

# EROS Imagery Products Guide

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# About ImageSat

ImageSat International N.V. is the owner and operator of the EROS A and EROS B very high resolution imaging satellites, whose global coverage provide high-quality imaging services, satisfying national security and management needs with maximum autonomy, secrecy and flexibility.

Established in 1997, ImageSat launched EROS A, its first commercial imaging satellite, into orbit on December 5, 2000. EROS B, the Company's sub-meter resolution satellite, was launched on April 25, 2006, providing customers with increased revisit time and the benefit of a variety of sensors. Both satellites were accurately placed in their orbit by Russian Start-1 launchers.

ImageSat serves a global customer base, comprised of governments and international agencies, which utilize EROS satellite imagery primarily for National Security, Homeland Security and Environmental Security, as well as a wide range of civilian applications.

ImageSat International N.V. is a Netherlands Antilles company with offices in Limassol, Cyprus and Tel Aviv, Israel. The Company's offices in Tel Aviv supervise the construction of the EROS family of satellites and the operation of ImageSat's main Ground Control Station.

# **EROS Satellites**

EROS satellites are lightweight LEO satellites with a single electro optical camera system. EROS satellites acquire high-resolution panchromatic image data.

EROS satellites are designed to maximize operator flexibility in the creation and adaptation of the daily image acquisition plan. The EROS Satellites' high maneuverability enables them to be quickly pointed to image customerspecified sites on Nadir or at oblique angles of up to 45 degrees. Oblique viewing enables the satellite to view virtually any site on earth as often as two to three times per week.

The orbital period of the EROS satellites, for one revolution around the Earth, is 94-96 minutes. The satellites complete approximately 15 revolutions around the Earth every 24 hours, with two daylight passes per day through the footprint of a typical Ground Receiving Station.

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# **EROS** satellites





	EROS A	EROS B
Sun-Synchronous Orbit	~500 km	~500 km
Nominal Life Expectancy	2000-2012	2006-2018
Spectral Bands	Panchromatic	Panchromatic
Resolution	1.9 m	0.7 m
Swath	14 km	7 km

# **Product definition**

ImageSat International offers various types of panchromatic images characterized either by:

- **Imaging Technique** the manner in which the satellite payload is used to acquire the imagery data; or
- **Processing Level** the level of post processing performed on the ground after acquisition and reception of the imagery at the ground station.

The tables below summarize the basic product types classified according to the Image Acquisition technique. All products listed are available. A more detailed description of ImageSat products and processing options follows the table.

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# **Imaging Technique - EROS A**

Panchromatic	Dimensions	Remarks
Images		
Basic Image	14 km x 14	1.9 meter ground sampling distance
	km	(GSD) at nadir for an orbit of 510km. It is
		possible to acquire longer "vector"
		scene, up to ~200 km, depending on
		resolution and destination (On Board
		Recorded image or directly acquired).
Stereo Pair	14 km x 14	Two overlapped images of the same
	km	scene, acquired at different symmetric or
		non-symmetric viewing angles (fore and
		aft) during the same pass.
Triplet	14 km x 14	Two Stereo images + one overhead
	km	image: Standard or Hypersampled-
		factor-2, of the same scene,
		acquired during the same pass.
Mosaic	25 km x 25 km	Two adjoined images acquired during
		the same pass with small overlapping.
Polygon coverage	Any shape	The polygons will be defined by "shape
	and size	files" of the "Arc View" software or by a
		set of coordinates. The polygon will be
		bigger than one basic scene.

## Imaging Parameters – EROS A

The imaging performances of the EROS A panchromatic camera will be as follows:

Scanning	Push-broom
Imaging sunlight conditions	Sun-over-horizon angle more than 10°
Sensor type	CCD
Spectral band	0. 5 to 0.9
Sampling Depth transmitted	10 bits
Ground Sampling Distance	1.9 m at Nadir from 510 km
Swath Width	14 km at Nadir from 510 km
Inclination	97.2°
Local time in descending node	09:45

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Imaging Technique - EROS B

Panchromatic Images	Dimensions	Remarks
Basic Image	7 km x 7 km	0.7 meter ground sampling distance (GSD) at nadir using TDI level 8 for an orbit of 510km.
		It is possible to acquire longer "vector" scene, up to ~480 km, depends on resolution, scanning direction, and destination (On Board Recorded image or directly acquired)
Stereo pair	7km x up to 21 km	Two overlapped images of the same scene, acquired at different symmetric or non-symmetric viewing angles (fore and aft) during the same pass.
Triplet	7 km x 14 km	Two Stereo images + one overhead Standard image of the same scene, acquired during the same pass.
		It is possible to acquire multiple images of the same scene in basic mode (for example two stereo pairs) in the same pass.
Mosaic	28 km x 26 km	Four adjoined images acquired during the same pass with small (500 m) overlapping.
Polygon coverage	Any shape and size	The polygons will be defined by "shape files" of the "Arc View" software or by a set of coordinates. The polygon will be bigger than one basic scene.

#### Imaging Parameters – EROS B

The imaging performances of the EROS B panchromatic camera will be as follows:

Scanning	Push-broom, maximum scanning rate of 2400 lines/sec
Imaging sunlight conditions	Sun-over-horizon angle more than 10°
Sensor type	CCD-TDI, Selectable 1,4,8,16,32,48,64,96
Spectral band	0. 5 to 0.9
Sampling Depth transmitted	10 bits
Ground Sampling Distance	0.7 m at Nadir from 510 km for TDI stages 1,4,8
	0.8 m at Nadir from 510 km for all other TDI stages
Swath Width	7 km at Nadir from 510 km
Inclination	97.2°
Local time in descending node	13:45

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# Processing Options EROS A and EROS B

Processing Level	Processing Designation	Remarks
Raw Imagery	Level 0A	Four image data channels ('rulers') are assembled, however, raw imagery is provided in completely unprocessed format just as it is received directly from the spacecraft. Provided only per customer request.
Radiometric System Correction	Level 1A	Raw imagery in 11-bit raw format is calibrated and gain adjusted to correct for known radiance response characteristics of the camera sensor system + ruler-overlap correction.
Geometric System Correction	Level 1B	Known sensor or acquisition (ephemeris) based geometric corrections are applied to compensate for camera optics and scanning distortions. Level 1B products are both radiometrically and geometrically corrected.
Orthorectified & Other Value Added Products		Available by special request

#### **Formats**

As a default EROS A and EROS B imagery processed to 1A and 1B levels and provided in 16 Bit Tiff (GeoTiff) formats.

Following images formats are available per customer request:

1A level products - 8 Bit Tiff (revision 6.0), or RAW.

1B level products – 8 Bit GeoTiff (revision 2.1)

#### **Qualified Images**

ImageSat is committed to the customer satisfaction with the quality of its products. The QA process of ImageSat is designed to find any anomalies in the products and to verify that the product meets the specifications.

**QA specifications** – the product should meet the quality specifications in a way that the product is clear of any anomaly (haze, BER, geometric distortion, etc.) and located within the requested area by the customer.

**Cloud Cover (CC) assessment** is done by calculating the number of pixels with a value above a threshold color out of all the product pixels (image or a polygon). **The validation criteria** is 80% clouds free product.

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#### Orbit Parameters

The EROS A & EROS B Satellites operates in a circular sun-synchronous orbit at an altitude of 510kms +/- 40 km. The local time of the descending node is 09:45 am for EROS A and 13:45 for EROS B.

# **Supply services**

ImageSat offers a wide range of services for the acquisition and purchasing of images; from purchasing images from our archive, through new acquisitions of images, to direct image acquisitions reception and ultimately direct tasking and reception by the customer.

## New acquisition request

ImageSat International offers various types of priorities to its clients. The client will receive the ordered images according to his request by CD/DVD and/or FTP download.

## **Normal Priority Service**

The Normal priority Service provides a service to the client that, within 90 days, ImageSat will fulfill its image acquisition request on a best effort basis. ImageSat commits to attempt to acquire the specified location on a best efforts basis in the context of the Satellite capacity and other higher priority orders in the queue.

The procedure for the Normal priority Acquisition Request Service order is as follows:

- Customer submits his coordinates of the area of interest (AOI).
- ImageSat Command Centre places the order in the imaging queue and attempts to acquire an image of the specified location.
- After acquisition of an image ImageSat conducts a quality Assessment (QA) of the image.
  - a) If the image complies with ImageSat's QA, the image is shipped to the customer immediately.
  - b) If the image does not comply with ImageSat's QA, ImageSat will make further attempts to acquire the image.
  - c) After every attempt the customer will get a notification with the imaging results and a "quick look" of the acquired image.

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# **Rush Services**

ImageSat offers to allow the client to activate rush acquisition of a scene of an area at the earliest possible time. The Rush Acquisition service provides a service to the client that within 10 days ImageSat will task the satellite to fulfill its image acquisition request (first attempt).

ImageSat commits to attempt to acquire the specified location at least once every 10 days until the image passes the QA and delivered to the customer. In addition, ImageSat offers the Customer the right to reserve the use of an EROS satellite for imaging a specific geographic location at a designated orbit, date and time.

The procedure for a Rush order is as follows:

- Customer submits his coordinates of the area of interest (AOI).
- ImageSat's Order Desk places the order in the imaging high priority list queue and attempts to acquire an image of the specified location in the nearest available opportunity (In case the customer asks for a specific orbit or date, it will be checked according to imaging opportunities and agreed with the customer).
- After acquisition of an image ImageSat conducts a quality assessment (QA) of the image
  - a) If the image complies with ImageSat's QA, the image is shipped to the customer immediately.
  - d) If the image does not comply with ImageSat's QA, ImageSat will make further attempts in the next available opportunities to acquire the image.
  - e) After every attempt the customer will get a notification with the imaging results and a "quick look" of the acquired image.

# Order of "Image Acquisitions"

"Acquisition" is defined as "One Shot" of the Satellite camera, taking an image of a specific location defined by a coordinate of the center point, regardless of cloud coverage.

For every acquisition of the Satellite/s the Satellite operators plan, program and upload the commands to the Satellite. The result of an acquisition is digital data transmitted by the Satellite/s to an EROS Compatible Ground Receiving Station and processed to radiometric and/or geometrically corrected level..

One acquisition is defined by the programming of a "basic scene" (7 X 7 Km for EROS B and 14x14 Km for EROS A).

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# **Archived images**

ImageSat offers data from the entire archive of EROS data. Archived images are offered at a special price (see Appendix 1 for pricing details). Requested archived images will be supplied to the customer no later than 72 hours after request is received by ImageSat (by courier or FTP). Archived image is defined as an image older than 6 month.

Order Desk- ImageSat has an order desk (orders@imagesatintl.com) to handle all customer requests and orders.

## Minimum order size

Minimum order size for new acquisition and archived data is one basic scene: EROS A - 14km x 14km EROS B - 7km x 7km.

# Advanced Services

## Exclusive Pass on Demand (EPOD) Program:

The EPOD Program enables users to enjoy the benefits of having <u>direct</u> <u>tasking and direct download</u> as an exclusive service from a High Resolution Satellite, in a risk-free program. The service offers the customer all the below mentioned benefits at a very cost effective price. In the proposed EPOD service the customer is the only one in the loop of satellite tasking and imagery reception, therefore the customer has most of the benefits of having his own satellite, without the risks.

## Description

ImageSat will upgrade the Customer's ground station (or build a new ground station if needed) to enable the customer to autonomously Task the EROS satellite and directly receive all the acquired imagery. The Customer will choose (in advance) and notify ImageSat of the relevant orbits that he would

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like to have full control over. In the selected pass, the customer will create and transmit to the satellite the acquisition command file. The satellite will acquire the images as planned and will downlink them to the Customer Ground Station in real-time.

Images collected will be for the exclusive use of the customer unless otherwise agreed with ImageSat.

The customer may order from 25% of the available passes within the footprint and up to full capacity of the satellite.

Please contact us if you want to learn more about the advanced programs

# **Priority Acquisition Service (PAS) Program**

ImageSat Offers a priority access service (the "PAS") for which the client undertakes to place satellite imagery orders for a minimum annual commitment of acquisitions per year during the term of a contract. All the acquisitions will be taken on a priority basis.

ImageSat will provide the client with the following:

- Exclusive/non exclusive license to use new collected images (multi-user license).
- Full secrecy regarding the ordered images' origin.
- High priority acquisition service.
- ImageSat acquires the specific requested area and submits to the client by FTP or courier no later than 24-hours/one working day after acquisition.
- After every attempt the client will receive a quick look (jpg) of the image with the QA results.

# The customer may use his own ground station to receive EROS data directly from the satellite. ImageSat can establish a new ground station or upgrade an existing ground station in a requested location

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