Eurimage
Products & Services

QUICKBIRD

THE WORLD'S HIGHEST RESOLUTION COMMERCIAL SATELLITE

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QuickBird from DigitalGlobe™ is the highest-resolution multispectral commercial remote sensing satellite now operating, offering imagery from 60 cm resolution.

Launched October 18, 2001, QuickBird collects multi-spectral and panchromatic imagery concurrently, and Pan-sharpened products in natural or infrared colours are offered. Strips up to 250km long can be collected in a single pass.

QuickBird provides the widest swath, largest on-board storage, and highest resolution of any current commercial satellite. QuickBird is designed to efficiently and accurately image large areas with industry-leading geolocational accuracy.

QuickBird Technical Summary

LAUNCH	October 18, 2001, Vandenberg Air Force Base, California	
ORBIT	450 km altitude; 93.5 minute orbit time; 10:30 am equator crossing time (descending); inclination 97.2° sun-synchronous	
NOMINAL SWATH WIDTH	16.5 Km at nadir	
ON-BOARD STORAGE	128 Gbit (approximately 57 scenes)	
DYNAMIC RANGE	11 bits per pixel	
	PANCHROMATIC	MULTI-SPECTRAL
RESOLUTION	*Basic*: 0.61 metres at nadir, 0.72 metres at 25° off-nadir nadir *Standard & Orthorectified:* resampled to 0.6 /0.7 metre GSD	*Basic*: 2.44 metres at nadir, 2.88 metres 25° off-nadir *Standard & Orthorectified:* resampled to 2.4/ 2.8 metre GSD
SPECTRAL BANDWIDTH	450—900 nanometers	*Blue:* 450—520 nanometers *Green:* 520—600 nanometers *Red:* 630—690 nanometers *Near-IR:* 760—900 nanometers

Coverage

QuickBird's on-board tape recorder gives world-wide coverage. Eurimage is the Master Distributor for world-wide QuickBird products for customers in Europe and the Mediterranean basin (excluding non-international organisations in Italy), appointed by Telespazio (Finmeccanica Group), Master Distributor and shareholder of DigitalGlobe.

Product Levels

DigitalGlobe panchromatic, multi-spectral and pan-sharpened colour products enable superior image classification and analysis based on discrete spectral bands and 11-bit information depth. Typically, customers utilize 4-band imagery for image classification and analysis, while panchromatic and pan-sharpened imagery is used for visual analysis and for GIS and Mapping applications that support the standard GeoTIFF format.

Imagery products are offered at three levels:

- Basic Imagery
- Standard Imagery
- Orthorectified Imagery

Panchromatic imagery is collected in 11-bit format (2048 gray levels) and delivered in 16 bit format for superior image interpretation (shadow detail, etc.), or 8-bit format (256 gray levels) supported by GIS and mapping applications. Four-band multi-spectral imagery consists of blue, green, red and near-infrared bands, delivered in 16-bit and 8-bit formats. In addition, pan and pan-sharpened imagery is available at 60 or 70-centimetre resolution.

Basic Imagery Products

Basic Imagery products are the least processed of the QuickBird Imagery products and are designed for customers having advanced image processing capabilities. Basic Imagery, together with the supplied attitude, ephemeris, and camera model information, is suitable for advanced photogrammetric processing (i.e., orthorectification).

Processing

Basic Imagery products are radiometrically corrected and sensor corrected, but not geometrically corrected nor mapped to a cartographic projection and ellipsoid. Image resolution varies between 61-centimeters (at nadir) to 72-centimeters (25° off-nadir look angle) for panchromatic products, and 2.44-meters (at nadir) to 2.88-meters (25° off-nadir look angle) for multi-spectral imagery. Note that the resolution varies across the field of regard depending on the viewing angle of the acquired image. Basic Imagery products are not available with pan-sharpening.

The radiometric corrections applied to this product include: relative radiometric response between detectors, non-responsive detector fill, and a conversion for absolute radiometry. The sensor corrections account for internal detector geometry, optical distortion and scan distortion. The sensor corrections account for line-rate variations and mis-registration of the multi-spectral bands, but do not account for the mis-registration of the panchromatic and multi-spectral bands.

Each scene in a Basic Imagery order is processed individually, therefore multi-scene Basic Imagery products are not spatially nor spectrally mosaiced.

Accuracy

The Basic Imagery product is essentially "geometrically raw". However, when the data are processed with the supplied refined Image Support Data (ISD), a horizontal geolocational accuracy of up to 23-meter (CE90%), excluding any topographic displacement may be achieved. Basic Imagery products may be processed by a supported commercial software applications package, which utilize the ISD associated with the image.

Physical Structure

Basic Imagery products are delivered as one or more full or fractional scenes. Each panchromatic Basic Imagery scene is 27,552 columns after processing, while the multi-spectral Basic Imagery scene is 6,888 columns. The Basic Image full scene has a minimum area of 272 km^2 (16.5 x 16.5 km) at nadir.

An order polygon that falls entirely within a single scene will result in a full Basic Imagery scene being delivered.

An order polygon which intersects several strips will result in the delivery of multiple full or partial scenes.

Standard Imagery Products

Standard Imagery products are suitable for users requiring modest absolute accuracy and/or small area coverage. Users of Standard Imagery products usually possess sufficient image processing tools and knowledge to manipulate and exploit the imagery for a wide variety of applications.

Processing

Standard Imagery products are radiometrically corrected, sensor corrected, geometrically corrected, and mapped to a cartographic projection.

Standard Imagery products are available as panchromatic with a 60 or 70-centimeter resolution, multi-spectral with a 2.4 or 2.8-meter resolution, or pan-sharpened (4-bands or 3 bands with natural or infrared false colour) with a 60 or 70-centimeter resolution. All Standard Imagery products have a uniform pixel spacing across the entire product.

The radiometric corrections applied to this product include: relative radiometric response between detectors, non-responsive detector fill, and a conversion for absolute radiometry. The sensor corrections account for internal detector geometry, optical distortion, scan distortion, any line-rate variations, and mis-registration of the multi-spectral bands.

Geometric corrections remove spacecraft orbit position and attitude uncertainty, Earth rotation and curvature, and panoramic distortion. Additionally, a coarse DEM is used to normalize for topographic relief with respect to the referenced ellipsoid. The degree of normalization

is relatively small, so while this product has terrain corrections, it is not considered orthorectified.

An Ortho-ready Standard product is also available, without use of the coarse DEM, but with a base elevation which allows ortho-rectification with accuracies comparable to those obtained from Basic Imagery.

If the order polygon crosses more than one strip, each strip will be processed individually.

As the Standard product is not mosaiced, one image file will be delivered for each strip the polygon intersects.

Accuracy

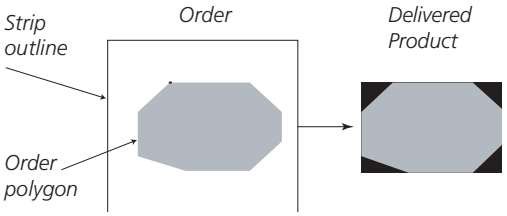
All Standard products may achieve an absolute geolocation accuracy of up to 23-meter (CE90%), excluding any topographic displacement. Ground location is derived from refined satellite attitude and ephemeris information without requiring the use of Ground Control Points (GCPs).

Physical Structure

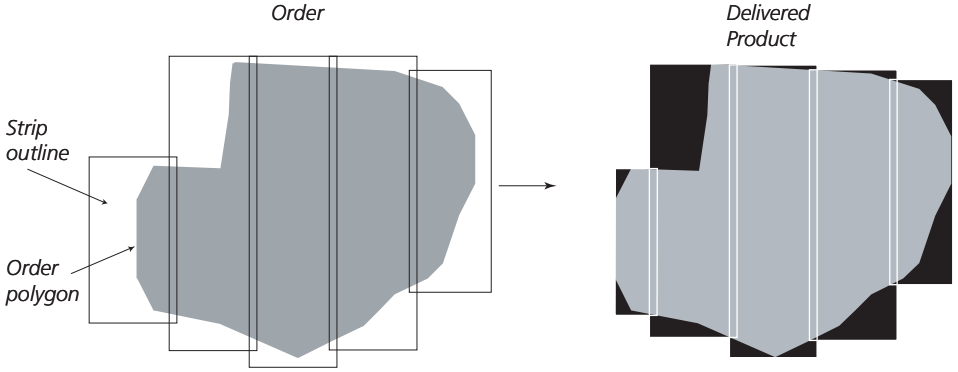
Standard Imagery products are area based and may be ordered by the square kilometer. The minimum order area is 25 km² for archived data and 64 km² for new acquisitions (100 km² for Rush Tasking). The maximum is 10,000 km² (2,500 km² for Rush Tasking)

Standard Imagery products are delivered as one image file for each strip the order polygon intersects. If the order polygon intersects more than one strip, the imagery in each strip will be delivered as separate files, will not be mosaiced together to form a single image, and will not be radiometrically balanced.

Final product physical structure for sub-strip Standard Imagery products



Final product physical structure for multi-strip Standard Imagery products



5 separate files comprising the order, with black fill determined by the minimum bounding rectangle.

Projections and Datums*

Map Projections

Geographic (Lat/Long)

State Plane Coordinate System

UTM

Datums

Bessel 1841 GDA 1994 NAD27 NAD83

GRS80 WGS84

* *Orders to Eurimage must be in decimal lat/long and use WGS 84*

Orthorectified Imagery Products

Orthorectification of imagery removes topographic distortion and therefore provides greater positioning accuracy.

These products are GIS-ready and ideally suited as an image base map for creating and/or revising mapping and GIS databases, or for registering existing feature layers. These products can also be used for change detection and other analytical applications that require a high degree of absolute accuracy. Orthorectified products require a Digital Elevation Model (DEM) and Ground Control Points (GCPs). Generally these may need to be provided by the customer.

Processing

Orthorectified Imagery products are radiometrically corrected, sensor corrected, orthorectified, and mapped to a cartographic projection and datum. Orthorectified Imagery products are available as multi-spectral with 2.4 or 2.8 metre resolution, or panchromatic or pan-sharpened with a 60 or 70-centimetre resolution.

Final accuracy depends on the quality of DEMs and GCPs. Ask Eurimage Customer Service for details and quotation.

Product Options

Panchromatic Products

QuickBird panchromatic (black and white) products are based on 61-centimeter resolution (at nadir) and 11-bit collected information depth. The panchromatic sensor

Product Specifications

	BASIC IMAGERY	STANDARD IMAGERY
Physical Characteristics		
MAXIMUM DELIVERABLE AREA	10,000 km² (approximately 6 x 7 scenes) (2,500 km² for Rush Tasking)	
MINIMUM DELIVERABLE AREA	1 scene	64 km² (25 km² for archive data) (100 km² for Rush Tasking)
PRODUCT FRAMING	Scene-based	Area-based
FINAL PRODUCT PHYSICAL STRUCTURE	Scenes	Blackfill to a minimum bounding rectangle surrounding the image pixels ordered
FULL PAN SCENE DIMENSIONS (PIXELS/ COL, ROW)	27,552 x 27,424	N/A
FULL MS SCENE DIMENSIONS (PIXELS/ COL, ROW)	6,888 x 6,856	N/A
FULL SCENE SIZE (AT NADIR)	16.5 km x 16.5 km (approximately 272 km²)	N/A
Processing Specifications		
RADIOMETRIC CORRECTIONS	Relative radiometric response between detectors; non-responsive detector fill; conversion for absolute radiometry	
SENSOR CORRECTIONS	Internal detector geometry; optical distortion; scan distortion; line-rate variations; mis-registration of the multi-spectral bands	
ADDITIONAL GEOMETRIC CORRECTIONS	N/A	Spacecraft orbit position and attitude uncertainty; Earth rotation; Earth curvature; panoramic distortion;
GEOLOCATION INFORMATION APPLIED	N/A	Ephemeris and attitude; rotation and alignment to map projection
APPLIED TERRAIN INFORMATION	N/A	Coarse resolution DEM (GTOPO 30 or SRTM) or Base Elevation
Product Parameters		
PRODUCT OPTIONS	Pan, MS, Bundle (both Pan & MS)	Pan, MS, Bundle (both Pan & MS), 3 or 4 bands Pan-sharpened
NUMBER OF BITS/PIXEL IN DELIVERABLE IMAGE	8 or 16	
DIGITAL SCALING METHOD (8 BIT ONLY)	Linear with maximum value set to 255	
RESAMPLING OPTION	4x4 cubic convolution; 2x2 bilinear; Nearest neighbor; 8-pt sinc; MTF; pan-sharpen kernel	
OUTPUT TILE SIZE OPTIONS	N/A	Pixel or map-based tiling
OUTPUT PIXEL SPACING	Same as collected	60/70 centimetres for Pan; 2.4/2.8 metres for MS; 60/70 centimetres for pan-sharpened color
MAP PROJECTIONS	N/A	Geographic, State Plane, UTM
ELLIPSOIDS AND DATUMS	N/A	Bessel 1841, GDA 1994, GRS 80, NAD27, NAD83, WGS84
OUTPUT ALIGNMENT	N/A	Map north
DELIVERY PARAMETERS		
OUTPUT PRODUCT DELIVERY MEDIA	DVD, CD (not for Basic), ftp - pull	
IMAGE DATA FORMAT	NITF 2.0; NITF 2.1; GeoTIFF 1.0	
Image Support Data		
ISD FILES SUPPLIED TO CUSTOMER	README file; image metadata file; RPC file; license text file; tile map file, ephemeris file; attitude file; geometric calibration file; GIS files, layout map, Browse Image of produced area	README file; image metadata file; RPC file; license text file; tile map file, GIS files, layout map, Browse Image of produced area

collects information at the visible and near-infrared wavelengths and has a bandwidth of 450—900 nm.

The output resolution of the panchromatic product varies with product level. Basic Imagery is delivered at the Ground Sample Distance in which the data were collected (ranging from 61 cm at nadir to 72 cm at 25° off-nadir), while Standard and Ortho Imagery products are resampled to a 60 or 70 cm resolution.

Multi-spectral Products

QuickBird multi-spectral products provide four discrete non-overlapping spectral bands and 11-bit collected information depth. The multi-spectral products cover the visible and near-infrared wavelengths in four bands. All four bands are delivered in one file.

The output resolution of the multi-spectral product varies with product level. Basic Imagery products are delivered at the resolution in which the data were collected (ranging from 2.44 m to 2.88 m), while Standard and Ortho Imagery products are resampled to a 2.4 or 2.8 m pixel spacing.

Panchromatic and Multi-spectral Bundle

The QuickBird satellite collects multi-spectral and panchromatic imagery concurrently, therefore customers have the option to order both products for the same area. When a customer selects this option, the products will be processed to the same level with the same parameters, and delivered as two distinct products (one containing panchromatic imagery and one containing all four multi-spectral bands) with two sets of associated Image Support Data (ISD) files.

Pan-Sharpened Colour Products

60 or 70-centimeter pan-sharpened products, combine the visual information of the 2.4/2.8-meter multi-spectral bands with the spatial information of the panchromatic band.

The options are:

4 BANDS (B, G, R, NIR)

NATURAL COLOUR COMPOSITE (blue, green, red)

COLOUR INFRARED COMPOSITE (green, red, infrared)

Pan-sharpened Colour products are delivered as a single file. They are available only as Standard or Ortho (not Basic) Imagery products.

Image Support Data

All QuickBird Imagery products are delivered with a set of metadata Image Support Data (ISD) files, with all useful ancillary data. The number and types of files delivered varies with the product type.

ATTITUDE FILE (.att) – includes the time of first data point, the number of points, and the interval between the points and attitude information (Basic Product only).

EPHEMERIS FILE (.eph) – includes the time of first data point, the number of points, and the interval between the points and ephemeris information (Basic Product only).

GEOMETRIC CALIBRATION FILE (.geo) – contains the standard photogrammetric parameters of a virtual camera that models the corresponding QuickBird camera and optical system for Basic Imagery products.

LICENSE FILE (.txt) – the text of the selected license.

IMAGE METADATA FILE (.imd) – describes key attributes about the image product, including product level, corner coordinates, and projection information, and time of acquisition.

README FILE (.txt) – provides copyright information and the names of the ISD files.

RPC FILE (.rpc) – contains the RPC information, which can be used to rectify the image. This is a mathematical mapping from object space coordinates to image space coordinates.

TILE MAP (.til) – assists the customer in determining what tile to ingest to look at a specific part of the order polygon. This is very useful for large polygon areas. This file indicates the relative location of tiles for Standard Imagery products. The tile map will allow customers to relate information provided in the image metadata file to the tiled product.

LAYOUT FILE (.jpg) – map showing the boundaries f each product as well as the volume number of the media where each product is located (each product is colour-coded)

BROWSE IMAGE (.jpg) – an overview of all the image files

GIS FILES – folder containing the shape files of

- whole strip
- order area
- product area
- tiles

Product Ordering

QuickBird products are either obtained directly from the QuickBird Archive or by tasking the spacecraft. There are three Commercial Tasking options for QuickBird Imagery products: Standard, Priority and Rush. Competition with other orders with higher priority, or with the same priority placed earlier, may impact the acquisition window, as may weather statistics, forecasts and feasibility parameters.

New Acquisitions

Tasking orders have multiple acquisition opportunities and customer-defined tasking parameters. If all collection attempts are unsuccessful, the customer will be contacted to cancel or re-instate the order.

Select Tasking

- Entry level tasking option
- Customers can set their own collection window or accept a suggested window
- Available for all missions and Product Levels
- Customer may define collection window up to 365 days
- For QuickBird orders, a report of probability of success will be provided with the feasibility study. If the customer-defined window has a low probability of

success, an alternative window will be suggested.

Select Plus Tasking

- Offers a higher level of service and shorter collection windows than Select Tasking, especially in areas of high competition
- Available for all missions and Product Levels except Basic Stereo Pair
- Customer may define collection window up to 365 days
- For QuickBird orders, a report of probability of success will be provided with the feasibility study. If the customer-defined window has a low probability of success, an alternative window will be suggested.

Assured Tasking

- Necessary capacity will be allocated to fulfill Assured Tasking orders within the agreed collection window
- If Assured Tasking orders are not successfully acquired within the specified window, customers will be given the option to either:
  - receive free ImageLibrary data for an area equivalent to the unfulfilled order, or
  - extend the order. Customer will be given an updated collection window for the unfulfilled portion of the order polygon
- Assured Tasking is available for QuickBird only, for all Product Levels
- Customer may define collection window up to 365 days, but if the customer-defined window has a low probability of success, the suggested window must be used to confirm the order.

Single Shot Tasking

- Highest service level for customers with an immediate need for new imagery or for a specific acquisition date
- Available for QuickBird only, for all Product Levels except Orthorectified
- Customer may define a window of 1 – 14 days
- A feasibility report will be provided with the first feasible access date within the customer-defined window
- Orders are guaranteed to be shot once confirmed, and must be collected in a single pass
- There is no cloud cover guarantee with this option

Archive Ordering (Image Library)

In addition to tasking the satellite, customers may order QuickBird products directly out of the QuickBird Image Library. Minimum order for Standard products is 25 km².

Rush Image Library

Rush Image Library orders guarantee production within 24 hours (for pan or multi-spectral imagery) or 48 hours (for pan-sharpened imagery) from the moment of order. Images ordered on a Friday will be available Monday.

Order Polygon

Each order, whether new acquisition or archive, scene based or area based, is defined by an Order Polygon. An Order Polygon may contain up to 1,000 vertices, consisting of longitude/latitude (decimal degrees) geographic coordinates on the WGS84 ellipsoid.

The minimum dimension of a polygon is 5 km. An order polygon may be defined using one of the following methods:

SEND POLYGON FILE: Customers may send a file that defines the Order Polygon. The supported file types for polygons are:

SHAPEFILE FORMAT – all three related files must be supplied (.shp, .shx, and .dbf). A shapefile must contain only one polygon

ASCII TEXT FORMAT (.gen) – Arc/Info Generate format. An ASCII text file must contain a closed polygon with a minimum of three points, and a maximum of 1,000 points

These files may be e-mailed to a Customer Service Representative at cust.service@eurimage.com.

MANUALLY ENTER COORDINATES: Customers may manually write the Upper Left and Lower Right corner coordinates that define the order polygon on the Eurimage QuickBird Order Form, or give the Centre coordinates and the height and width.

Tasking Parameters

OFF-NADIR ANGLE	RUSH	PRIORITY	STANDARD
minimum 10° interval in the range:		0°—45°	
	Standard Ortho-Ready products: suggested 0—25°		
SUN ELEVATION		>= 15°	
SUN AZIMUTH		0°—360° (as collected)	
TARGET AZIMUTH		0°—360° (as collected)	
	RUSH	PRIORITY	STANDARD
MINIMUM COLLECTION AREA	100 km²	64 km²	64 km²
MAXIMUM COLLECTION AREA	2,500 km²	10,000 km²	10,000 km²
MAXIMUM CLOUD COVER	n/a	20%	20%
START COLLECTION WINDOW from order placement	>= 48 hours	>= 2 days	>= 2 days
COLLECTION WINDOW	1—14 days	7—365 days	14—365 days

Cloud Cover

Cloud Cover is calculated on the intersection between the ordered area and the whole acquired strip; if over 20%, the strip is considered unusable and tasked again.

It might happen that, if the strip is produced with scene-based framing, some scenes could have cloud cover over 20% (see below). This is normal and is not a reason to reject a cloudy scene.

Rush tasking orders are not evaluated for cloud cover. It is the customer's responsibility to choose dates where he is confident to get fewer clouds.

For archive orders it is the customer's full responsibility to verify the cloud cover of the selected strips over the ordered area.

Acquired strip: less than 20% cloud cover over order area

Scenes produced: although the first may have more than 20% cloud cover, the scene is considered valid

Product Delivery

QuickBird Standard products are provided to customers on a variety of industry standard image formats and edia. In addition to the imagery products, also the Image Support Data files in text format are delivered.

Image Formats

QuickBird imagery products are available in three image formats:

- GeoTIFF 1.0
- NITF 2.0
- NITF 2.1

Delivery Options

Eurimage provides a variety of direct and timely delivery options for delivering QuickBird imagery products to the customer. These options include:

STANDARD DELIVERY SERVICE: Eurimage uses standard delivery services (DHL) to deliver media directly to the customer in a timely fashion.

ELECTRONIC DELIVERY SERVICE: The customer may request electronic delivery. Eurimage supports ftp – pull, where the customer logs on to the DigitalGlobe system and retrieves their imagery. Those customers who select electronic delivery will not receive imagery on media.

Standard Media

CD	640 MByte (not available for Basic products)
DVD	4.7 GByte

Delivery Timelines

Delivery time for the various products through the available delivery methods depends on the different options that the customer selects with each order.

Production times

	Standard	Priority	Rush
TASKING	3 days	3 days	60 hours
IMAGE LIBRARY	3 days	N/A	24–48 hours

- Times are number of business days, after image acquisition
- Processing assumes one image
- Additional contiguous scenes in a single order will add a nominal number of days

Product Naming Parameters

<product file name> = <acquisition time>-<product info>-<product id>.<format extension>

Example

Product File Name	=	08SEP01123645-P2AS-000000000987_01_P001.TIF
<acquisition time>	=	08SEP01 (date) 123645 (time). UTC time
<product info>	=	P (pan) 2A (standard imagery) S (single/sub-scene)
<product id>	=	000000000987 (order item id) _01 (increment) _P001 (offset)
<format extension>	=	TIF (GeoTIFF)

Additional parameters

Image Band	*Product level*	*Image Type*	*Image Format*
P = Panchromatic	1b = Basic	S = Single/Sub-scene	TIF = GeoTIFF 1.0
M = Multi-spectral	2A = Standard	M = Mosaic	NTF = NITF 2.0 or 2.1
S = Pan-sharpened			