IKONOS SATELLITE IMAGES AND SENSOR SPECIFICATIONS

IKONOS Satellite Launch; IKONOS in Orbit

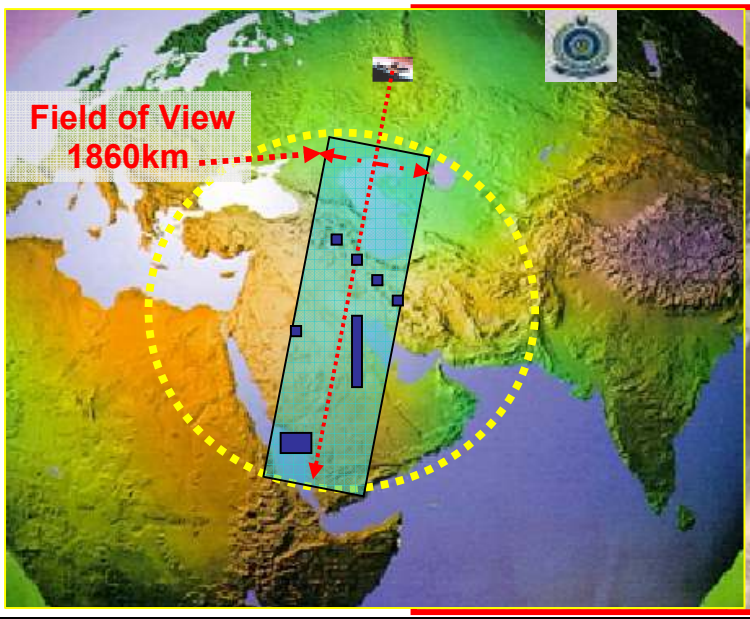
SUMMARY

The **IKONOS Satellite** is a high-resolution satellite operated by **GeoEye**. Its capabilities include capturing a 3.2m multispectral, **Near-Infrared (NIR)** /0.82m panchromatic resolution at nadir. Its applications include both urban and rural mapping of natural resources and of natural disasters, tax mapping, agriculture and forestry analysis, mining, engineering, construction, and change detection. It can yield relevant data for nearly all aspects of environmental study. IKONOS images have also been procured by SIC for use in the media and motion picture industries, providing aerial views and satellite photos for many areas around the world. Its high resolution data makes an integral contribution to homeland security, coastal monitoring and facilitates **3D terrain analysis**.

GeoEye is the premier provider of satellite and aerial imagery, geospatial information (information referenced to a specific location), geospatial products, and solutions for the national security community, strategic partners, and commercial customers helping them better map, measure and monitor the world. GeoEye's world is one seen through our Earth imaging satellites—IKONOS, GeoEye-1 and OrbView-2, two mapping aircraft, and a global network of regional partners and satellite receiving ground stations. GeoEye's geospatial information supports key industries, including national intelligence, defense and security, air and marine transportation, oil and gas, environmental monitoring, on-line mapping, insurance and risk management, urban planning and emergency preparedness.

IKONOS SATELLITE SYSTEM: SENSOR CHARACTERISTICS

Launch Date	24 September 1999 at Vandenberg Air Force Base, California, USA
Operational Life	Over 7 years
Orbit	98.1 degree, sun synchronous
Speed on Orbit	7.5 kilometers per second
Speed Over the Ground	6.8 kilometers per second
Revolutions Around the Earth	14.7, every 24 hours
Altitude	681 kilometers
Resolution at Nadir	0.82 meters panchromatic; 3.2 meters multispectral
Resolution 26° Off-Nadir	1.0 meter panchromatic; 4.0 meters multispectral
Image Swath	11.3 kilometers at nadir; 13.8 kilometers at 26° off-nadir
Equator Crossing Time	Nominally 10:30 AM solar time
Revisit Time	Approximately 3 days at 40° latitude
Dynamic Range	11-bits per pixel
Image Bands	Panchromatic, blue, green, red, near IR



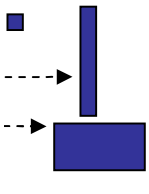
Collection Options

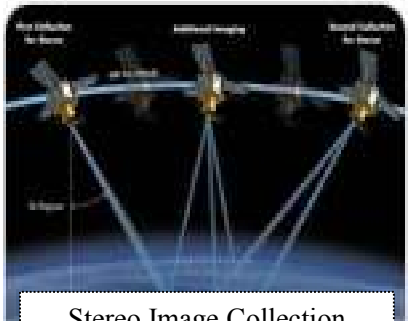
1- Single frames 11x11km

2- Strips 11x "up to" 1000km

3- Wide area up to 10000 sq.km.

4- Stereo Images





Stereo Image Collection
Real time - same path

IKONOS STEREO SATELLITE IMAGERY

The IKONOS Satellite sensor can be programmed to acquire Stereo IKONOS Satellite Image data for the production of **Digital Surface Models (DSM's)** or **Digital Elevation Models (DEM's)** with postings of ≤5m. From the Stereo pair the near Nadir scene will be utilized to produce <1m Natural Color Satellite Image mosaic. The DSM/DEM's and IKONOS Image mosaic are used to provide **3D Terrain Visualization** for the planning of: Transmission lines, Pipelines , Roads, Railroads Construction Projects, 3D Flythrough Movies, Simulation, Targeting and Mission Planning. In addition, the Geospatial data sets are used to support ongoing operations for Mining, Oil and Gas Exploration and many other applications, including Military applications such as Intelligence (Change detection: facilities and targets), Mission planning, Terrain Analysis, Mapping and Targeting.

ARCHIVED IKONOS IMAGERY

For many image requests, a matching image can already be located in the archives of high-resolution IKONOS imagery from around the world. If no image data is available in the archives, new IKONOS satellite image data can be acquired through a satellite tasking process. For more information and **pricing**, or to have us search the stock imagery database to see if an archived photo of your area of interest already exists.

IKONOS SATELLITE SERVICES

With our satellite imagery from the IKONOS and other satellites, Satellite Imaging Corp. provides the following **services** for multiple industries, including **oil and gas**, agriculture and land management, **environmental analysis**, and **motion pictures**:

- We obtain and provide aerial and satellite images along with professional advice to help you in finding the best solution for your project.
- We process imagery, including **orthorectification**, culture extraction, **Digital Terrain Models**, and raster-to-vector translation.
- We incorporate third-party service data for **Geographic Information System** (GIS) projects.
- We consult on band combinations most appropriate for remote sensing applications, including environmental impact studies (EIS), regional environmental monitoring, and change detection to bring out the geographical and manmade features that are pertinent to your project.

Satellite Imagery Products

Simple and Clear. Geo. GeoProfessional. GeoStereo. The new product line makes it easy to get the accuracy that you need with the options you want!. As your trusted imagery experts, we offer a wide range of sub-meter imagery product levels intended to match your specific area of interest—anywhere in the world.

IKONOS

GeoEye first made history with the IKONOS satellite launch almost ten years ago.

IKONOS, derived from the Greek word for image, is the world's first commercial satellite able to collect black-and-white (panchromatic) images with 1-meter resolution and multispectral imagery with 4-meter resolution. Imagery from both sensors can be merged to create 1-meter color imagery (pan-sharpened). The more than 300 million square kilometers of imagery that IKONOS has collected over every continent is being used for national security, military mapping, air and marine transportation, and by regional and local governments

GeoEye-1

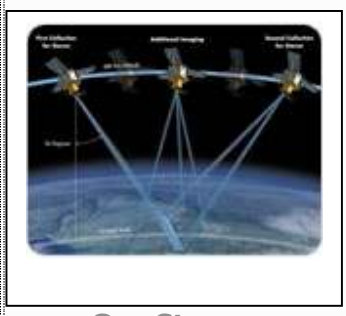
GeoEye will again make history with the upcoming launch of GeoEye-1—the world's highest resolution commercial earth-imaging satellite.

GeoEye-1 will be equipped with the most sophisticated technology ever used in a commercial satellite system. It will offer unprecedented spatial resolution by simultaneously acquiring 41 cm panchromatic and 165 cm multispectral imagery.

The detail and geospatial accuracy of GeoEye-1 imagery will further expand applications for satellite imagery in every commercial and government market sector.

SATELLITE IMAGERY PRODUCTS

GeoEye categorizes its imagery products according to resolution and positional accuracy, which is an assessment of the closeness of the object's location in relation to its true position on the Earth's surface. Location error is defined in relation to a confidence level (i.e., range of error) of 90% (CE90)—meaning that the object's location is represented on the image, within the stated accuracy, 90% of the time. The CE90 accuracy scale can be related to Root Mean Square Error (RMSE) as well as the U.S. National Map Accuracy Standards (NMAS).

Product Applications At-a-Glance	
Geo: 	The foundation of the GeoEye imagery product line, the Geo, is a radiometrically corrected map oriented image suitable for a wide range of uses. In addition to being suitable for visualization and monitoring applications, the Geo is shipped with the sensor camera model in rational polynomial coefficient (RPC) format. This camera model maps the respective ground coordinates to image product coordinates. Block adjustment, ortho-rectification, and other photogrammetric processing can be performed with the RPC camera model. This product, coupled with a digital elevation model (DEM), permits skilled users to make their own orthorectified products using standard commercial software and available data sets. Geo imagery products are available as panchromatic, multispectral, and pan-sharpened color imagery.
Geo Professional: 	GeoProfessional products are orthorectified (terrain corrected) by GeoEye's staff of experienced production personnel using proprietary processes perfected in our production facilities and optimized to the data collected by GeoEye satellites. The ortho-rectification process employed by GeoEye enables us to quickly deliver the most accurate and precise terrain corrected multispectral products available from a satellite platform. Available in various levels of accuracy, GeoProfessional, Precision and PrecisionPlus, these products are suitable for feature extraction, change detection, base mapping and other similar applications. GeoProfessional imagery products are available as panchromatic, multispectral, and pan-sharpened color imagery.
 **Geo Stereo:**	Providing a strong base for three-dimensional feature recognition, extraction and exploitation, the GeoStereo product provides two images with stereo geometry to support a wide range of stereo imagery applications such as DEM creation, building height extraction, spatial layers, and three-dimensional feature extraction. Stereo products in epipolar or map projections provide RPC camera model data. The RPC camera model supports block adjustment, three-dimensional stereo extraction, DEM generation, ortho-rectification, and other photogrammetric operations. GeoStereo imagery products are available as panchromatic, multispectral, and pan-sharpened color imagery

Product Specifications At-a-Glance:

1m mono	CE90	RMSE	NMAS	Ortho	Mosaic
Geo (1)	15m	8m	N/A	No	No
GeoPro	10m	5m	1:12K	SI	SI
Precision (2)	4m	2m	1:5K	SI	SI
1m Stereo	**CE90**	**RMSE**	**NMAS**	**Ortho**	**Mosaic**
GeoStereo	15m	22m	1:20K	NO	NO
Precision (3)	4m	6m	1:5K	SI	SI
0.5m Mono	**CE90**	**RMSE**	**NMAS**	**Ortho**	**Mosaic**
Geo (1)	5m	3m	N/A	NO	NO
GeoPro	10m	5m	1:12K	SI	SI
Precision (2)	4m	2m	1:5K	SI	SI
0.5m Stereo	**CE90**	**RMSE**	**NMAS**	**Ortho**	**Mosaic**
GeoStereo	4m	6m	1:20K	NO	NO
Precision (3)	2m	3m	1:5K	SI	SI

(1) CE90 sin considerar distorsiones por efecto del terreno.
(2) Requiere provision DEM y GCPs
(3) Requiere provision GCPs

Location Accuracy Scales
CE90: Location error confidence level of 90%.
RMSE: Root Mean Square Error.
NMAS: U.S. National Map Accuracy Standards.

PRODUCT APPLICATIONS AT-A-GLANCE	
Geo	Visual and interpretive analysis; temporal archive and new collection for change detection; surveillance; habitat monitoring
GeoProfessional	Regional, large-area mapping; general GIS applications, base mapping, land use, economic development, real estate and insurance analysis High positional accuracy for urban applications Detailed urban analysis, cadastral and infrastructure mapping for transportation, infrastructure, and utilities planning
GeoStereo	DEM creation for flood plain analysis, engineering grade quality for transportation, infrastructure and utilities planning, and economic development

PRODUCT SPECIFICATIONS AT-A-GLANCE ((IKONOS))

1-Meter	Positional Accuracy			Ortho-Corrected	Target Elevation Angle	Mosaics Available	Sample Application
	CE90	RMSE	NMAS				
Geo[1]	15 m	8 m	N/A	No	>60°	No	Visual and interpretative analysis and change detection
GeoProfessional	10 m	5 m	1:12,000	Yes	>66°	Yes	Regional large-area mapping, general GIS applications, base mapping, land use, economic development
Precision[2] [3]	4 m	2 m	1:5,000	Yes	>72°	Yes	High positional accuracy for urban applications
	CE90	LE90	NMAS				
GeoStereo	15 m	22 m	1:20,000	No	>60°	No	DEM creation for flood plain analysis
Precision[4]	4 m	6 m	1:5,000	No	>60°	No	DEM creation for flood plain analysis

[1] CE 90% exclusive of terrain displacement; Geo imagery is not terrain corrected
[2] Ground control required, DEM from NED or stereo may be used as appropriate to achieve specified accuracy
[3] Other accuracies are achievable; please contact a Service Expert with your requirements
[4] Ground control required

PRODUCT SPECIFICATIONS AT-A-GLANCE ((GEOEYE-1))

.50-Meter	Positional Accuracy			Ortho-Corrected	Target Elevation Angle	Mosaics Available	Sample Application
	CE90	RMSE	NMAS				
Geo[5]	5 m	3 m	N/A	No	>60°	No	Visual and interpretative analysis, change detection, surveillance, habitant monitoring
GeoProfessional	10 m	5 m	1:12,000	Yes	>66°	Yes	Regional large-area mapping, general GIS application, base mapping, land use, economic development, real estate and insurance analysis
Precision[6] [7]	4 m	2 m	1:5,000	Yes	>72°	Yes	High positional accuracy for urban applications
	CE90	LE90	NMAS				
GeoStereo	4 m	6 m	1:5,000	No	>60°	No	DEM creation for flood plain analysis, engineering grade quality
Precision[8]	2 m	3 m	1:2,500	No	>60°	No	DEM creation for flood plain analysis, engineering grade quality

[5] CE 90% exclusive of terrain displacement; Geo imagery is not terrain corrected
[6] Ground control required, DEM from NED or stereo may be used as appropriate to achieve specified accuracy
[7]Other accuracies are achievable; please contact a Service Expert with your requirements

[8]Ground control required

PRODUCT SPECIFICATIONS AT-A-GLANCE

1-Meter	Positional Accuracy			Ortho-Corrected	Target Elevation Angle	Mosaics Available	Sample Application
	CE90	RMSE	NMAS				
Geo[1]	15 m	8 m	N/A	No	>60°	No	Visual and interpretative analysis and change detection
GeoProfessional	10 m	5 m	1:12,000	Yes	>66°	Yes	Regional large-area mapping, general GIS applications, base mapping, land use, economic development
Precision[2] [3]	4 m	2 m	1:5,000	Yes	>72°	Yes	High positional accuracy for urban applications
	CE90	LE90	NMAS				
GeoStereo	15 m	22 m	1:20,000	No	>60°	No	DEM creation for flood plain analysis
Precision[4]	4 m	6 m	1:5,000	No	>60°	No	DEM creation for flood plain analysis

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