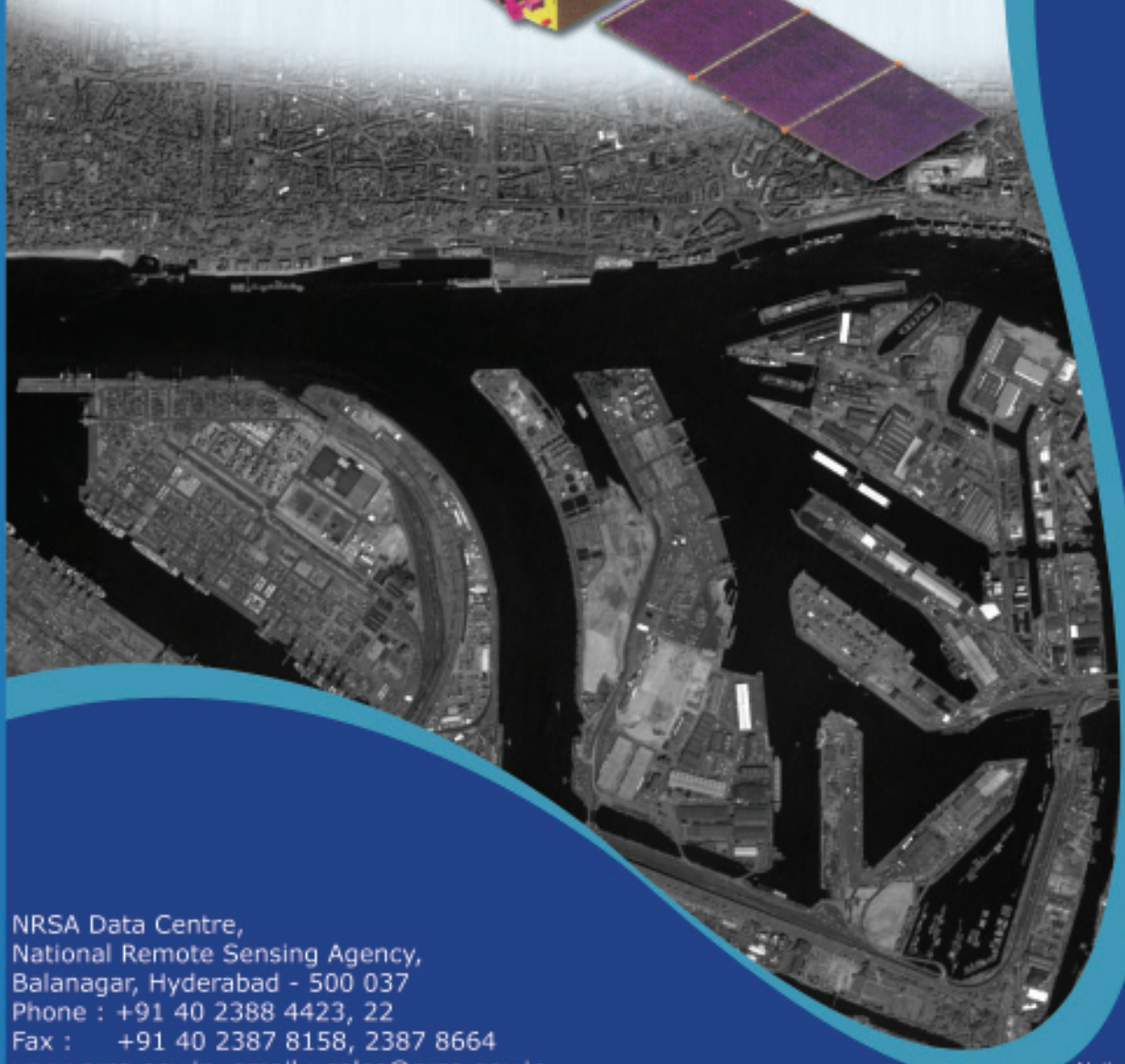
ANTRIX

इसरो ISRO

CARTOSAT - 1

A global IRS Mission for large scale mapping and Terrain Modelling applications





CARTOSAT-1

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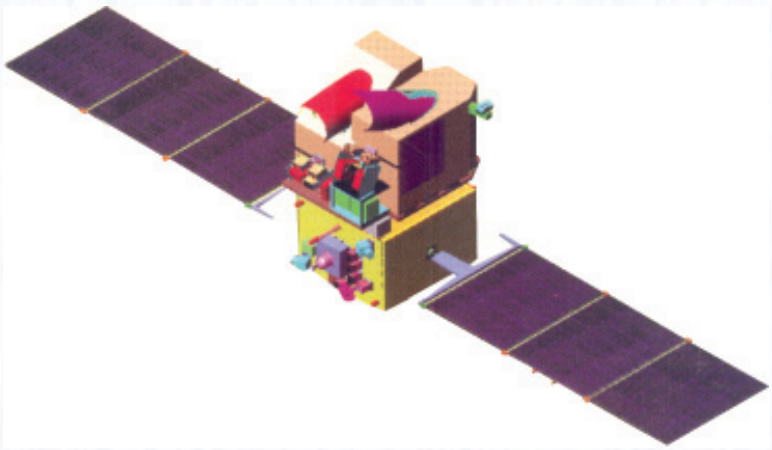
ISO 9001 : 2000

National Remote Sensing Agency

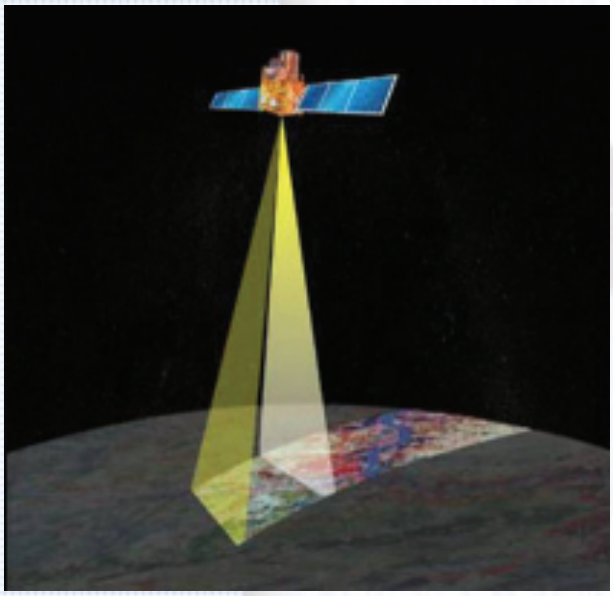
Introduction

Department of Space (DOS), Government of India has a glorious history of having launched a series of satellites for Earth's resource management and monitoring. These satellites have been very successful in providing data in various scales ranging from 1:1Million upto 1:12,500 scale.

Cartosat - 1



Along Track Stereo Viewing

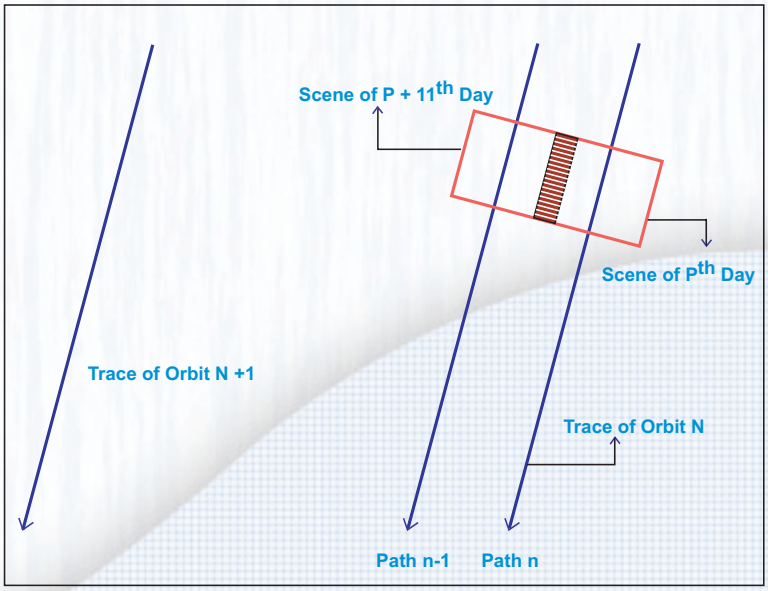


Globally there are many satellite systems which provide high resolution data to meet the requirements for geo-engineering and cartographic applications. The Cartosat-1 satellite has a number of advantages over these systems in that it provides high resolution near-instantaneous stereo data with a spatial resolution of 2.5m and 10bit quantization.The Cartosat-1 carries two Panchromatic cameras, which generate stereoscopic image of the area along the track.

Each of the IRS Missions ensured data continuity while introducing improvements in the spatial, spectral and radiometric resolutions. Hitherto, the best spatial resolution offered from the IRS satellites is 5.8m in both Panchromaticand multispectral mode.

There is now an increasing demand for large scale and topographic mapping. To meet this requirement. DOS has launched the **Cartosat-1** satellite which is dedicated to stereo viewing for large scale mapping and terrrain modelling applications.

Ground Trace Pattern



Orbit and Coverage

Cartosat-1 is a global mission. The nominal life of the mission is planned to be five years. The satellite was launched by the indigenously built Polar Satellite Launch Vehicle (PSLV - C5). The satellite covers the entire globe in 1867 orbits with a repetivity of 126 days. Adjacent paths are covered with a separation of eleven days.

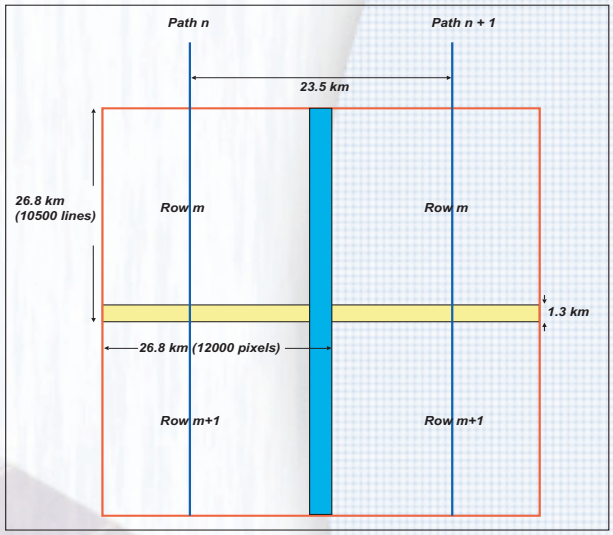
Orbit Specifications

S.No	Parameter	Specifications
01	Orbit	Polar Sun Synchronous
02	Orbital Altitude	618 km
03	Orbits / cycle	1867
04	Semi Major Axis	6996.14 km
05	Eccentricity	0.001
06	Inclination	97.87 ^{o}
07	Local Time	10:30 AM
08	Revisit	5 days
09	Repetition	126 days
10	Orbits / day	14
11	Orbital Period	97 minutes

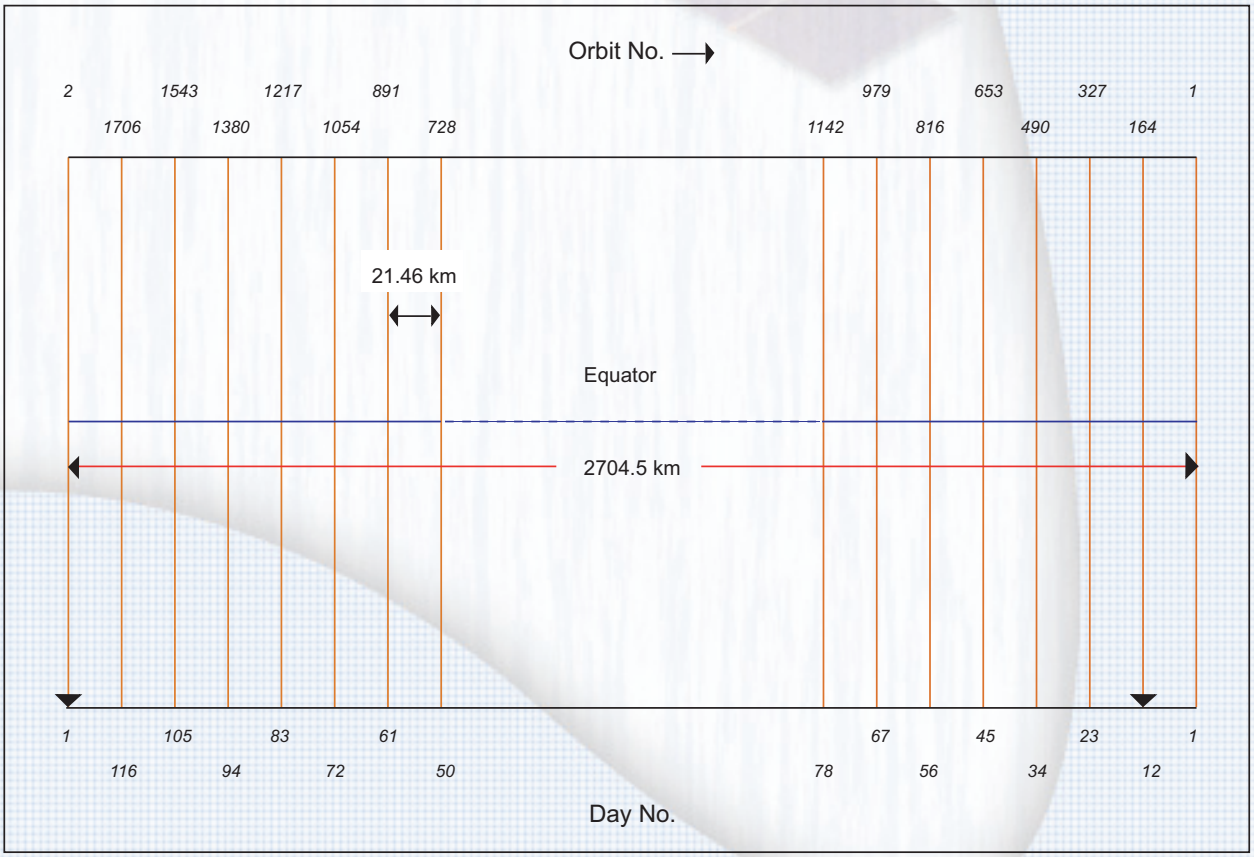
Payload

The Cartosat-1 satellite has two panchromatic cameras with 2.5 m spatial resolution, to acquire two images simultaneously, one forward looking (FORE) at +26 degrees and one aft of the satellite at -5 degrees for near instantaneous stereo data.The time difference between the acquisitions of the same scene by the two

Stereo Scene Layout



Orbit & Coverage Pattern



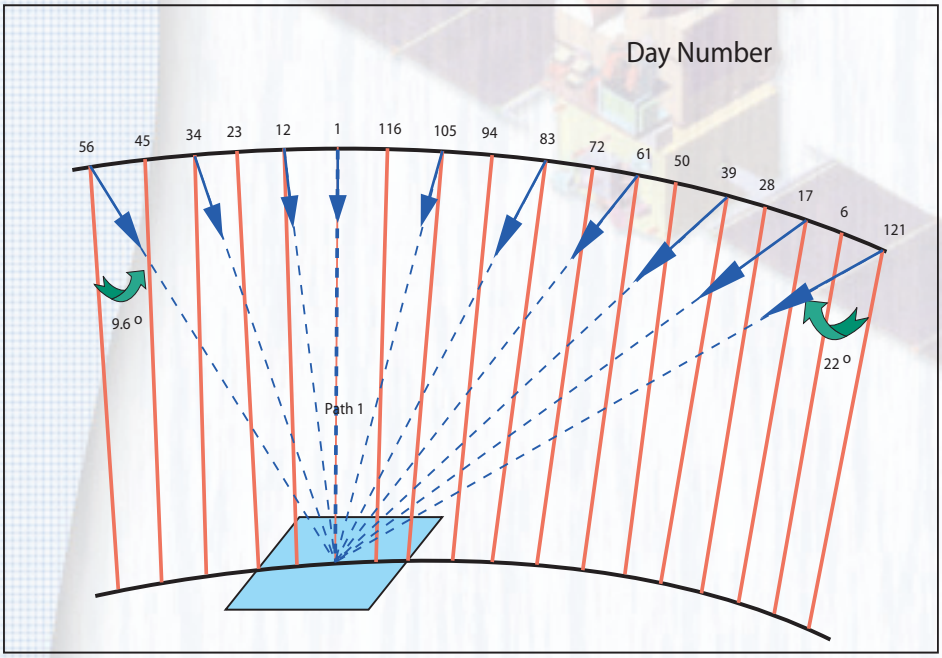
cameras is about 52 seconds. The spacecraft body is steerable to compensate the earth rotation effect and to force both Fore and Aft cameras to look at the same ground strip when operated in stereo mode. Simultaneous stereo pair acquisitions are of great advantage since the radiometric parameters of the images will be identical. The stereo pairs have a swath of 26 km and a fixed B/H ratio of 0.62. Apart from the stereo mode, the satellite is also equipped to operate in the wide swath mode. When operated in this mode the satellite can be maneuvered such that image strips will fall side by side so that wider swath images of 55 km are obtained by the cameras. The spacecraft also has a facility to provide various pitch-biases to vary the look angle conditions of the stereo pair.

The satellite covers the same area in a specified interval of 126 days.Cartosat-1's roll tilt capability can be used to increase this viewing frequency, which varies with latitude. The revisit capability at equator is 5 days.

Payload Specifications

S.No	Parameter		Specifications
01	Swath	Fore	29.42 km
		Aft	26.24 km
02	IGFOV	Fore	2.452 m (Across track)
		Aft	2.187 m (Across track)
03	Ground sample distance		2.54 m (Along Track)
04	Spectral band		0.5 – 0.85 microns
05	Quantisation		10 bits (1024)
06	Number of detectors		12 K
07	Pixel size		7 x 7 micron
08	Integration time		0.336 ms
09	Focal length		1945 mm
10	Data rate per Camera		336 Mbps
11	Data compression Ratio		3.22:1(nominal)depends on terrain
12	Type of compression		JPEG
13	Data rate transmitted to ground		105 Mbps/camera

Roll Tilt Capability



Data Handling system

The data rate requirement for 2.5 m resolution system is about 336 Mbps for a 10 bit quantization. This high bit data is compressed by 3.2:1 by JPEG compression technique. A spherical Phased Array Antenna with steerable beam is used to transmit the data to the required ground station. A solid state recorder with 120 Gb capacity to store about 9 minutes of Payload data is available for global operation of the payloads.

Cartosat - 1 Products

Cartosat-1 data products are of two categories.

* Standard product (radiometrically corrected, georeferenced)
* Precision product (ortho rectified product)

Standard products are generated after accounting for radiometric and geometric distortions while precision products are ortho rectified. Ortho rectified products are corrected for terrain distortions and camera tilt effects with the help of control points and using Stereo Strip Triangulation (SST) based DEM (only for Indian region). All Cartosat-1 data products are supplied with 10 bit radiometry for both PAN Fore and Aft cameras.

Area of Interest (AOI) based standard products

One or more scenes covering the user's area of interest, specified as a single polygon in the form of an ESRI shapefile, are provided as tiled products (not mosaiced). The user-specified polygon (order polygon) is padded outside with extra buffer distance to ensure the area coverage, considering the accuracy specifications of the system corrected product. The modified polygon boundaries are used to define each constituent full/sub-scene product. The different tiles are not radiometrically matched. The minimum order area is 25 km x 25 km. The location accuracy of these products is better than 250m. All AOI based products are provided as digital products (CD/DVD) only. AOI products are available for only radiometrically corrected or Geo-referenced data.

Standard Products

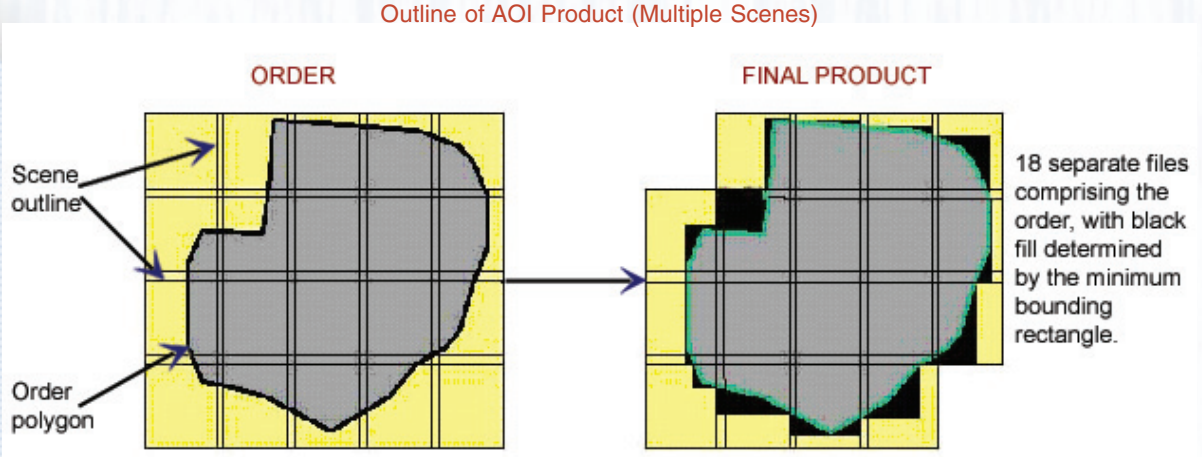
S. No	Type of Product	Correction applied
01	Radiometrically corrected / Basic Stereo	Stagger corrections, line loss corrections, radiometric correction at scene level
02	Standard Georeferenced	Radiometric and geometric corrections (north-oriented) at scene level using System knowledge
03	Orthokit products (Mono / Stereo)	Radiometric corrections along with Rational Polynomial Coefficients (RPCs)
04	Ortho product	Terrain corrected products using TCPs and DEM from SST software (only for Indian region)

Standard Products Specifications

S. No	Area Coverage (Scene based / Float)	Level of Processing	Digital data Format	Media	Accuracy specifications		Remarks
					Location Accuracy	Internal Distortion	
01	Scene/float Mono/Stereo*	RAD	LGSOWG	CD-ROM/DVD/Disk	250m	Terrain dependent	Basic stereo pair
02	Scene/float (Mono/Stereo) *	RAD	Orthokit ###	CD-ROM/DVD/Disk	250m	Terrain dependent	RAD product with RPC file
03	Scene/float (Mono) *	Standard § Corrections Applied ##	LGSOWG* GeoTIFF Fast Format	CD-ROM/DVD/Disk	250m	Terrain dependent	Geo - Referenced product
04	Scene/float Mono *, AOI §	Standard Corrections Applied #	GeoTIFF	CD-ROM/DVD	250m	Terrain dependent	Geo - Referenced product

\# Includes AOI
All standard corrections products are Geo-Referenced.
Include RPC file and Meta file.
§ Minimum area of AOI is 25*25 Sq km, supplied with Meta file.
* Restricted Area Masking is done, wherever required.

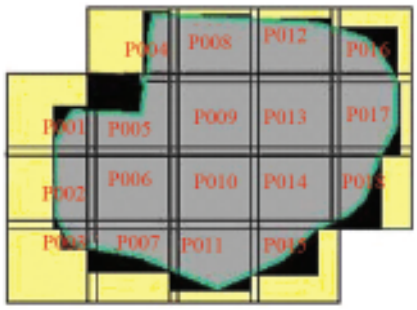
Outline of AOI Product (Multiple Scenes)



File naming convetion of AOI Product

a) Full Scenes

b) Product Sub - scenes files



Orthokit Products

Ortho kit products are supplied with only radiometric corrections. A file consisting of the rational polynomial coefficients (RPC) is also provided for further processing at user's end. An orthokit product consists of an image file (GeoTIFF format), an RPC file (text file) and a metadata file.

Orthokit products facilitate the user to produce high precision products by using control points / external DEM in the commercially available off-the-shelf (COTS) software. It is recommended to use software packages, certified by Department of Space, for better results.

Stereo Products

Scene based stereo products are supplied with only radiometric corrections. Stereo data are supplied as digital products only. These products can be supplied in LGSOWG format and in GeoTIFF format with RPCs. In the case of stereo data in LGSOWG format, radiometrically corrected data fromboth Fore and Aft cameras are provided. Stereo data in GeoTIFF format comprise of radiometrically corrected data from both Fore and Aft cameras and an RPC file.

These products facilitate the user to produce high precision products and extract digital elevation models (DEM). The location accuracy of the products is better than 250m. It is recommended to use software packages, certified by Department of Space, for better results.

Precision geo-referenced products

These are mosaiced and ortho rectified products. These products can be supplied with different area coverages – 7 ½' x 7 ½' (both Survey of India (SOI) mapsheet based and floating), 5' x 5', 3.75' x 3.75' and 2.25' x 2.25'. All these products are supplied as a single product. Best efforts are made to provide the data with seamless radiometry in case the area is covered on two different dates.The location accuracy of these products will be better than 25m. For global users, these products can be supplied with the help of GCPs provided by the user.

Precision (Ortho) Products

S. No	Area Coverage	Level of Processing	Digital data Format	Media	Accuracy specifications		Remarks
					Location Accuracy	Internal Distortion	
01	Mapsheet based/Float 7.5′ * 7.5′ *	Precision (ortho) Terrain corrected	GeoTIFF	CD-ROM	≦ 25m	Around 10m	Using DEM and TCPs
02	Float 5′ * 5′ *	Precision (ortho) Terrain corrected	GeoTIFF	CD-ROM	≦ 25m	Around 10m	Using DEM and TCPs
03	Float 3.75′ * 3.75′ *	Precision (ortho) Terrain corrected	GeoTIFF	CD-ROM	≦ 25m	Around 10m	Using DEM and TCPs
04	Float 2.25′ * 2.25′ *	Precision (ortho) Terrain corrected	GeoTIFF	CD-ROM	≦ 25m	Around 10m	Using DEM and TCPs

Note:

All the Geocoded products ortho corrected.

* Restricted Area Masking is done, wherever required.

Services

Various services provided include :

On-line Digital browse facility

Facilitates easy location and selection of available data.

On-line data ordering facility

Enables the user to place requests for products on-line based on the type of products required.

On-line Payload programming request placing system

Enables users to request for programmed data.

Data dissemination in near real-time throught network

Facilitates data delivery within a few hours of acquisition using a web based ftp site.

These facilities are available at http://www.nrsa.gov.in

How to avail these facilities ?

Users can avail these facilities by registering themselves with the services. All the services are made available without any service fees.

Cartosat - 1 data distribution

Various sources of Cartosat-1data world-wide are as follows :

1. Indian users and users from neighbouring countries covered by Indian ground station, can procure Cartosat-1 data products from NDC.

2. International users can get Cartosat-1 data products from the following source :

Antrix Corporation Ltd.
Antariksh Bhavan, New BEL Road
Bangalore - 560 094,
Karnataka, India

e-mail : antrix@bgl.vsnl.net.in
Phone : +91 80 2341 6274
: +91 80 2217 2189
Fax : +91 80 2341 8981
Web site : www.antrix.org

3. IRS International Ground Stations operating in various parts of the World.

4. It is possible to provide raw data for the user specified areas and period of interest along with the data processing software. This concept is known as virtual station. For such data requirements, users can contact Antrix corporation.

For specific information on availability of an IGS or data of a particular location, users may contact Antrix Corporation Ltd. - the commercial wing of DOS.

Data down link access

Antrix Corporation Ltd., Department of Space, is responsible for data distribution outside the Indian visibility cone. For data down link access, users can contact Antrix Corporation Ltd.

Upgradation / Establishment of Ground Station

Antrix Corporation Ltd. has the required expertise to upgrade the existing ground station having X-band (8 to 8.4 GHz) reception capability to receive Cartosat-1 data or set up an entirely new reception and processing facility. Antrix shall announce from time to time other agencies authorised to provide reception capability for Cartosat-1.

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Cartosat - 1 Image - Adana, Turkey