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QuickBird Imagery Products

Product Guide

ISO 9001:2000 CERTIFIED

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1. Introduction

QuickBird Imagery Products offer customers a variety of options for accurate and timely imagery. DigitalGlobe™ offers QuickBird Imagery Products at three processing levels: (1) Basic Imagery with the least amount of processing (geometrically raw), designed for customers desiring to process imagery into a useable form themselves, (2) Standard Imagery with radiometric and geometric correction, and delivered in a map projection, and (3) Orthorectified Imagery with radiometric, geometric, and topographic correction, and delivered in a map projection. Please refer to Section 5 for more details about QuickBird Imagery Products.

In addition to processing levels, DigitalGlobe offers QuickBird Imagery Products in five product options: (1) Black & White (panchromatic) products enable superior visual analysis, (2) Multispectral products cover the visible and near-infrared wavelengths and are ideal for multispectral analysis, (3) Bundle (black & white and multispectral) products, (4) Color (3-band natural color or color infrared) products that combine the visual information of three multispectral bands with the spatial information of the panchromatic band, and (5) Pan-sharpened (4-band) that combines the visual information of all four multispectral bands with the spatial information of the panchromatic band. Please refer to Section 6 for more details about QuickBird Imagery Product options.

DigitalGlobe provides customers with flexibility in Product Levels, Ordering Options, Delivery Options, and Licensing Options. This document discusses, in detail, QuickBird Imagery Products and ordering options, including:

QuickBird Satellite: The QuickBird satellite collects the highest resolution imagery commercially available.

Product Ordering: The DigitalGlobe ImageLibrary allows customers to order previously collected imagery. If the customer's area of interest is not covered in the ImageLibrary, DigitalGlobe will task the image collection in one of three commercial tasking options.

Product Delivery: DigitalGlobe delivers its QuickBird Imagery Products to customers in industry standard image formats and media. Customers may receive their products via commercial delivery services or electronically via ftp (pull).

Product Levels: DigitalGlobe offers QuickBird Imagery Products in several processing and accuracy levels to suit customers' needs.

Product Options: DigitalGlobe offers products in a variety of multispectral options.

Product Naming: Product File Naming Conventions provide information about the acquisition of the QuickBird Imagery.

Product Licensing: DigitalGlobe licenses its imagery in a flexible manner to ensure that all personnel who need access to the imagery may use it.

Image Support Data: The metadata provided with QuickBird Imagery Products provides all the information needed to analyze and process imagery to the customer's specifications.

2. QuickBird Satellite

DigitalGlobe's QuickBird satellite provides the largest swath width, largest on-board storage, and highest resolution of any currently available or planned commercial satellite. QuickBird is designed to efficiently and accurately image large areas with industry-leading geolocational accuracy. The QuickBird spacecraft is capable of acquiring over 75 million square kilometers of imagery data annually (over three times the size of North America), allowing DigitalGlobe to populate and update its ImageLibrary at unprecedented speed.

QuickBird Characteristics	
Launch Date	October 18, 2001
Launch Vehicle	Boeing Delta II
Launch Location	Vandenberg Air Force Base, California
Orbit Altitude	450 km
Orbit Inclination	97.2 degree, sun-synchronous
Speed	7.1 km/second
Equator Crossing Time	10:30 a.m. (descending node)
Orbit Time	93.5 minutes
Revisit Time	1-3.5 days depending on latitude (30^{o} off-nadir)
Swath Width	16.5 km at nadir
Metric Accuracy	23-meter horizontal (CE90%)
Digitization	11 bits
Resolution	Pan: 61 cm (nadir) to 72 cm (25^{o} off-nadir) MS: 2.44 m (nadir) to 2.88 m (25^{o} off-nadir)
Image Bands	Pan: 725 nm Blue: 479.5 nm Green: 546.5 nm Red: 654 nm Near IR: 814.5 nm

Note: maximum order polygon size for a single scene is approximately 14 km x 14 km

Table 1. QuickBird Spacecraft Characteristics.

3. Product Ordering

QuickBird products are either obtained directly from the DigitalGlobe ImageLibrary or by tasking the spacecraft. This section details the different tasking and ImageLibrary order types as well as the methods for specifying an order polygon.

3.1 QuickBird Tasking Orders

There are three Commercial Tasking options for QuickBird Imagery Products: Standard, Priority, and Rush. Tasking orders have single or multiple acquisition opportunities and customer-defined tasking parameters, depending on the tasking type selected. In addition, each tasking type has a priority level in relation to the other tasking types (see Table 2).

Tasking Type	Relative Priority
Commercial Standard	**3**
Commercial Priority	**2**
Commercial Rush	**1**

Table 2. QuickBird Tasking Types and Relative Priorities.

When preparing its collection plan, DigitalGlobe considers several factors, including order priority, date an order was received, the customer-specified collection window, and the cloud cover forecast. In rare instances, DigitalGlobe may pre-empt some orders due to collection efficiency and/or satellite calibration and maintenance. For Standard and Priority Tasking, the customer will be contacted prior to the end of the collection window to cancel the order or extend the collection window if the original tasking order was unsuccessful. Tables 3, 4, and 5 define commercial tasking options and defaults.

3.1.1 Collection Feasibility

All QuickBird Tasking Orders must pass two feasibility studies prior to acceptance of the order:

- Physical Feasibility assesses the number of times that QuickBird has physical access to your target based upon the parameters you provide. Items that affect physical feasibility include off-nadir angle (wider angles will have more accesses than narrow angles), latitude (QuickBird has increased access to locations at higher latitudes), collection windows (the larger the collection window, the more access QuickBird will have), and cloud cover forecast. Note that orders over a 30 degree off-nadir angle will require a special review.
- Competitive Feasibility assesses DigitalGlobe's ability to collect your order based upon other orders in the system. Items that affect competitive feasibility include orders already in the system and orders that have a higher relative priority (see Table 2).

3.1.2 Standard Tasking

- An order placed at least 48 hours before the start collect date.
- Customer specifies length of collection window up to 365 days. Collection window is subject to feasibility. DigitalGlobe suggests a 90 day collection window to ensure enough time to collect imagery that meets your specifications. Larger areas will require a longer collection window.
- Unlimited number of collection attempts within the customer specified collection window, depending on off-nadir angle, latitude, competition, and length of collection window. A longer collection window will result in more physical collection opportunities and increased likelihood of a successful collect.
- Standard image processing.

Tasking Parameters - Standard Commercial		Customer Selected
Minimum Collection Area	1 scene for Basic Imagery 64km^2 for Standard Imagery 100km^2 for all Orthorectified Imagery Products	
Start Collection Date	>= 48 hours from order placement	Yes
End Collection Date	Customer specified number of days from Start Collection Date, up to 365 days from Start Collect 90 days recommended	Yes
Maximum Cloud Cover	20%	
Off-Nadir Angle	0^o - 45^o Basic, Standard, and Ortho Ready Standard Imagery 0^o - 25^o Orthorectified Imagery (1:50,000, 1:12,000, and Custom) 0^o - 15^o for Orthorectified Imagery (1:5000 and 1:4800)	Yes
Maximum Number of Acquisition Attempts	Limited only by length of the collection window and competition	
Sun Elevation	>= 15^o (as collected)	
Sun Azimuth	0^o - 360^o (as collected)	
Target Azimuth	0^o - 360^o (as collected)	

Table 3. Commercial Standard Tasking Parameters.

3.1.3 Priority Tasking

- An order placed at least 48 hours before the start collect date.
- Customer specifies length of collection window up to 365 days. Collection window is subject to feasibility.
- Unlimited number of collection attempts within the customer specified collection window, depending on off-nadir angle, latitude, competition, and length of collection window. A longer collection window will result in more physical collection opportunities and increased likelihood of a successful collect.
- Priority image processing.

Tasking Parameters - Priority Commercial		Customer Selected
Minimum Collection Area	1 scene for Basic Imagery 64km^2 for Standard Imagery 100km^2 for all Orthorectified Imagery Products	
Start Collection Date	>= 48 hours (2 days) from order placement	Yes
End Collection Date	Customer specified number of days from Start Collection Date, up to 365 days from Start Collect	Yes
Maximum Cloud Cover	20%	
Off-Nadir Angle	0^o - 45^o Basic, Standard, and Ortho Ready Standard Imagery 0^o - 25^o Orthorectified Imagery (1:50,000, 1:12,000, and Custom) 0^o - 15^o Orthorectified Imagery (1:5000 and 1:4800)	Yes
Maximum Number of Acquisition Attempts	Limited only by length of the collection window and competition	
Sun Elevation	>= 15^o (as collected)	
Sun Azimuth	0^o - 360^o (as collected)	
Target Azimuth	0^o - 360^o (as collected)	

Table 4. **Commercial Priority Tasking Parameters.**

3.1.4 Rush Tasking

- An order placed at least 24 hours before the start collect date.
- A collection window of 1 - 14 days.
- A single collection attempt.
- Basic and Standard Imagery only.
- Rush image processing.

Tasking Parameters - Rush Commercial		Customer Selected
Minimum Collection Area	1 scene for Basic Imagery 100km^2 for Standard Imagery	
Maximum Collection Area	2,500km^2 (must be able to collect in a single pass)	
Start Collection Date	>= 24 hours from order placement	Yes
End Collection Date	1 to 14 days after Start Collection Date	Yes
Maximum Cloud Cover	20% to 100%	
Off-Nadir Angle	0^o - 45^o	Yes
Maximum Number of Acquisition Attempts	1	
Sun Elevation	>= 15^o (as collected)	
Sun Azimuth	0^o - 360^o (as collected)	
Target Azimuth	0^o - 360^o (as collected)	

Table 5. Commercial Rush Tasking Parameters.

3.2 ImageLibrary Ordering

In addition to tasking the satellite, customers may order QuickBird Imagery Products directly out of the DigitalGlobe ImageLibrary. Customers may define their order polygons in several ways (see below). ImageLibrary orders receive the Standard level image processing, unless ordered as a Rush ImageLibrary order.

3.2.1 Rush ImageLibrary Delivery

DigitalGlobe offers customers a Rush ImageLibrary delivery option for Basic and Standard Imagery already existing in the ImageLibrary. This option features a 24 hour turnaround time between order confirmation and order shipment or FTP for Black & White, Multispectral, and Bundle products. For Color and Pan-sharpened products, a 48 hour turnaround time (between order confirmation and order shipment or FTP) is offered. Orders comprised of more than one scene for any one customer will be subject to a feasibility assessment.

There are special considerations and timelines for orders over the weekend. Orders received outside of normal business hours will have feasibility assessed on the next business day. Products ordered on Friday will not be sent to the FTP site or shipping dock until Monday morning (Black & White, Multispectral, and Bundle products) or Tuesday morning (Pan-Sharpened products). Processing will start on the next business day for orders confirmed outside of normal business hours.

3.3 Order Polygon

Each order, whether tasking or an ImageLibrary order, scene based or area based, is defined by an Order Polygon. An Order Polygon may contain a minimum of 4 vertices and a maximum of 1,000 vertices, consisting of longitude/latitude (decimal degrees) geographic coordinates on the WGS84 ellipsoid.

The minimum and maximum size for an order polygon depends on the order type and the product selected. Refer to Tables 11, 12, and 13 for order polygon restrictions by product type. An order polygon may be defined using one of the following methods:

- Upper left and lower right corner coordinates if your area is rectangular.
- A center point and a height and width to define your area.
- Shapefile format –the .shp, .shx, and .dbf files must be supplied. 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 four points, and a maximum of 1,000 points (see Table 6).

Format	Example
"ID"	BRISBANE_AUSTRALIA
Longitude, Latitude	152.808,-27.671
Longitude, Latitude	153.244,-27.671
Longitude, Latitude	153.244,-27.236
Longitude, Latitude	152.808,-27.236
END	END

Table 6. Example of the ASCII text file format.

Order polygons that fit within a 12 km x 12 km box (for both scene and area based framing) will be collected in a single satellite pass, unless otherwise requested by the customer. Scene based products will remain 16.5 km (wide) x ~16.5 km (long) in size.

4. Product Delivery

DigitalGlobe provides its QuickBird Imagery Products to customers on a variety of industry standard image formats and media. In addition to the imagery products, DigitalGlobe also delivers the Image Support Data files in text format as described in Section 10.

4.1 File Formats

QuickBird Imagery Products are available in three image formats:

- GeoTIFF 1.0
- NITF 2.0
- NITF 2.1

4.2 Delivery Options

DigitalGlobe provides a variety of direct and timely delivery options for delivering QuickBird Imagery Products. These options include:

Standard Delivery Service: DigitalGlobe uses standard delivery services (FedEx, DHL, UPS) to deliver media directly to the customer in a timely fashion. DigitalGlobe selects the most reliable and quickest service based upon customer location.

Electronic Delivery Service: The customer may request electronic delivery. DigitalGlobe supports ftp (pull), where the customer logs on to the DigitalGlobe system and retrieves their imagery.

4.3 Media

DigitalGlobe supports delivery on CD and DVD for its QuickBird Imagery Products:

Media	Capacity
CD	640 MB
DVD	4 GB

Note: Basic Imagery not available on CD

Table 7. DigitalGlobe Supported Media.

Those customers who select electronic delivery via ftp (pull) will not receive imagery on media.

4.4 Tiling

Because some QuickBird Imagery Products cannot fit in their entirety on all available media types or may be cumbersome to work with due to their large size, DigitalGlobe offers you the option to break up imagery into smaller pieces called tiles. Tiles may be defined by pixel based grids or by map based coordinates. Pixel based tiles may be defined by approximately 8,000 pixels by 8,000 pixels (8k x 8k), 14,000 pixels by 14,000 pixels (14k x 14k), or 16,000 by 16,000 pixels (16k x16k). Map based tiles are based on map coordinates in product units (meters or feet) and are defined by tile size and tile overlap. Customers who do not wish to tile their imagery may change their media type to one that will accommodate the full size of their product, but should understand that large data files may be difficult to import into some software packages. Please note that most image processing, GIS, and cartographic applications cannot open files over 2 GB in size.

Tiling is an option for all QuickBird products, except Basic Imagery. Note that all Pan-sharpened products must be tiled regardless of media type. Please see Section 5 for a complete definition of QuickBird products.

If an order polygon crosses strip boundaries, then the imagery product will be divided into product components, denoted as P001, P002, etc. When an individual product component exceeds the size limit for the media selected, it is tiled. Each tile, regardless of the tiling option (pixel based or map based) is then given a number corresponding to its position in rows and columns. (See Figure 1).

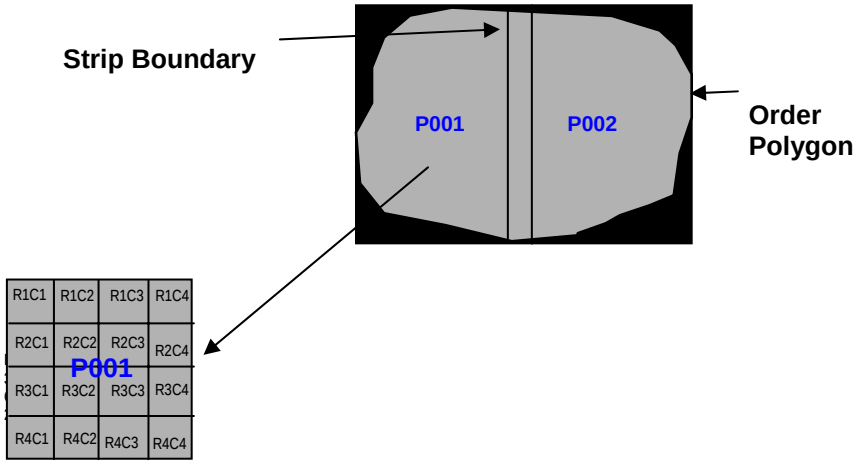

Figure 1. Tile Naming

A tile map file (.til) is delivered with every product to help place the tiles in product coordinates. For more information on the tile map file and more technical information on tiling, see section 10.5.4.

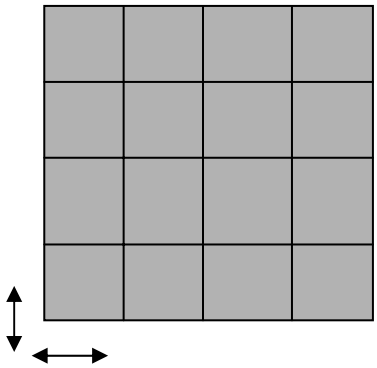

Figure 2. Tile Map Naming Example

Pixel Based Tiling
DigitalGlobe tiles imagery based on pixel grids by first drawing a minimum-bounding rectangle (MBR) around the image-oriented map. That MBR is then divided into tiles, which are sized according to the tiling option selected. Three pixel based tiling options are available, giving you the ability to specify the amount of data in each tile. These are as follows: 8k x8k, 14k x14k, and 16k x16k.

8k x 8k - 8k x 8k tiles have exactly 8,192 pixels by 8,192 pixels per tile. This tiling option may be easily read by commercial off the shelf (COTS) software products.

When the 8k option is selected, DigitalGlobe starts at the upper left corner of the MBR and counts 8000 x 8000 pixels to create the first tile. (The tiles are actually 8 multiplied by 1024 due to internal blocking, so the first tile would be composed of 8,192 by 8,192 pixels for a panchromatic product. Divide by 4 for a multispectral product). The next tile is generated starting where the first tile ends (pixel 8192, 0), and pixels are counted down and across. (This same process is applied to 14k x 14k and 16k x 16k tiling, although 1024 is multiplied by 14 or 16, respectively, for these options.)

If the amount of imagery in a tile is less than 8192 x 8192 pixels, then the tile is cut off at the edge of the imagery. Some padding, or blackfill, pixels may be included to complete the block. A block is comprised of 1024 panchromatic pixels or 256 multispectral pixels.

14k x14k -14k x14k tiles have exactly 14,336 by 14,336 pixels per tile.

16k x16k -16k x16k tiles contain 16,384 X 16,384 pixels per tile.

Map Based Tiling
Map based tiling is available for all projections except Geographic and defined by product units (meters or feet). With this tiling option, the customer defines the tile size and tile overlap. The default tiling origin is the upper left corner of the minimum bounding rectangle for area based products and the upper left corner of the scene for scene based products. In order to define the tiling layout, the customer will specify length and width of the tiles in the product units. In addition, the amount of overlap is customizable between adjacent tiles. Although this tiling option allows for more custom tiling, tile sizes will be limited by the file size restrictions defined in the No Tiling option below.

No Tiling
DigitalGlobe strives to respect the wishes of its customers in regards to tile size selection. However individual scene size, file size, and media type may determine whether a scene requires tiling, regardless of the option selected. An order polygon whose boundaries intersect multiple scenes may need to have individual scenes tiled. An individual scene will be tiled if it is:

- Larger than 2 GB for any available media choice
- Larger than 640 MB for a CD

The following table shows file sizes for each pixel based tiling options.

	Black & White	Color (3-band)	Multispectral	Pan-sharpened (4-band)	Bit Depth
Basic Imagery (one scene)	800 MB	NA	200 MB	NA	8
	1600 MB	NA	400 MB	NA	16
Standard and Orthorectified Imagery (8k x 8k tile)	75 MB	200 MB	20 MB	270 MB	8
	150 MB	400 MB	40 MB	540 MB	16
Standard and Orthorectified Imagery (14k x 14k tile)	200MB	600MB	50Mb	800MB	8
	400MB	1200MB	100MB	1600MB	16
Standard and Orthorectified Imagery (16k x 16k tile)	300 MB	800 MB	75 MB	1080 MB	8
	600 MB	1600 MB	150 MB	2160 MB	16

Table 8. File Size of QuickBird Imagery Products at Different Tile Sizes

Please see the *QuickBird Imagery Products FAQ* for more information on tiling, tile file sizes, and working with tiled imagery.

4.5 Delivery Timelines

Delivery time for products depends on the product and product options that a customer selects. Table 9, Expected Delivery Times by Product and Tasking Type, establishes the average timetables for product delivery. Times in this table indicate the number of business days to shipment, after DigitalGlobe receives all of the necessary support data to process an order. For Basic and Standard Imagery, this is after imagery acquisition. For Orthorectified Imagery, this is after imagery acquisition, and the collection of appropriate DEMs and GCPs. For ImageLibrary imagery, this time is number of days after order confirmation.

	Standard Tasking	Priority Tasking	Rush Tasking	ImageLibrary	Rush ImageLibrary
Basic[1]	3 days	3 days	60 hours	3 days	24 hours
Standard[1]	3 days	3 days	60 hours	3 days	24 hours
Standard - Pan-sharpened[1]	3 days	3 days	60 hours	3 days	48 hours
Orthorectified[1]	5 days	5 days	N/A	5 days	N/A
Orthomosaic - less than 1500km2	12 days	12 days	N/A	12 days	N/A
Orthomosaic - more than 1500km2	20 days	20 days	N/A	20 days	N/A
[1]Processing assumes one image. Additional contiguous scenes in a single order will add a nominal number of days.					

Table 9. Expected Delivery Times, by Product Type and Tasking Type.

5. QuickBird Product Levels

DigitalGlobe offers QuickBird Imagery Products at several product levels. As shown in Table 10, the product levels equate to different levels of processing and geolocational accuracy.

Product Level	Processing	Absolute Accuracy		Geographic Availability
		CE90%	RMSE	
Basic Imagery	Sensor Corrected (Raw)	23-meters*	14-meters*	Worldwide
Standard Imagery	Georectified	23-meters**	14-meters**	Worldwide
Ortho 1:50,000	Orthorectified	25.4-meters	15.4-meters	Worldwide
Ortho 1:12,000	Orthorectified	10.2-meters	6.2-meters	US and Canada
Ortho 1:5,000	Orthorectified	4.23-meters	2.6-meters	Worldwide
Ortho 1:4,800	Orthorectified	4.1-meters	2.5-meters	US and Canada
Custom Ortho	Orthorectified	variable***	variable***	Worldwide

*Attained using supplied Image Support Data files and a user supplied DEM, excluding sensor and viewing geometry and topographic displacement

**Excluding viewing geometry and topographic displacement

*** Accuracy of the Custom Ortho is determined by the accuracy and quality of customer supplied support data.

Table 10. QuickBird Imagery Products and Associated Accuracies.

5.1 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 with off nadir angle. Resolution for black & white products is 61-centimeters at nadir, but increases to 72-centimeters at a 25° off-nadir look angle, and up to 1.14m at the maximum off nadir angle of 45°. Resolution for multispectral imagery ranges from 2.44-meters

(at nadir) to 2.88-meters (25° off-nadir look angle) to 4.56-meters (45° off-nadir look angle). The image is resampled to a coordinate system defined by the ideal Basic Imagery camera model. The resulting GSD varies over the entire product as a function of the attitude & ephemeris during the imaging process. Basic Imagery products are not available with pan-sharpening.

The radiometric corrections applied to this product include:

- Relative radiometric response between detectors – removes differences in imagery due to sensitivity variations between pixels
- Non-responsive detector fill – fills in null values on imagery due to detectors that are no longer collecting data
- Conversion for absolute radiometry – calibrates overall detector response from known radiometric signals

The sensor corrections account for:

- Internal detector geometry – combines the six digital chip assemblies into a virtual array
- Optical distortion – corrects image distortion caused by sensor optics
- Scan distortion – corrects for distortions caused by slew and scan rate
- Line-rate variations – corrects for variations in the panchromatic scan rate
- Registration of the multispectral bands – all multispectral bands line up with each other, but the panchromatic and multispectral bands are not registered

Each scene in a Basic Imagery order is processed individually, therefore, multi-scene Basic Imagery products are neither spatially nor spectrally mosaiced.

Accuracies: The Basic Imagery product is in the satellite frame of reference, is not tied to ground location, and is therefore a geometrically raw product with no implied accuracy. However, when the data are processed with the supplied refined Image Support Data (ISD) and a user-supplied Digital Elevation Model, a horizontal geolocational accuracy of 23-meter CE90%, excluding viewing geometry and topographic displacement may be achieved. Basic Imagery products may be processed with a supported commercial imaging software application, which utilize the ISD associated with the image. Many software packages offer two ways to orthorectify QuickBird imagery: the QuickBird Rigorous Sensor Model which uses the supplied attitude and ephemeris files or Rational Polynomial Coefficients (RPCs) which provide a mathematical mapping from satellite coordinates to image coordinates. When Basic Imagery is processed with commercial software packages using high quality DEMs (e.g., DTED Level 2) and sub-meter GCPs, internal DigitalGlobe testing has produced orthorectification accuracies of 2-5 meters RMSE with the QuickBird Rigorous Sensor Model and orthorectification accuracies of 3-6 meters RMSE with the RPC method.

Physical Structure: Basic Imagery products are delivered as scenes. In length, a scene will be approximately 16.5 km. In width, a scene will be the full strip width (27,552 pan pixels). The area that this width represents on the ground depends on the collection parameters of the scene (off-nadir angle, orientation of collection, etc). A scene has an approximate area of 272 km2 (16.5 km by 16.5 km) at nadir.

For orders of Basic Imagery products larger than a single scene, the delivered product will be a full strip width wide (27,552 pan pixels), but the length of the product will be determined by the Minimum Bounding Rectangle of the Order Polygon. The product will be delivered in scene sized increments, or increments of 16.5 km in length, except for the last scene in the strip, which may be a fractional scene. There will be at least 1.8 km overlap between each scene.

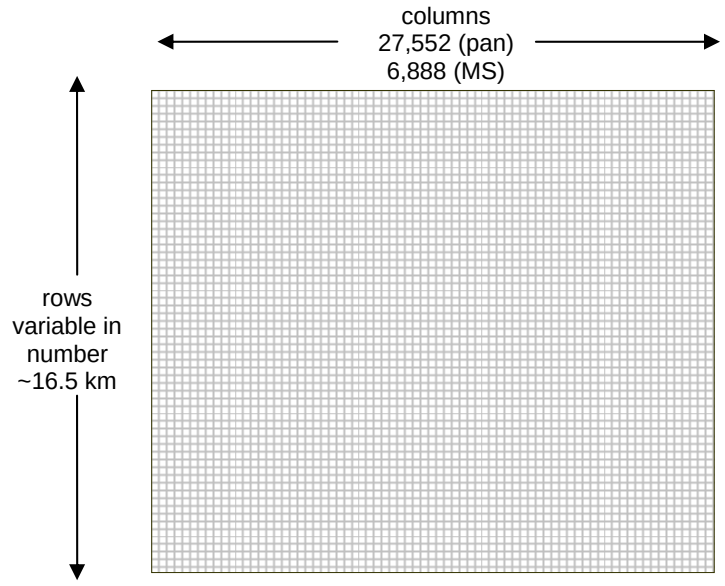

Figure 3. Panchromatic and Multispectral Basic Imagery Scene Characteristics.

As shown in Figure 4, each order polygon that falls entirely within a single scene will result in a full Basic Imagery scene being delivered.

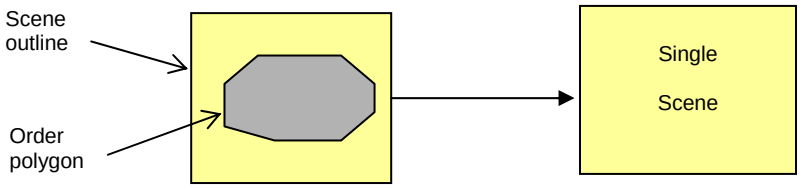

Figure 4. Final Product Structure for Sub-Scene Basic Imagery Products.

Figure 5, Final Product Structure for Multi-Scene Basic Imagery products, shows the final product structure for Basic Imagery products larger than a single scene.

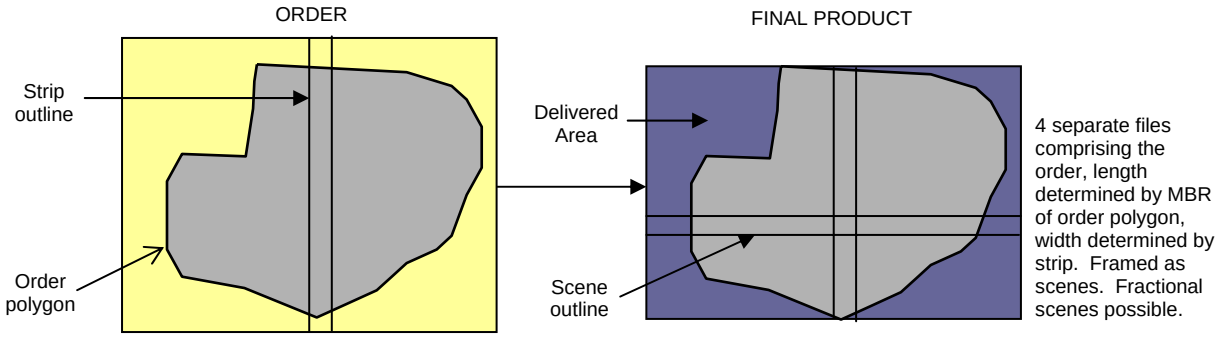

Figure 5. Final Product Structure for Multi-Scene Basic Imagery Products**.**

5.1.1 Specification Table for Basic Imagery Products

Table 11, Characteristics of Basic Imagery products, describes the processing specifications, product parameters, and delivered Image Support Data files for Basic Imagery products.

Physical Characteristics - Basic Imagery		Customer Selected
Minimum deliverable area	1 scene	
Product Framing	Scene-based	
Final product physical structure	Scenes, fractional scenes	
Pan scene dimensions (pixels col, row)	27,552 x variable length (~16.5 km)	
Pan scene size (approximate at nadir)	16.5 km x 16.5 km	
MS scene dimensions (pixels col, row)	6,888 x variable length (~16.5km)	
MS scene size (approximate at nadir)	16.5 km x 16.5 km	
Processing Specifications		
Absolute geolocation accuracy (nadir)	Geometrically raw, supplied Image Support Data and user supplied DEM allows processing to 23-m CE90%, excluding viewing geometry and terrain displacement	
Additional geometric corrections applied	N/A	
Geolocation information applied	N/A	
Applied terrain information	N/A	
Spatial mosaicing applied	N/A	
Color balance applied	N/A	
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	
Product Parameters		
Product Options	Black and White, MS, Bundle (Black and White & MS)	Yes
Number of bits/pixel deliverable image	8 or 16	Yes
Digital scaling method (applies to 8 bit only)	Linear with maximum value set to 255	
Resampling option	4x4 cubic convolution; 2x2 bilinear; Nearest neighbor; 8-pt sinc; MTF kernel	Yes
Output tile size options	N/A	
Output pixel spacing	Same as collected	
Map projections	N/A	
Ellipsoids and datums	N/A	
Output alignment	N/A	
Cloud cover	0-20%	
Delivery Parameters		
Output product delivery media options	DVD; ftp (pull)	Yes
Image data format options	NITF 2.0; NITF 2.1; GeoTIFF 1.0	Yes
Image Support Data		
ISD files supplied to customer	README file; image metadata file; ephemeris file; attitude file; geometric calibration file; RPC00B file; license text file; tile map file	
Spacecraft telemetry	Refined attitude/ephemeris (supplied with ISD)	

Table 11. Characteristics of Basic Imagery Products.

5.2 Standard Imagery Products

Standard Imagery products are suitable for users requiring modest absolute accuracy and/or large 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 black & white, color, or pan-sharpened with a 60-centimeter or 70-centimeter GSD, or multispectral with a 2.4-meter or 2.8-meter GSD. All Standard Imagery products have uniform pixel spacing throughout 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 registration of the panchromatic and multispectral bands. Geometric corrections remove spacecraft orbit position and attitude uncertainty, Earth rotation and curvature, and panoramic distortion.

Standard Imagery comes in two varieties:

Standard Imagery: Standard Imagery has a coarse DEM applied to it, which is used to normalize for topographic relief with respect to the reference ellipsoid. The degree of normalization is relatively small, so while this product has terrain corrections, it is not considered orthorectified.

Accuracies: Standard Imagery products have an average absolute geolocation accuracy of 23-meter CE90%, excluding any topographic displacement and off-nadir viewing angle. Ground location is derived from refined satellite attitude and ephemeris information without requiring the use of Ground Control Points (GCPs).

Ortho Ready Standard Imagery: Ortho Ready Standard Imagery has no topographic corrections, making it suitable for orthorectification. Ortho Ready Standard Imagery is projected to a constant base elevation, which is calculated on the average terrain elevation per order polygon.

Accuracies: Ortho Ready Standard Imagery products have a delivered absolute geolocation accuracy of 23-meter CE90%, excluding any topographic displacement and off-nadir viewing angle. When processed using supplied RPCs, a high quality DEM (e.g. DTED Level 2), and submeter GCPs, accuracies in the range of 3 to 10 meters RMSE may be achieved.

With the exception of lack of terrain correction, Ortho Ready Standard Imagery products have all the same specifications as Standard Imagery products. All the specifications in this section apply to both Standard Imagery products and Ortho Ready Standard Imagery products. Please see section 5.3 for more detail and comparisons between Basic Imagery products, Standard Imagery products, and Ortho Ready Standard Imagery products.

If the order polygon crosses more than one strip, one product is made for each image strip that is used to fulfill the order. As the Standard Product is not mosaiced, one product will be delivered for each strip the order polygon intersects.

Physical Structure: Standard Imagery products are area based and may be ordered by the square kilometer. Figure 6 shows the final product structure for order polygons that fall within a single strip for Standard Imagery products.

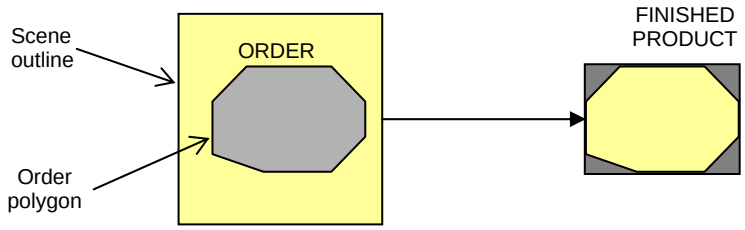

Figure 6. Product Structure for Standard and Orthorectified Imagery Products within a single strip.

Figure 7 shows the final product structure for a Standard Imagery product formed from multiple strips.

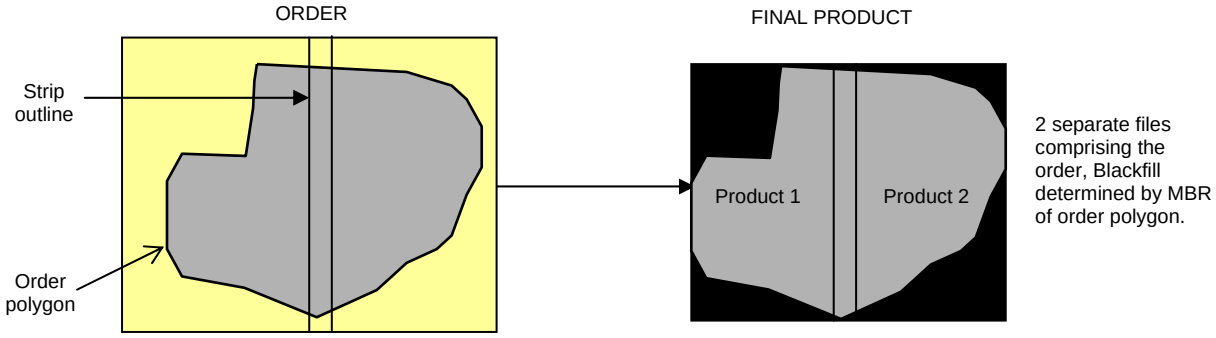

Figure 7. Product Structure for Standard and Orthorectified Imagery Products fulfilled from multiple strips.

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.

5.2.1 Specification Table for Standard Imagery Products

Table 12, Characteristics of Standard Imagery products, lists the processing specifications, product parameters, and delivered Image Support Data files for Standard Imagery products.

Physical Characteristics - Standard Imagery		Customer Selected
Minimum deliverable area	25km^2 (ImageLibrary); 64 km^2 (new collection)	
Product Framing	Area-based	
Final product physical structure	Blackfill to a MBR surrounding the ordered image pixels	
Pan scene dimensions (pixels col, row)	N/A	
Pan scene size (approximate at nadir)	N/A	
MS scene dimensions (pixels col, row)	N/A	
MS scene size (approximate at nadir)	N/A	
Processing Specifications		
Absolute geolocation accuracy (nadir)	23 m CE90% (excluding terrain distortion & viewing geometry)	
Additional geometric corrections applied	Spacecraft orbit position and attitude uncertainty; Earth rotation; Earth curvature; panoramic distortion; terrain elevation (coarse)	
Geolocation information applied	Ephemeris and attitude; rotation and alignment to map projection	
Spatial mosaicing applied	N/A	
Color balance applied	N/A	
Radiometric corrections	Relative radiometric response between detectors; non-responsive detector fill; conversion for absolute radiometry	
Sensor corrections	Internal detector geometry; optical distortion; scan distortion; any line-rate variations; mis-registration of the multi-spectral bands	
Terrain corrections	none (Ortho Ready Standard); coarse DEM (Standard)	Yes
Product Parameters		
Product Options	Black and White, MS, Bundle (Black and White & MS), Natural Color, Color Infrared, Pan-sharpened (4 band)	Yes
Number of bits/pixel deliverable image	8 or 16	Yes
Digital scaling method (applies to 8 bit only)	Linear with maximum value set to 255 (if highest DN is <= 255, no scaling is applied)	
Resampling option	pan-sharpening kernel; 4x4 cubic convolution; 2x2 bilinear; Nearest neighbor; 8-pt sinc; MTF kernel	Yes
Dynamic Range Adjustment (DRA) option	Color correction and contrast enhancement (8-bit only)	Yes
Output tile size options	None; 8k x 8k pixels; 14k x14k; 16k x 16k pixels	Yes
Output pixel spacing	60 or 70 centimeters for Black and White, Color, and Pan-sharpened; 2.4 or 2.8 meters for MS	Yes
Map projections	Listed in Table 14	Yes
Ellipsoids and datums	Listed in Table 14	Yes
Output alignment	Rotated to Map North up	
Cloud cover	0-20%	
Delivery Parameters		
Output product delivery media options	CD; DVD; ftp (pull)	Yes
Image data format options	NITF 2.0; NITF 2.1; GeoTIFF 1.0	Yes
Image Support Data		
ISD files supplied to customer	README file; image metadata file; RPC00B; license text file; tile map file	
Spacecraft telemetry	Refined attitude/ephemeris (used to create product)	

Table 12. Characteristics of Standard Imagery Products.

5.3 Comparison of Basic, Standard, and Ortho Ready Standard Imagery

Basic, Standard, and Ortho Ready Standard Imagery all have different attributes, making them appropriate for different uses. This section highlights some of the main differences between the products.

Basic Imagery: Basic Imagery allows orthorectification using the QuickBird Rigorous Sensor Model or RPCs. Results will be slightly better using the QuickBird Rigorous Sensor Model. Orthorectification must be done on a per scene basis.

Standard Imagery: Standard Imagery is most useful for applications requiring georeferenced imagery that are not terrain corrected. Standard Imagery has a coarse DEM applied to it, making it unsuitable for orthorectification.

Ortho Ready Standard Imagery: Ortho Ready Standard Imagery is a georeferenced product, designed for area-based orthorectification, using supplied RPCs. Achievable accuracies will be comparable to those attainable using Basic Imagery with RPCs. If orthorectification is not the goal, then Standard Imagery is recommended. Ortho Ready Standard Imagery is projected to the average base elevation of terrain covered by the order polygon. As such, it provides a close approximation of the order polygon on the ground. However, it could be off by several hundred meters, especially in areas of high relief, if the user does not apply terrain corrections.

5.4 Orthorectified Imagery Products

Orthorectified Imagery products are GIS-ready and are used as an image base map for a wide variety of applications. Orthorectified Imagery products are an ideal base for creating and 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.

Processing: Orthorectified Imagery products are radiometrically corrected, sensor corrected, geometrically corrected, orthorectified, and mapped to a cartographic projection and datum. Orthorectified Imagery products are available as black & white, color, or pan-sharpened, with a 60-centimeter or 70-centimeter resolution, or multispectral, with a 2.4-meter or 2.8-meter resolution. 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 registration of the multispectral bands. Geometric corrections remove spacecraft orbit position and attitude uncertainty, earth rotation and curvature, and panoramic distortion.

For order polygons that require more than 1 strip, customers have the option to have their products spatially mosaicked and/or color balanced. Mosaicking the imagery will assure that strips are edgematched, while color balancing will assure that radiometric differences between scenes are minimized.

Orthorectified Imagery products require DEMs and/or GCPs to remove relief displacement and to place each pixel into its correct, map location. Before an order for an Orthorectified Imagery product is accepted, DigitalGlobe will determine whether it can obtain the appropriate support data to make the desired product. The accuracy of the DEMs and/or GCPs used to make each product depends on the scale of the Orthorectified Imagery product ordered. For Orthorectified Imagery products with stated accuracies (1:50,000, 1:12,000, 1:5,000 and 1:4800), it is DigitalGlobe's responsibility to acquire the support data necessary to make the product.

DigitalGlobe also offers customers the opportunity to order Custom Orthorectified Imagery products. To create these products DigitalGlobe uses customer provided support data to orthorectify QuickBird Imagery. There is no stated accuracy associated with the Custom Orthorectified Imagery product because the quality and accuracy of the finished product is directly dependent on the quality and accuracy of the support data. DEMs and GCPs are the most typical types of support data that customers provide to DigitalGlobe. Alternate forms of control, such as existing orthorectified data or high accuracy GIS data, may also be accepted. Please refer to *Specifications for Customer-Provided Support Data*, available from Customer Service, for detailed format requirements for support data.

Accuracies: Orthorectified products have an absolute geolocational accuracy, which varies depending on mapping scale (see Table 9, QuickBird Imagery Products and Associated Accuracies). Ground location is measured with refined satellite attitude and ephemeris information with Ground Control Points depending on final mapping scale.

Physical Structure: Orthorectified Imagery products are area-based and may be purchased by the square kilometer. The delivered area for Orthorectified Products is the order polygon, which is blackfilled to the Minimum Bounding Rectangle.

Figure 6 shows the final product structure for order polygons that fall within a single strip for Orthorectified Imagery.

Figure 8, Product Structure for Orthomosaicked Imagery products, shows the final product tiling for an Orthorectified product formed from multiple strips.

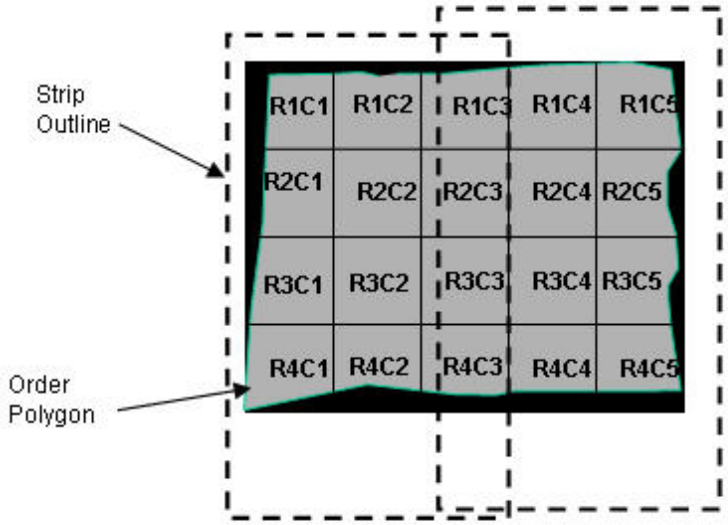

Figure 8. Product Structure for Orthomosaicked Imagery Products

5.4.1 Specification Table for Orthorectified Imagery Products

Table 13, Characteristics of Orthorectified Imagery products, lists the processing specifications, product parameters, and delivered Image Support Data files for Orthorectified Imagery products.

Physical Characteristics - Ortho Imagery		Customer Selected
Minimum deliverable area	100 km2	
Product Framing	Area-based	
Final product physical structure	Blackfill to a MBR surrounding the ordered image pixels	
Pan scene dimensions (pixels col, row)	N/A	
Pan scene size (approximate at nadir)	N/A	
MS scene dimensions (pixels col, row)	N/A	
MS scene size (approximate at nadir)	N/A	
Processing Specifications		
Absolute geolocation accuracy (nadir)	See Table 9	
Additional geometric corrections applied	Spacecraft orbit position and attitude uncertainty; Earth rotation; Earth curvature; panoramic distortion; terrain elevation (fine)	
Geolocation information applied	Refined ephemeris and attitude; rotation; and alignment to map projection	
Spatial mosaicing applied	Images mosaicked to minimize seamlines	Yes
Color balance applied	Color balanced across mosaic seamlines	Yes
Radiometric corrections	Relative radiometric response between detectors; non-responsive detector fill; conversion for absolute radiometry	
Sensor corrections	Internal detector geometry; optical distortion; scan distortion; any line-rate variations; mis-registration of the multispectral bands	
Product Parameters		
Product Options	Black and White, MS, Bundle (Black and White & MS), Natural Color, Color Infrared, Pan-sharpened (4 band)	Yes
Number of bits/pixel deliverable image	8 or 16	Yes
Digital scaling method (applies to 8 bit only)	Linear with maximum value set to 255 (if highest DN is <= 255, no scaling is applied)	
Resampling option	pan-sharpening kernel; 4x4 cubic convolution; 2x2 bilinear; Nearest neighbor; 8-pt sinc; MTF kernel	Yes
Dynamic Range Adjustment (DRA) option	Color correction and contrast enhancement (8-bit only)	Yes
Output tile size options	None; 8k x 8k pixels; 14k x14k; 16k x 16k pixels Product Units-customer specified (mosaics only)	Yes
Output tile overlap	customer specified in product units (mosaics only)	Yes
Output pixel spacing	60 or 70 centimeters for Black and White, Color, and Pan-sharpened; 2.4 or 2.8 meters for MS	Yes
Map projections	Listed in Table 14	Yes
Ellipsoids and datums	Listed in Table 14	Yes
Output alignment options	Map north	
Cloud cover	0-20%; 0% (pending feasibility assessment)	Yes
Delivery Parameters		
Output product delivery media options	CD; DVD; ftp (pull)	Yes
Image data format options	NITF 2.0; NITF 2.1; GeoTIFF 1.0	Yes
Image Support Data		
ISD files supplied to customer	README file; image metadata file; license text file; tile map file	
Space craft telemetry	Refined attitude/ephemeris (used to create product)	

Table 13. Characteristics of Orthorectified Imagery Products.

5.5 Projections and Datums

DigitalGlobe supports the following map projections, ellipsoids, and datums:

Map Projections
Geographic (Lat/Long)
State Plane Coordinate System
UTM (default)

Ellipsoids and Datums
GDA 1994
GRS80
NAD27
NAD83
WGS84

Table 14. DigitalGlobe Supported Map Projections, Ellipsoids, and Datums.

6. QuickBird Imagery Product Options

Each of the QuickBird Imagery Product levels described in section 5 is available in a variety of product options. These product options use different spectral band combinations and imply differences in the pixel resolution of the final product. The QuickBird sensor collects five image bands. Table 15 describes the spectral bands that are used to produce each product option.

Product Option	Black & White	Blue	Green	Red	Near - IR
	725nm	479.5nm	546.5nm	654nm	814.5nm
Black & White (panchromatic)	XX				
Multispectral (MS)		XX	XX	XX	XX
Bundle (Pan & MS)	XX	XX	XX	XX	XX
Natural Color (3-band)	XX	XX	XX	XX	
Color Infrared (3-band)	XX		XX	XX	XX
Pan-sharpened (4-band)	XX	XX	XX	XX	XX

Table 15. The Relationship between Spectral Bands and Product Options.

6.1 Black & White (Panchromatic) Products

DigitalGlobe QuickBird black & white products enable superior visual analysis based on 61-centimeter resolution (at nadir) and 11-bit collected information depth. The panchromatic sensor collects information at the visible and near-infrared wavelengths and has a bandwidth of 725 nm.

The output Ground Sample Distance of black & white products varies with product level. Basic Imagery products are delivered at the GSD in which the data were collected (ranging from 61 cm at nadir to 1.14m at 45° off-nadir). For Standard and Orthorectified Imagery products the customer has the choice to resample to either a 60 cm or 70 cm GSD.

6.2 Multispectral Products

DigitalGlobe QuickBird multispectral products provide four discrete non-overlapping spectral bands and 11-bit collected information depth. The multispectral products cover the visible and near-infrared wavelengths in four bands. All four bands are delivered as one file when this product is ordered by the customer.

The output Ground Sample Distance of the Multispectral Product varies with product level. Basic Imagery products are delivered at the GSD in which the data were collected (ranging from 2.44 m to 4.56 m at 45° off-nadir). For Standard and Orthorectified Imagery products the customer has the choice to resample to either a 2.4 m or 2.8 m GSD.

6.3 Bundle (Black & White and Multispectral) Products

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

6.4 Color Products (3-band)

QuickBird Imagery Products are available in two 3-band color product options:

- Natural Color (using blue, green, and red bands)
- Color Infrared (using green, red, and infrared bands)

These pan-sharpened products combine the visual information of three multispectral bands, with the spatial information of the black & white band. Color Products are available as product options for Standard and Orthorectified Imagery, but not for Basic Imagery. Customers may choose between a 60 cm or 70 cm GSD. Currently, Color products are resampled using only the 4x4 cubic convolution or the 8 pt sinc methods.

6.5 Pan-sharpened Products (4-band)

QuickBird Imagery Products are also available in a 4-band pan-sharpened product option. These products combine the visual information of four multispectral bands (blue, green, red, and infrared), with the spatial information of the panchromatic band. Pan-sharpened Products are available as product options for Standard and Orthorectified Imagery, but not for Basic Imagery. Customers may choose between a 60 cm or 70 cm GSD. Currently, Pan-sharpened products are resampled using the DigitalGlobe pan-sharpening kernel. The 4x4 cubic convolution and 8 pt sinc methods are available but are not recommended for QuickBird imagery.

Figure 9. 4-band Pan-sharpened Product, Natural Color on the Left and Color Infrared on the Right.

6.6 Dynamic Range Adjustment Option

Dynamic Range Adjustment (DRA) is a visual enhancement applied to QuickBird imagery. The DRA enhancement consists of two parts; color correction and contrast enhancement. This enhancement is strictly visual and does not affect the geographic location of the pixels. This product is recommended for users who don't have the tools to apply visual enhancements to QuickBird imagery. This product is not recommended for those users intending to perform scientific analysis or spectral classification using QuickBird imagery data. This option is available for 8 bit QuickBird Standard and Orthorectified Imagery Products.

7. Quality

All imagery is placed in the DigitalGlobe ImageLibrary. Prior to being placed in the ImageLibrary, DigitalGlobe assesses all imagery for quality, including Cloud Cover ratings and National Image Interpretability Rating Scales (NIIRS) (Table 16).

Cloud cover is defined to include pixels through which ground features are obscured either partially or in their entirety due to atmospheric conditions. To be considered cloud cover, a definite boundary between the affected pixels and the unaffected pixels must be visible.

National Image Interpretability Rating Scales (NIIRS) is utilized to systematically define and measure the quality of images and performance of imaging systems. The NIIRS is used by imagery analysts to assign a number which indicates the interpretability of a particular image. The NIIRS is one way to directly relate the quality of an image to the interpretation tasks for which it may be used.

Imagery that is greater than 20% cloud cover will be automatically retasked. For area-based products, the cloud cover assessment is performed on your Order Polygon. For scene-based products, the cloud cover assessment is performed on the full scene.

Quality	
Cloud cover rating ranges	5%; 10%; 15%; 20%; 30%; 40%; 50%; 60%; 70%; 80%; 90%; 100%
Quality metadata	NIIRS rating (0 - 9)

Table 16. **Possible Quality ratings for QuickBird Imagery Products in the DigitalGlobe ImageLibrary.**

8. Product Naming

DigitalGlobe's product naming provides key information about an image, including acquisition time and date, imaging bands, product level, and product identification. Specifically, the product name is comprised of:

<product file name> = <acquisition time>-<product info>-<product id>.<format extension>
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) _R1C1 (tile identifier)
<product id> = 000000000987 (order item id) _01 (increment) _P001 (offset)
<format extension> = TIF (GeoTIFF)

Additional parameters for the 'product info' parameter of the product naming convention are listed in Table 17 Product Naming Parameters.

Image Band	Product Level	Image Type	Tile Identifier (if product is tiled)	Image Format
P = Panchromatic	1B = Basic	S = Single/Sub-scene	R1C1 = row1,column1	TIF = GeoTIFF 1.0
M = Multispectral	2A = Standard	M = Mosaic	R1C2 = row1,column2	NTF = NITF 2.0, 2.1
S = Pan Sharpened	3A = Ortho (1:50,000)		R2C1 = row2,column1	
	3D = Ortho (1:12,000)		R2C2 = row2,column2	
	3F = Ortho (1:5,000)		etc.	
	3G = Ortho (1:4,800)			
	3X = Custom Ortho			

Table 17. Product Naming Parameters.

9. Licensing

DigitalGlobe offers flexible licensing options to meet your needs. Customers may select the license type at time of order. For all licenses, customers must identify the organizations that will be using the data at the time of order placement. Licensing options include:

Base	Up to 5 (five) permitted customer groups, working on a joint project, as defined by the DigitalGlobe Product End User License Agreement	License cannot be transferred. License is not exclusive. Can be used by agents and/or contractors of the User. All Users must be identified at time of purchase. Cannot be used to create Derivative Works*
Group	6 (six) to 10 (ten) permitted customer groups, working on a joint project, as defined by the DigitalGlobe Product End User License Agreement	License cannot be transferred. License is not exclusive. Can be used by agents and/or contractors of the User. All Users must be identified at time of purchase. Cannot be used to create Derivative Works*
Enterprise	11 (eleven to 25 (twenty-five) permitted customer groups, working on a joint project, as defined by the DigitalGlobe Product End User License Agreement	License cannot be transferred. License is not exclusive. Can be used by agents and/or contractors of the User. All Users must be identified at time of purchase. Cannot be used to create Derivative Works*
Enterprise Premium	26 (twenty-six) or more permitted customer groups, working on a joint project, as defined by the DigitalGlobe Product End User License Agreement	License cannot be transferred. License is not exclusive. Can be used by agents and/or contractors of the User. All Users must be identified at time of purchase. Cannot be used to create Derivative Works*
Educational	1 (one) department within a single educational organization within a single country	Publish research results derived from the use and analysis of the Product after the advance review and approval by DigitalGlobe. Cannot be used to create Derivative Works*

* - Customers are permitted to create derivative works for internal use, including reformatting QuickBird Imagery Products into different formats or media from which they are delivered, modifying the QuickBird Imagery Products through manipulation techniques and/or the addition of other data, and making copies of the resulting bundled image product.

Customers are permitted to use the imagery data provided by DigitalGlobe to prepare vector maps so long as the created vector maps do not include DigitalGlobe's imagery data, and to further distribute the created vector maps.

Table 18 Imagery Licenses and Definitions.

10. Image Support Data

All QuickBird Imagery Products are delivered with a set of metadata files called Image Support Data (ISD). This section describes Version R of the ISD specification. The number and types of files delivered varies depending on the product ordered. The Image Support Data files can be viewed as a collection point for all useful ancillary data. Table 19 lists the Image Support Data files that are delivered with each product type.

File Name	Extension	Basic Imagery	Standard Imagery	Orthorectified Imagery
DELIVERY LEVEL ISD				
Top Level Index (Readme) File	.TXT	**XX**	**XX**	**XX**
Top Level Index (XML) File	.XML	**XX**	**XX**	**XX**
Layout File	.JPG	**XX**	**XX**	**XX**
Shapefiles	.shx, .shp, .dbf	**XX**	**XX**	**XX**
Manifest File	.MAN	**FTP only**	**FTP only**	**FTP only**
End of Transfer File	.TXT	**FTP only**	**FTP only**	**FTP only**
PRODUCT COMPONENT LEVEL ISD				
Product Component Index (Subdirectory Readme) File	.TXT	**XX**	**XX**	**XX**
License File	.TXT	**XX**	**XX**	**XX**
Image Metadata File	.IMD	**XX**	**XX**	**XX**
Product Browse File	.JPG	**XX**	**XX**	**XX**
Tile Map File	.TIL	**XX**	**XX**	**XX**
Attitude File	.ATT	**XX**		
Ephemeris File	.EPH	**XX**		
Geometric Calibration File	.GEO	**XX**		
RPC00B File	.RPB	**XX**	**XX**	
XML File	.XML	**XX**	**XX**	**XX**

Table 19. Image Support Data (ISD) Files Delivered with Product Type.

10.1 ISD File Description

Products include ISD at two levels: one set of Delivery ISD, and one set of Product Component ISD for each product option ordered. The number of product components depends on the layout of the order polygon with respect to scene or strip boundaries. If the order polygon is entirely contained within a single scene or strip, then only one product component will be delivered. If an order polygon crosses strip or scene boundaries, then the imagery product will be divided into multiple product components. Product options include panchromatic, multispectral, or pan-sharpened.

The Delivery ISD (one set per delivery) consists of:

Top Level Index (Readme) File – This file contains a list of names of the product files and the ISD files, along with copyright information for the entire product delivery.

Top Level Index XML File – This file contains the same information as the Top Level Index (README) file but in XML format.

Layout File – This file spatially illustrates how the delivery order is spread out across the media including product and order polygon extents. The map includes volume and product labels. The file is in the standard jpeg format. Media volume information is not included for electronic deliveries.

Shapefiles – These files spatially illustrate the product layout in a similar way to the layout file except in shapefile format. The files represent the order polygon, strip boundaries, product boundaries, and tile boundaries.

Manifest File – The manifest file is included with electronic (FTP) deliveries, only. The file contains the directory listing of the files delivered with the product

End of Transfer File – The end of transfer file is included with electronic (FTP) deliveries, only. The appearance of this file on the FTP site indicates that DigitalGlobe has completed transferring all product files. It is a zero length file.

The Product Component ISD (one set per product component option) consists of:

Product Component Index (Subdirectory Readme) File – The README file provides copyright information and the names of the ISD files for a single product within a delivery.

License File – The license file contains the text of the selected license.

Image Metadata File – The image metadata file describes key attributes about the image product, including product level, corner coordinates, and projection information, and time of acquisition.

Product Browse File – The product browse file is a JPEG compressed browse image of the delivered product.

Tile Map – The tile map file assists the customer in determining what tile to ingest to look at a specific part of the order polygon.

Attitude File – The attitude includes the time of first data point, the number of points, and the interval between the points and attitude information.

Ephemeris File – The ephemeris file includes the time of first data point, the number of points, and the interval between the points and ephemeris information.

Geometric Calibration File – The geometric calibration file contains the standard photogrammetric parameters of a virtual camera that models the corresponding QuickBird camera and optical system for Basic Imagery products.

RPC00B File – The RPC00B file 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.

XML File – This file contains the same information as the combined README, Licensing, Image Metadata, Tile Map and RPC00B files, in XML format. For Basic Imagery Products, the attitude, ephemeris, and geometric calibration file are included as well.

10.2 File Layout

This section describes the structure by which the ISD files are organized for delivery. Figure 10 diagrams the layout as it applies to delivery of imagery and ISD files for all media types. Product Level Directories are identified with the product id and a 3 character descriptor: PAN for Panchromatic, MUL for Multispectral, PSH for Pansharpened, and MOS for Mosaicked products.

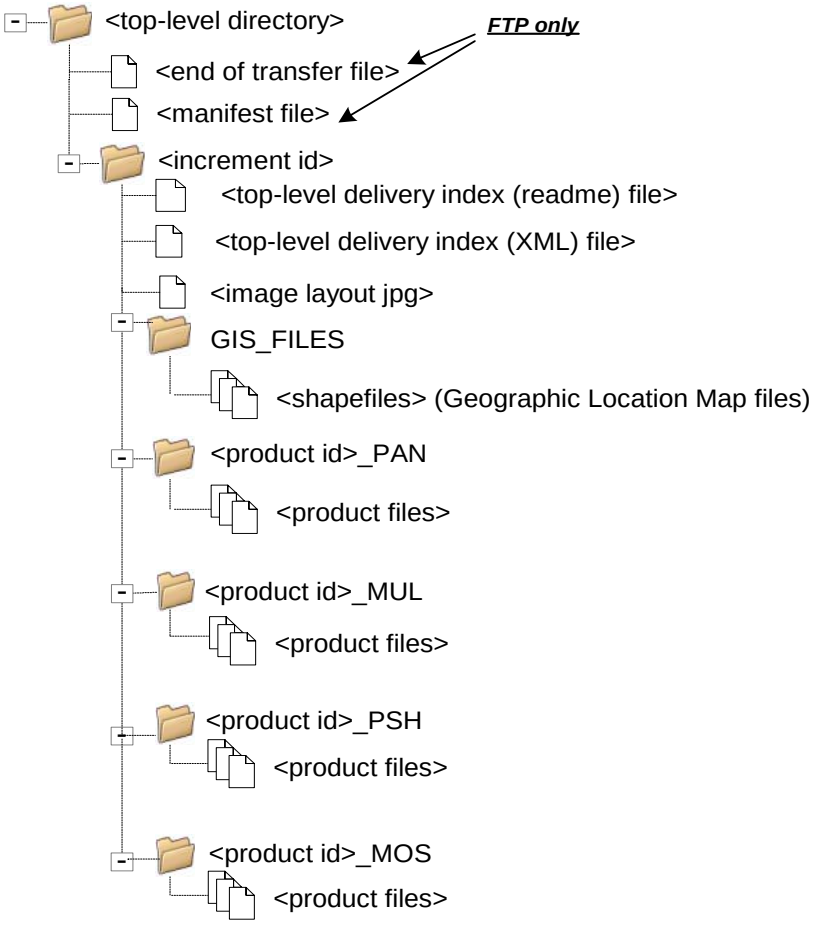

Figure 10. File Layout diagram

10.3 ISD File Format

ISD files are written in the Parameter Value Language (PVL) and Extensible Markup Language (XML). The information in PVL format is provided in multiple files while the information in XML is provided in a single file. The information provided in PVL and XML are the same semantically but differ only in syntax.

10.3.1 PVL Format

Each record consists of a variable length parameter name and a parameter value, in the form parameterName = value followed by a semi-colon. The value can be an integer (decimal, binary, octal, or hexadecimal), a floating point number, a character string, a UTC time, a set, or a list. The format for UTC time is YYYY-MM-DDThh:mm:ss.dddddd Z. Character strings values can be enclosed in quotation marks, although the quotation marks are not required if the string contains no special characters or whitespace. Sets are delimited by { }, and lists are delimited by ( ). Nested sets and lists are allowed. Comments in the file begin with a slash-asterisk /* and end with an asterisk-slash */.

Named groups begin with BEGIN_GROUP = GROUPNAME and end with END_GROUP = GROUPNAME. Nested groups are allowed. The end of a PVL module is indicated by the keyword END, followed by a semi-colon.

See sections 10.5.2.1 and 10.5.2.2 for examples of the file structure.

10.3.2 XML Format

The information contained in the PVL ISD files is also provided in XML format. See section 10.5.9 for an example of the file structure.

10.4 Delivery Level ISD

10.4.1 Delivery Index (Readme) Contents

The Delivery Index is found in a Top Level README file and a Top Level XML file delivered with each delivery. Each file contains a list of names of the product files and the ISD files, along with copyright information for the entire product delivery. The Top Level File is named for the 12 digit DigitalGlobe Order Item number and the 2 digit delivery increment, for example: 000000077583_01_README.TXT or 000000077583_01_README.XML.

Top Level Delivery Index (README) Contents

FIELD	DESCRIPTION	RANGE	CONDITIONS
version	Version of the ISD.		
copyrightText	Copyright and restricted use text.		
mediaCreation Date	Time of media creation, in UTC.		
orderNumber	12 digit DigitalGlobe Order Item number, underscore, and 2-digit delivery increment.		
fileList	A list of all files in the delivery including path directories.		
areaDesc	Customer supplied description of order. “Null” if no information supplied by the customer.		
DGOrderNo	DigitalGlobe Order Number.		
DGOrderItem No	12-digit DigitalGlobe Order Item Number.		

FIELD	DESCRIPTION	RANGE	CONDITIONS
custOrderNo	Customer supplied order number. 'Null' if no information supplied by the customer.		
custOrderItemNo	Customer supplied order item number. 'Null' if no information supplied by the customer.		
collectionStart	Date, in UTC, of first image acquisition.		
collectionStop	Date, in UTC, of final image acquisition.		
countryCode	Two letter country code of center point of order polygon.		
productScale	The NMAS mapping scale of Orthorectified Products	1:50,000 1:25,000 1:24,000 1:12,000 1:10,000 1:5,000 1:4,800 1:2,400 Custom unavailable	Orthorectified Only
numberOf Looks	Indicates whether this is a single product, a stereo pair or a stereo triplet	1, 2, 3	
cloudCover	Estimate of the max cloud-covered fraction of the delivery.	0.000 to 1.000 -999	Not applicable for Metadata Only. -999 if not assessed
NWLat	Latitude of NW corner of the minimum bounding rectangle (MBR) of the order polygon.	8 decimal places	
NWLong	Longitude of NW corner of the minimum bounding rectangle (MBR) of the order polygon.	8 decimal places	
SELat	Latitude of SE corner of the minimum bounding rectangle (MBR) of the order polygon.	8 decimal places	
SELong	Longitude of SE corner of the minimum bounding rectangle (MBR) of the order polygon.	8 decimal places	

Table 20. Top Level Delivery Index (Readme) File

10.4.2 Delivery Layout File

To help in locating portions of your imagery quickly, a diagram illustrating how the order polygon is distributed across multiple pieces of media and multiple strips is included with every order (see Figure 11, Sample Image Layout). This file will be in jpeg format and will be located in the

top level directory of the media. The name of this file will be in the form of 005500637010 (order item id) _01 (increment) _LAYOUT.jpg. In this example, the order polygon is contained within one strip (p001).

DVD Layout for Delivery Order 005500637010_01

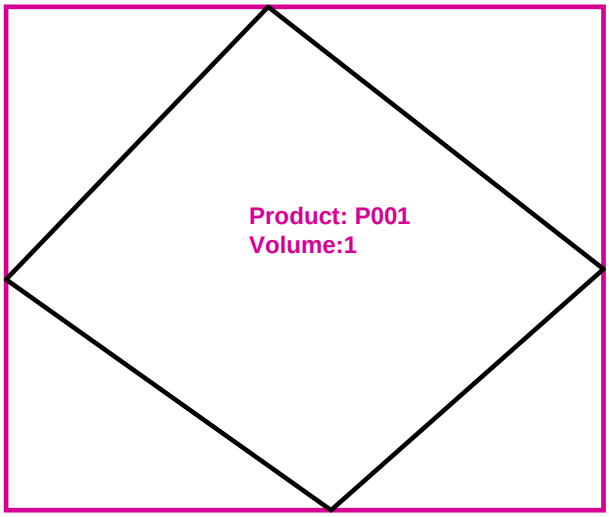

Figure 11. Sample Delivery Layout File.

10.4.3 Delivery Shapefiles

Four separate shapefiles are delivered with each QuickBird imagery product purchased. These are the Strip, Order, Tile, and Product shapefiles.

Shapefile Description

Strip- The Strip shapefile illustrates the boundaries of the strip(s) used to generate the product. This shapefile contains attributes describing information applicable to the strip including off nadir angle and sun azimuth.

Order- The Order Polygon shapefile illustrates the customer's order polygon. This is the Area of Interest that was specified and confirmed by the user at the time that their order was placed. (For Basic product orders, this will be the scene/scenes that comprise the order.) Attributes of this shapefile give general information about the product ordered such as projection and datum the product is delivered in, product creation date, etc.

Tile- The Tile shapefile illustrates how an order polygon has been tiled to fit onto a selected media format. For images that are not tiled (e.g. Basic images) the shapefile will simply show one square tile, illustrating the four corners of tile boundary. This tile shall be named R1C1. The filename of the imagery product is provided for each tile.

Product- The Product shapefile indicates the product components within the delivered product Order Polygon. Multiple product components occur if an order polygon crosses over strip or scene boundaries. Each portion of the polygon within a separate strip or scene is considered a separate product component, denoted as P001, P002, etc.) Additionally, media volume

numbers are listed as an attribute field within the shapefile so that users can identify which volume (e.g. CD 1, 2, or 3) each imagery product file is located on.

Attributes

Three fields are inherently generated when a shapefile is created. These are the FID (Feature ID), Shape, and ID fields. The FID and Shape fields cannot be deleted as they maintain internal information about the geometry and naming convention that is necessary for the shapefile to exist. Table 21 shows the attributes that come with each delivered shapefile as well as an example of the type of information one might expect to see for each of these attribute types. Because the FID and Shape fields are automatically created at the inception of a shapefile, they have been omitted from this table.

Delivery Shapefile Names and Attributes

Shapefile Name	Label Attribute	Description	Sample Item	Attribute Type	Attribute Length
Strip	stripDesc	Catalog ID corresponding with associated strip or substrip	10100100017C2400	Text	16
	sunAzimuth	Azimuth angle of the sun measured from north clockwise, in degrees, at the time the strip or substrip was acquired	159.1	F	0.0 to 360.0
	offNadir	The spacecraft elevation angle measured from nadir to the image center as seen from the spacecraft at the time the strip or substrip was acquired	20	F	0.0 to 90.0
Order	orderDesc	Item number corresponding with associated order polygon	92184	Text	12
	custOrd	Optional order number supplied by the customer at time of order placement.	44,968	Text	25
	custOrdItm	Optional order item number supplied by the customer at time of order placement.	1	Text	25
	datum	The Datum in which the product was ordered. NA for Basic products.	WGS84	Text	40

	projection	The projection in which the product was ordered. NA for Basic products.	UTM	Text	60
	bandInfo	Defines type of spectral bands in product. (e.g. PanSharp, Multispectral, All Band, Panchromatic)	MS	Text	30
	createDate	Start date of product creation.	02JUN25001236	Text	20
Tile	tileName	Tile Name	R1C1	Text	6
	fileName	Name of the imagery file.	02JUN25001236-M2AS_R1C1-000000092184_01_P001.NTF	Text	50
	productDesc	Unique product identifier	P001	Text	4
	volNum	Volume number of the media on which the tile is located.	Vol. 1	Text	20
Product	prodDesc	Unique product identifier	P001	Text	4
	volNum	Volume number of the media on which the tile is located.	Vol. 1-2	Text	20

Table 21. Shapefile Attributes

10.5 Product Component Level ISD

If an Order Polygon crosses strip or scene boundaries, then the imagery product will be divided into product components. Every product component stands on its own, with complete support data such that customers can treat each as an independent image.

10.5.1 Product Component Index (Readme)

The Product Component Index contains a list of names of the image and ISD files that are included for a particular product within a delivery. Other ISD files may or may not be included in a delivery depending on the type of the products in the order (see Table 19). One Product Component Index is provided for each product component of each delivery within the product component subdirectory.

Product Component Index (README) Contents		
Field	**DESCRIPTION**	**CONDITIONS**
copyrightText	Copyright and restricted use text	
version	Version of the ISD	
intro	Introduction. General textual information about the product and file contents.	
BEGIN_GROUP = PRODUCT_1		
XMLFilename	Product Component XML file	
licenseTxtFilename	Licensing text file name	
IMFFilename	Image metadata file name	
NRDFilename	Non-responsive detector file name	
radFilename	Radiometric calibration file name	
ephemFilename	Ephemeris file name	
attFilename	Attitude file name	
tilFilename	Tile map file name	
geoCalFilename	Geometric calibration file name	
stereoFilename	Stereo file name	
RPC00BFilename	RPC00B file name	
END_GROUP = PRODUCT_1		
END;		

Table 22. Product Component Index (README) Contents.

10.5.2 Image Metadata File

This file specifies the basic characteristics of an image. The following table describes the fields that you will see in the Image Metadata File. Note that these fields are divided into three sections with the following kinds of information:

1. Information that should be present for all products.
2. Information about images (Basic Imagery, Standard Imagery products). Each image in this category corresponds to a single imaging event.
3. Information about cartographic products in a map projection (all Standard Imagery and Orthorectified Imagery products).

Image Metadata Contents			
FIELD	**DESCRIPTION**	**RANGE**	**CONDITIONS**
version	Version of the ISD		
generationTime	Time of file generation, in UTC.		
productOrderId	Order Item ID of product		Optional if product does not originate from DG or co-producer
productCatalogID	ID for the corresponding record in DG's catalog (In multi-set products this would be the "group catalog id")		"None" if catalog not kept in DG archive.
childCatalogID	ID for the corresponding record in DG's catalog (for multi-set products this would be the "child" or "subset" catalog id) In cases where children products do not have separate IMD files, this field may be repeated.		Used only with multi-set products
imageDescriptor	This is a combination of product name and product type	"Level0", "Metadata", "Basic1A", "Basic1B", "Standard2A", "ORStandard2A", "OrthoRectified3", "Stereo1B"	
productScale	This is the NMAS mapping scale of the Orthorectified Product	1:50,000	Orthorectified Only
		1:25,000	
		1:24,000	
		1:12,000	
		1:10,000	
		1:5,000	
		1:4,800	
		1:2,500	
		1:2,400	
		Custom	
		unavailable	
productAccuracy	CE90% in meters		If available
RMSE2D	The Two Dimensional Root Mean Square Error		If available
bandId	Identifies the spectral band. "P" = Panchromatic, "Multi" = all Multi-spectral bands (Blue + Green + Red + Near-IR), "RGB" = Red + Green + Blue, "NRG" = Near-IR + Red + Green, "BGRN" = Blue + Green + Red + Near-IR. Both	P	
		Multi	
		RGB	
		NRG	
		BGRN	

	RGB and NRG are pan-sharpened color images, stored at the panchromatic spatial resolution.		
panSharpenAlgorithm	Identifies the algorithm used to create pan-sharpened products:	HIS	
	HIS = Hue, Intensity, Saturation	PCA	
	PCA = Principal Component Analysis	UNB	
	DG = DigitalGlobe Wavelet	DG	
	UNB = University of New Brunswick	None	
numRows	Number of rows.		
numColumns	Number of columns.		
productLevel	Product level that indicates the radiometric and geometric corrections for backward compatibility with QB conventions.	Metadata, LV0, LV1A, LV1B, LV2A, LV3A, LV3B, LV3C, LV3D, LV3E, LV3F, LV3G, LV3X, LV4A, LV3H, LV3I, LV4,	
productType	Product type	Metadata, Raw, Cal/Val, Basic, Stereo, Standard, Ortho, DEM	
numberOfLooks	Indicates whether this is a single product or a stereo pair	1, 2	
radiometricLevel	Options for radiometric correction.	Raw	Not applicable for a DEM product
		Corrected	
radiometricEnhancement	Option for Color Correction and Contrast Enhancement	DRA/Color	Standard and Orthorectified Products only
		DRA/Contrast	
		Off	
bitsPerPixel	The number of bits per pixel in the product image files. This value will be either 8, 11, or 16, depending on the product. Note that this is the number of bits stored in the image file for each pixel value as opposed to the number of significant bits that define the pixel brightness value (i.e., for a product which is delivered as 16 bits per pixel, only 11 bits define the brightness value of each pixel).	8, 11, 16	This field will not be included in Metadata products.
	For Raw products, this indicates the number of bits per pixel before compression or after decompression.		11 bits per pixel applies to raw products only.

compressionType	The type of compression, if any, applied to the product imagery.	None, Downlink	This field will not be included in Metadata products. "Downlink" compression applies to Raw products only.
The following group is repeated for each spectral band in the delivered image product. The index b in the group name is one of (P,N,R,G,B) to differentiate the band group names. In this group, latitudes (Lat) and longitudes (Lon) are in degrees and heights above the WGS 84 ellipsoid (HAE) are in meters.			
BEGIN_GROUP = BAND_b			
ULLon	Geodetic coordinates of the upper left pixel of the image.	ULLon = 8 decimal places	
ULLat		ULLat = 8 decimal places	
ULHAE		ULHAE = 2 decimal places	
URLon	Geodetic coordinates of the upper right pixel of the image.	ULLon = 8 decimal places	
URLat		ULLat = 8 decimal places	
LRLon	Geodetic coordinates of the lower right pixel of the image.	ULLon = 8 decimal places	
LRLat		ULLat = 8 decimal places	
LRHAE		ULHAE = 2 decimal places	
LLLon	Geodetic coordinates of the lower left pixel of the image.	LLLon = 8 decimal places	
LLLat		LLLat = 8 decimal places	
LLHAE		LLHAE = 2 decimal places	
absCalFactor	The conversion factor, K_{nTDI}, that converts the relative radiance values in an image file into corresponding absolute radiance, measured in watts/sq m/ster. (This is calibrated 6000 °K blackbody radiance, integrated over the appropriate spectral window)		-999 = "None" when radiometricEnhancement = "DRA".
effectiveBandwidth	The effective bandwidth (units of microns) is associated with the absCalFactor and it's value is required to calculate top-of-atmosphere spectral radiance.	0.0000 to 1.0000 scientific notation	
END_GROUP = BAND_b			

outputFormat	External product format. GeoTIFF, TIFF, and NITF are image formats for Basic, Stereo, Standard and Orthorectified products, CIB is an image format for orthorectified 1:24,000 and 1:12,000, while DTED, USGS DEM, and ASCII DTM are digital elevation model formats for DEM products.	GeoTIFF	Not applicable for Metadata-Only Products
		TIFF	
		NITF20	
		NITF21	
		NITF21NCDRD	
		CIB	
		DTED	
The following group is repeated for each n = 1,…,numImagesInProduct, i.e., for all images used to create the image product. For single image products (Metadata, Cal/Val, Basic) there is one .IMD file per source image or strip, so the group will appear only once for each product component. For multiple image products (Stereo, Standard, and Orthorectified), the following group will be repeated for each source image in the image product. The index "n" in the group name is a sequential number of the image used to produce the product (1,2,3,…,n) to differentiate the image group names.			
BEGIN_GROUP = IMAGE_n			
satId	Satellite Id.	QB01, QB02,	
mode	Sensor Mode	FullSwath, CenterSwath	
scanDirection	Sensor scan direction	Forward, Reverse	
CatId	DigitalGlobe catalog Id for the raw data used in this product		
TLCTime	Absolute time of the first time-tagged line count record, in UTC, used in the product component.		Only for Basic products
numTLC	Number of time-tagged line count records in the TLCList used in the product component.		
TLCList	List of time-tagged line count (TLC) records. Each TLC record consists of ▪ lineNumber (I) ▪ timeOffset (F) lineNumber is the image line number for a line in the product component. This number will be negative if the TLC record precedes the product component. timeOffset is the recorded time tag for this line, in seconds after TLCTime.		

	The timeOffset will be negative if the image is in the reverse scan direction.		
firstLineTime	Exposure time for the first line in the product component, in UTC		
avgLineRate	Average number of image lines exposed per second	avgLineRate = 2 decimal places	
exposureDuration	Duration of the exposure interval for each line, in seconds.		
minCollectedRowGSD	Minimum, original, collected GSD of the product in the row direction, in meters.	As collected, 3 decimal places	The Pan GSD is used for Panchromatic and Pan-sharpened products; the MS GSD is used for MS products.
maxCollectedRowGSD	Maximum, original, collected GSD of the product in the row direction, in meters.	As collected, 3 decimal places	
MeanCollectedRowGSD	Mean, original, collected GSD of the product in the row direction, in meters.	As collected, 3 decimal places	
minCollectedColGSD	Original collected GSD of the product in the column direction, in meters.	As collected, 3 decimal places	
maxCollectedColGSD	Maximum, original, collected GSD of the product in the column direction, in meters.	As collected, 3 decimal places	
meanCollectedColGSD	Original collected GSD of the product in the column direction, in meters.	As collected, 3 decimal places	
meanCollectedGSD	Mean GSD of the original, collected row and column GSD, in meters.	As collected, 3 decimal places	
rowUncertainty	Mean position uncertainty in line and pixel directions, in meters. These are 3-sigma, one-dimensional values.		
colUncertainty			
minSunAz,	Minimum, maximum, and mean azimuth angle of the sun measured from north clockwise, in degrees.	0.0 to 360.0	
maxSunAz,			
meanSunAz			
minSunEl,	Minimum, maximum, and mean elevation angle of the sun from horizontal, in degrees.	±90.0	
maxSunEl,			
meanSunEl			
minSatAz,	Minimum, maximum, and mean azimuth angle of the satellite with respect to the center line, in degrees.	0.0 to 360.0	
maxSatAz,			
meanSatAz			
minSatEl,	Minimum, maximum, and mean elevation angle of the satellite with respect to the center line, in degrees.	±90.0	
maxSatEl,			
meanSatEl			

minInTrackViewAngle, maxInTrackViewAngle, meanInTrackViewAngle	Minimum, maximum, and mean dihedral angle measured at the spacecraft from the nominal spacecraft YZ plane to the plane that contains the ground projection of the product center-line and the spacecraft Y-axis, in degrees. A positive angle indicates the sensor is looking forward.	±90.0	
minCrossTrackViewAngle, maxCrossTrackViewAngle, meanCrossTrackViewAngle	Minimum, maximum, and mean dihedral angle measured at the spacecraft from the nominal spacecraft XZ plane to the plane that contains the ground projection of the product center-line and the spacecraft X-axis, in degrees. A positive angle indicates the sensor is looking to the right.	±90.0	
MinOffNadirViewAngle, maxOffNadirViewAngle, meanOffNadirViewAngle	The spacecraft elevation angle measured from nadir to the product center-line as seen from the spacecraft	0.0 to 90.0	
PNIIRS	Mean predicted image quality on the National Imagery Interpretability Rating Scale (NIIRS), as computed by the General Image Quality Equation (GIQE).	0.0 to 9.0	Not applicable for Metadata-Only Products
cloudCover	Estimate of the max cloud-covered fraction of the product component.	0.000 to 1.000	Not applicable for Metadata-Only
		-999	-999 if not assessed
resamplingKernel	Method used to resample the image. ”NULL”=no resampling kernel,	NULL	
	“NN”=nearest neighbor,	NN	
	“BL”=bilinear,	BL	
	“CC”=cubic convolution,	CC	
	“DS8”=8 point sinc,	DS8	
	“DS16”=16 point sinc,	DS16	
	“K16”=16 pointed Kaiser sinc,	K16	
	“MTF”=Modulation Transfer Function,	MTF	
	“PS”=Pan sharpening.	PS	
	“UserDefined”	UserDefined	
TDILevel	Level of the time-delayed integration, as commanded to the spacecraft.	Integer	
positionKnowledgeSrc	Source of knowledge of the satellite position. “R” = Refined, “P” = Predicted.	R	
		P	

attitudeKnowledgeSrc	Source of knowledge of the satellite attitude. "R" = Refined, "P" = Predicted.	R	
		P	
revNumber	Orbit revolution number at the time of exposure.		
END_GROUP = IMAGE_n			
BEGIN_GROUP = MAP_PROJECTED_PRODUCT			Only for map-projected (Standard and Orthorectified) products.
earliestAcqTime	Acquisition time (UTC) of the first line of the earliest image contained in the product component.		
latestAcqTime	Acquisition time (UTC) of the first line of the latest image contained in the product component.		For a single image product this value will be the same as earliestAcqTime
datumName	Name of the datum specified for the map projection when the product was ordered.	See the DigitalGlobe web site for the list of datum names.	
semiMajorAxis	Length of semi-major axis of the datum ellipsoid, in meters.	semiMajorAxis = 4 decimal places	
inverseFlattening	Inverse flattening of the datum ellipsoid, 1/f. Some useful relationships between flattening (f), semi-major axis (a), semi-minor axis (b), and eccentricity squared (e^2) are:	inverseFlattening = 9 decimal places	
	$f = (a - b) / a$		
	$e^2 = (a^2 - b^2) / a^2$		
	$= 2f - f^2$		
	$b = a (1 - f)$		
datumOffset	X, Y, Z offset of the center of the datum ellipsoid relative to the origin of the WGS 84 system, in meters.		
mapProjName	Name of the map projection specified when the product was ordered.	See the DigitalGlobe web site for the list of map projection names.	
mapProjCode	Integer code for the map projection that was used. This is an index into the table of generalized projections in Reference 6.		.
mapZone	Zone used for the map projection.		Only for UTM and State Plane projections
mapHemi	Code indicating the hemisphere used for the map projection.	N	Only for UTM projection
		S	

mapProjParam	A list of up to 15 parameters that describe the particular map projection. The meaning of each parameter depends on the map projection selected in mapProjCode. Note: all latitude and longitude values are in decimal degrees, not degrees-minute-seconds.	mapProjParam = 9 decimal places	
productUnits	Units of projected product	DD = Decimal Degrees	
		M = Meters	
		F = Feet	
		USF = US Survey Feet	
originX	Easting of the center of the upper left pixel of the image, in productUnits.	originX = 8 decimal places	
originY	Northing of the center of the upper left pixel of the image, in productUnits.	originY = 8 decimal places	
orientationAngle	Azimuth angle measured clockwise from map north to the "up" direction at the center of the image, in degrees. This is a rotation between raster image and the map coordinate systems. Since map-projected products are always Map-North up, this is always zero.	0	
colSpacing	GSD of the image in the column direction, in productUnits	colSpacing = 2 decimal places for non-geographic projected products	
		colSpacing = scientific notation for geographic projected products	
rowSpacing	GSD of the image in the row direction, in productUnits.	rowSpacing = 2 decimal places for non-geographic projected products	
		rowSpacing = scientific notation for geographic projected products	
productGSD	GSD of the product in meters	2 decimal places	Standard and Ortho products only.

edgeMatch	Indication of the use of edge matching for orthomosaic products, i.e. bundle adjusted.	On	Orthorectified products only
		Off	
colorBalance	Indication of the use of color balance for ortho mosaic products.	On	Orthorectified products only
		Off	
ULX	Easting, northing, and height above the ellipsoid of the upper left pixel of the image in the specified datum and map projection, in productUnits. ULH in meters. Includes blackfill	ULX = 8 decimal places	
ULY		ULY = 8 decimal places	
ULH		ULH = 2 decimal places	
URX	Easting, northing, and height above the ellipsoid of the upper right pixel of the image in the specified datum and map projection, in productUnits. ULH in meters. Includes blackfill	URX = 8 decimal places	
URY		URY = 8 decimal places	
URH		URH = 2 decimal places	
LRX	Easting, northing, and height above the ellipsoid of the lower right pixel of the image in the specified datum and map projection, in productUnits. ULH in meters. Includes blackfill	LRX = 8 decimal places	
LRY		LRY = 8 decimal places	
LRH		LRH = 2 decimal places	
LLX	Easting, northing, and height above the ellipsoid of the lower left pixel of the image in the specified datum and map projection, in productUnits. ULH in meters. Includes blackfill	LLX = 8 decimal places	
LLY		LLY = 8 decimal places	
LLH		LLH = 2 decimal places	
DEMCorrection	Level of the DEM used for the terrain correction.	"none"	
		"Base Elevation"	Stereo Products use only “Base Elevation”.
		"Coarse DEM"	Standard and Orthorectified Products use anything except “none”.
		"Fine DEM"	All other products use “none”.
		“Customer Supplied DEM”	
		“GTOPO30”	
		“SRTM1”, “SRTM2”	
		“DTED1” “DTED2” “DTED3” “DTED4” “DTED5”	

terrainHAE	The constant value of the height above the ellipsoid that was used for the terrain correction, in meters.		Only when DEMCorrection = "Base Elevation".
numGCP	Number of ground control points used to create this product.		
END_GROUP = MAP_PROJECTED_PRODUCT			
END;			

Table 23. ISD Image Metadata File.

Image Metadata File – Basic Imagery

This section contains a complete example of an Image Metadata File for Basic Imagery.

```
version = "AA";
generationTime = 2006-01-18T22:39:26.000000Z;
productOrderId = "005366075010_01_P001";
productCatalogId = "9010010002575B00";
childCatalogId = "2020010002575E00";
imageDescriptor = "Basic1B";
bandId = "P";
panSharpenAlgorithm = "None";
numRows = 16132;
numColumns = 27552;
productLevel = "LV1B";
productType = "Basic";
numberOfLooks = 1;
radiometricLevel = "Corrected";
bitsPerPixel = 16;
compressionType = "None";
BEGIN_GROUP = BAND_P
        ULLon =    0.12848615;
        ULLat =   52.28230413;
        ULHAE =    54.51;
        URLon =    0.38184538;
        URLat =   52.27780535;
        URHAE =    63.19;
        LRLon =    0.37944202;
        LRLat =   52.18646042;
        LRHAE =   145.76;
        LLLon =    0.12666018;
        LLLat =   52.19140586;
        LLHAE =    61.51;
        absCalFactor = 4.656600e-02;
        effectiveBandwidth = 3.980000e-01;
END_GROUP = BAND_P
outputFormat = "NITF20";
BEGIN_GROUP = IMAGE_1
        satId = "QB02";
        mode = "FullSwath";
        scanDirection = "Forward";
        CatId = "1010010001B72600";
        TLCTime = 2003-03-14T10:54:05.372682Z;
        numTLC = 2;
        TLCList = (
        (0,  0.000000),
        (16132,  2.337971)    );
        firstLineTime = 2003-03-14T10:54:05.372681Z;
        avgLineRate = 6900.00;
        exposureDuration = 0.0026087;
        minCollectedRowGSD =   0.628;
        maxCollectedRowGSD =   0.629;
        meanCollectedRowGSD =   0.628;
        minCollectedColGSD =   0.628;
        maxCollectedColGSD =   0.628;
        meanCollectedColGSD =   0.628;
        meanCollectedGSD =   0.628;
        rowUncertainty =   38.63;
        colUncertainty =   39.04;
        minSunAz = 157.7;
        maxSunAz = 157.7;
        meanSunAz = 157.7;
        minSunEl =  33.1;
        maxSunEl =  33.2;
        meanSunEl =  33.1;
        minSatAz = 126.0;
        maxSatAz = 137.0;
        meanSatAz = 132.5;
```

```
        minSatEl =  79.2;
        maxSatEl =  80.2;
        meanSatEl =  79.6;
        minInTrackViewAngle =  -5.1;
        maxInTrackViewAngle =  -4.3;
        meanInTrackViewAngle =  -4.8;
        minCrossTrackViewAngle =   8.0;
        maxCrossTrackViewAngle =   8.3;
        meanCrossTrackViewAngle =   8.2;
        minOffNadirViewAngle =   9.4;
        maxOffNadirViewAngle =   9.4;
        meanOffNadirViewAngle =   9.4;
        PNIIRS = 4.4;
        cloudCover = -999.000;
        resamplingKernel = "CC";
        TDILevel = 18;
        positionKnowledgeSrc = "R";
        attitudeKnowledgeSrc = "R";
        revNumber = 7873;
END_GROUP = IMAGE_1
END;
```

10.5.2.1 Image Metadata File – Standard Imagery

This section contains a complete example of an Image Metadata File for Standard Imagery.

```
version = "AA";
generationTime = 2006-01-18T23:01:15.000000Z;
productOrderId = "005366076010_01_P001";
productCatalogId = "9010010002576B00";
childCatalogId = "2020010002576C00";
imageDescriptor = "Basic1B";
bandId = "P";
panSharpenAlgorithm = "None";
numRows = 31192;
numColumns = 27552;
productLevel = "LV1B";
productType = "Basic";
numberOfLooks = 1;
radiometricLevel = "Corrected";
bitsPerPixel = 16;
compressionType = "None";
BEGIN_GROUP = BAND_P
        ULLon =  121.49001073;
        ULLat =   25.16744119;
        ULHAE =   431.56;
        URLon =  121.67976665;
        URLat =   25.16637071;
        URHAE =   118.80;
        LRLon =  121.67959076;
        LRLat =   24.98477902;
        LRHAE =   332.95;
        LLLon =  121.49024593;
        LLLat =   24.98403212;
        LLHAE =    86.62;
        absCalFactor = 4.656600e-02;
        effectiveBandwidth = 3.980000e-01;
END_GROUP = BAND_P
outputFormat = "GeoTIFF";
BEGIN_GROUP = IMAGE_1
        satId = "QB02";
        mode = "FullSwath";
        scanDirection = "Forward";
        CatId = "10100100017C2400";
        TLCTime = 2002-12-15T02:38:11.631232Z;
        numTLC = 2;
        TLCList = (
        (0,  0.000000),
        (31192,  4.520580)    );
        firstLineTime = 2002-12-15T02:38:11.631232Z;
```

```
        avgLineRate = 6900.00;
        exposureDuration = 0.0026087;
        minCollectedRowGSD =   0.647;
        maxCollectedRowGSD =   0.650;
        meanCollectedRowGSD =   0.648;
        minCollectedColGSD =   0.690;
        maxCollectedColGSD =   0.698;
        meanCollectedColGSD =   0.694;
        meanCollectedGSD =   0.671;
        rowUncertainty =   37.35;
        colUncertainty =   50.83;
        minSunAz = 159.1;
        maxSunAz = 159.1;
        meanSunAz = 159.1;
        minSunEl =  38.8;
        maxSunEl =  39.0;
        meanSunEl =  38.9;
        minSatAz = 264.4;
        maxSatAz = 275.6;
        meanSatAz = 269.8;
        minSatEl =  68.0;
        maxSatEl =  68.9;
        meanSatEl =  68.5;
        minInTrackViewAngle =  -3.6;
        maxInTrackViewAngle =  -2.1;
        meanInTrackViewAngle =  -2.8;
        minCrossTrackViewAngle = -20.1;
        maxCrossTrackViewAngle = -19.5;
        meanCrossTrackViewAngle = -19.8;
        minOffNadirViewAngle =  20.0;
        maxOffNadirViewAngle =  20.0;
        meanOffNadirViewAngle =  20.0;
        PNIIRS = 4.3;
        cloudCover = 0.000;
        resamplingKernel = "DS8";
        TDILevel = 18;
        positionKnowledgeSrc = "R";
        attitudeKnowledgeSrc = "R";
        revNumber = 6499;
END_GROUP = IMAGE_1
END;
```

10.5.2.2 Image Metadata File – Orthorectified Imagery

```
version = "AA";
generationTime = 2006-01-19T21:15:18.000000Z;
productOrderId = "005366083010_01_P001";
productCatalogId = "9020010002578900";
childCatalogId = "2040010002578A00";
imageDescriptor = "OrthoRectified3";
productScale = "1:50,000";
productAccuracy = 25.40;
RMSE2D = 15.44;
bandId = "RGB";
panSharpenAlgorithm = "UNB";
numRows = 21773;
numColumns = 16054;
productLevel = "LV3A";
productType = "Ortho";
numberOfLooks = 1;
radiometricLevel = "Corrected";
radiometricEnhancement = "Off";
bitsPerPixel = 16;
compressionType = "None";
BEGIN_GROUP = BAND_R
        ULLon = -112.08921873;
        ULLat =   33.55152403;
        ULHAE =   335.00;
        URLon = -111.98547821;
        URLat =   33.55239330;
        URHAE =   463.39;
        LRLon = -111.98414440;
```

```
        LRLat =   33.43458512;
        LRHAE =   315.00;
        LLLon = -112.08774457;
        LLLat =   33.43371970;
        LLHAE =   294.00;
        absCalFactor = 1.267350e-02;
        effectiveBandwidth = 7.100000e-02;
END_GROUP = BAND_R
BEGIN_GROUP = BAND_G
        ULLon = -112.08921873;
        ULLat =   33.55152403;
        ULHAE =   335.00;
        URLon = -111.98547821;
        URLat =   33.55239330;
        URHAE =   463.39;
        LRLon = -111.98414440;
        LRLat =   33.43458512;
        LRHAE =   315.00;
        LLLon = -112.08774457;
        LLLat =   33.43371970;
        LLHAE =   294.00;
        absCalFactor = 1.438470e-02;
        effectiveBandwidth = 9.900000e-02;
END_GROUP = BAND_G
BEGIN_GROUP = BAND_B
        ULLon = -112.08921873;
        ULLat =   33.55152403;
        ULHAE =   335.00;
        URLon = -111.98547821;
        URLat =   33.55239330;
        URHAE =   463.39;
        LRLon = -111.98414440;
        LRLat =   33.43458512;
        LRHAE =   315.00;
        LLLon = -112.08774457;
        LLLat =   33.43371970;
        LLHAE =   294.00;
        absCalFactor = 1.604120e-02;
        effectiveBandwidth = 6.800000e-02;
END_GROUP = BAND_B
outputFormat = "GeoTIFF";
BEGIN_GROUP = IMAGE_1
        satId = "QB02";
        mode = "FullSwath";
        scanDirection = "Forward";
        CatId = "101001000183E600";
        firstLineTime = 2002-12-28T18:06:07.594644Z;
        avgLineRate = 1725.03;
        exposureDuration = 0.000579701;
        minCollectedRowGSD =   0.629;
        maxCollectedRowGSD =   0.631;
        meanCollectedRowGSD =   0.629;
        minCollectedColGSD =   0.659;
        maxCollectedColGSD =   0.662;
        meanCollectedColGSD =   0.660;
        meanCollectedGSD =   0.645;
        rowUncertainty =   17.61;
        colUncertainty =   20.04;
        minSunAz = 157.7;
        maxSunAz = 157.8;
        meanSunAz = 157.8;
        minSunEl =  29.9;
        maxSunEl =  30.0;
        meanSunEl =  29.9;
        minSatAz =  84.4;
        maxSatAz =  94.9;
        meanSatAz =  90.0;
        minSatEl =  73.4;
        maxSatEl =  73.9;
        meanSatEl =  73.7;
        minInTrackViewAngle =   0.6;
        maxInTrackViewAngle =   1.7;
```

```
        meanInTrackViewAngle =   1.1;
        minCrossTrackViewAngle =  15.2;
        maxCrossTrackViewAngle =  15.5;
        meanCrossTrackViewAngle =  15.3;
        minOffNadirViewAngle =  14.9;
        maxOffNadirViewAngle =  14.9;
        meanOffNadirViewAngle =  14.9;
        PNIIRS = 4.3;
        cloudCover = -999.000;
        resamplingKernel = "PS";
        TDILevel = 24;
        positionKnowledgeSrc = "R";
        attitudeKnowledgeSrc = "R";
        revNumber = 6708;
END_GROUP = IMAGE_1
BEGIN_GROUP = MAP_PROJECTED_PRODUCT
        earliestAcqTime = 2002-12-28T18:06:10.182333Z;
        latestAcqTime = 2002-12-28T18:06:10.182333Z;
        datumName = "WE";
        semiMajorAxis = 6378137.0000;
        inverseFlattening = 298.257223563;
        datumOffset = (
             0.000,
             0.000,
             0.000 );
        mapProjName = "UTM";
        mapProjCode = 1;
        mapZone = 12;
        mapHemi = "N";
        mapProjParam = (
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000,
          0.000000000 );
        productUnits = "M";
        originX =     398885.09999973;
        originY =    3712962.89999963;
        orientationAngle =    0.0;
        colSpacing =  0.60;
        rowSpacing =  0.60;
        productGSD =  0.60;
        ULX =  398885.09999973;
        ULY = 3712962.89999963;
        ULH =     335.00;
        URX =  408516.89999987;
        URY = 3712962.89999964;
        URH =     463.39;
        LRX =  408516.89999987;
        LRY = 3699899.69999963;
        LRH =     315.00;
        LLX =  398885.09999974;
        LLY = 3699899.69999962;
        LLH =     294.00;
        DEMCorrection = "Fine DEM";
        numGCP = 0;
END_GROUP = MAP_PROJECTED_PRODUCT
END;
```

10.5.3 Product Browse file

The product browse file is a compressed JPEG file of the delivered product. The product browse file will be consistent with the bands ordered for the final product, except for multispectral and 4-band pan-sharpened products for which natural color browse imagery will be supplied. Figure 12 is sample of a natural color-product browse file.

Figure 12. Sample Product Browse File

10.5.4 Tile Map File

Large images are tiled into sub-images and distributed as a group of sub-image files, called tiles. Tiles are not uniform in size. If the image does not fill the whole tile, blackfill will be added to the top and left of the imagery, but removed from the bottom and right of the imagery in order to maintain a uniform upper left pixel and reduce tile sizes. Blackfill will only be present in the upper left corner of a product if a tiling origin is specified that does not correspond to the upper left corner of the Minimum Bounding Rectangle of the order polygon. If no tiling origin is specified, the upper left corner of the order poly will be the tiling origin by default. The tile map file in the ISD provides the row and column offset and geodetic coordinates for the center of the pixel of the four corners of each tile, relative to the image. For map-projected image products, it also provides the map projected coordinates of the center of the four corner pixels in the tile. Because the coordinates are based on the center of the pixel, there is a one pixel gap between tile boundaries as detailed in the tile map file, and shapefiles generated from these coordinates. Only Standard and Orthorectified Imagery products can be tiled.

Tile Map Contents			
FIELD	**DESCRIPTION**	**RANGE**	**CONDITIONS**

Tile Map Contents			
bandId	Identifies the spectral band. Identifies the spectral band. "P" = Panchromatic, "Multi" = all Multi-spectral bands (Blue + Green + Red + Near-IR), "RGB" = Red + Green + Blue, "NRG" = Near-IR + Red + Green, "BGRN" = Blue + Green + Red + Near-IR. Both RGB and NRG are pan-sharpened color images, stored at the panchromatic spatial resolution.	P Multi RGB NRG BGRN	
numTiles	The number of tiles for this product. For a Cal/Val Level 1A product, this is the number of detector arrays or subarrays.		
tileSizeX	Size of the X component (columns) of each tile in either product units or pixels		
tileSizeY	Size of the Y component (lines) of each tile in either product units or pixels		
tileUnits	Units of tiles	Pixels Meters Feet	
tileOverlap	Overlap of tiles, in tile units		
The following group is repeated for n = 1,…,numTiles, i.e., once for each of the tiles.			
BEGIN_GROUP = TILE_n			
filename	Filename of the tile.		
ULColOffset	*Column offset of the upper left pixel of this tile, relative to the upper left pixel of the base image.*	>=0	
ULRowOffset	Row offset of the upper left pixel of this tile, relative to the upper left pixel of the base image.	>=0	
URColOffset	Column offset of the upper right pixel of this tile, relative to the upper left pixel of the base image.	>=0	
URRowOffset	Row offset of the upper right pixel of this tile, relative to the upper left pixel of the base image.	>=0	
LRColOffset	Column offset of the lower right pixel of this tile, relative to the upper left pixel of the base image.	>=0	
LRRowOffset	Row offset of the lower right pixel of this tile, relative to the upper left pixel of the base image.	>=0	

Tile Map Contents			
LLColOffset	Column offset of the lower left pixel of this tile, relative to the upper left pixel of the base image.	>=0	
LLRowOffset	Row offset of the lower left pixel of this tile, relative to the upper left pixel of the base image.	>=0	
ULLon	The geodetic longitude of the center of the upper left pixel in the tile, in degrees.	180.00000000±	
		ULLon = 8 decimal places	
ULLat	The geodetic latitude of the center of the upper left pixel in the tile, in degrees.	90.00000000±	
		ULLat = 8 decimal places	
URLon	The geodetic longitude of the center of the upper right pixel in the tile, in degrees.	180.00000000±	
		ULLon = 8 decimal places	
URLat	The geodetic latitude of the center of the upper right pixel in the tile, in degrees.	90.00000000±	
		ULLat = 8 decimal places	
LRLon	The geodetic longitude of the center of the lower right pixel in the tile, in degrees.	180.00000000±	
		ULLon = 8 decimal places	
LRLat	The geodetic latitude of the center of the lower right pixel in the tile, in degrees.	90.00000000±	
		ULLat = 8 decimal places	
LLLon	The geodetic longitude of the center of the lower left pixel in the tile, in degrees.	180.00000000±	
		ULLon = 8 decimal places	
LLLat	The geodetic latitude of the center of the lower left pixel in the tile, in degrees.	90.00000000±	

Tile Map Contents			
		ULLat = 8 decimal places	
ULX	Easting of the center of the upper left pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	For Standard and Orthorectified products, only.
ULY	Northing of the center of the upper left pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	
URX	Easting of the center of the upper right pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	
URY	Northing of the center of the upper right pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	
LRX	Easting of the center of the lower right pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	
LRY	Northing of the center of the lower right pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	
LLX	Easting of the center of the lower left pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	
LLY	Northing of the center of the lower left pixel of the tile in the specified map projection, datum, and units of the product.	8 decimal places	
END_GROUP = TILE_n			
END;			

Table 24. ISD Tile Map File.

10.5.5 Attitude File

This file contains sampled mean and covariance estimates of the attitude of the spacecraft system relative to the ECF system. These files are produced for a continuous imaging period (a scene), and span the period from at least four seconds before the start of imaging to at least four seconds after the end of imaging.

Attitude File			
FIELD	**DESCRIPTION**	**RANGE**	**CONDITIONS**
SatId	Satellite Id.	QB02	
RevNumber	Orbit revolution number at startTime. The revolution number is incremented at the ascending node crossing each orbit.		
StripId	Unique 6 character strip Id. Data is represented as an ASCII-encoded hexadecimal integer.		
Type	Type of data . "I" = initial attitude, "R" = refined attitude.	I R	
Version	Version of the data. "A" for first version, "B" for second, etc.	A, B, C, etc.	
GenerationTime	Time of file generation, in UTC.		
StartTime	Time of first data point, in UTC.		
NumPoints	Number of points in the file.		
TimeInterval	Time interval between points, in seconds.	TimeInterval = 3 decimal places	
AttList	List of attitude data. This is a time-sequential list of records for point = 1,…,numPoints. Each record is a list with 15 fields in the following order: (Type of field is in parenthesis). 1. point (I); Following is the attitude quaternion for this point: 2. q1 (D); 3. q2 (D); 4. q3 (D); 5. q4 (D); Following are the upper-right elements of the attitude quaternion covariance matrix for this point: 1. (1,1) element (F) 2. (1,2) element (F) 3. (1,3) element (F) 4. (1,4) element (F) 5. (2,2) element (F) 6. (2,3) element (F) 7. (2,4) element (F) 8. (3,3) element (F) 9. (3,4) element (F) 10. (4,4) element (F) The quaternions describe the rotation of the spacecraft coordinate system relative to the ECF frame.	AttList = 16 decimal places	
END;			

Table 25. ISD Attitude File.

10.5.6 Ephemeris File

This file contains sampled mean and covariance estimates of the position of the spacecraft system relative to the ECF system. These files are produced for a continuous imaging period (a scene), and span the period from at least four seconds before the start of imaging to at least four seconds after the end of imaging.

Ephemeris File			
FIELD	**DESCRIPTION**	**RANGE**	**CONDITIONS**
satId	Satellite Id.	QB02	
revNumber	Orbit revolution number at startTime. The revolution number is incremented at the ascending node crossing each orbit.		
stripId	Unique 6 character strip Id. Data is represented as an ASCII-encoded hexadecimal integer.		
type	Type of data . "I" = initial ephemeris, "R" = refined ephemeris.	I R	
Version	Version of the data. "A" for first version, "B" for second, etc.	A, B, C, etc.	
GenerationTime	Time of file generation, in UTC.		
StartTime	Time of first data point, in UTC.		
NumPoints	Number of points in the file.		
TimeInterval	Time interval between points, in seconds.	TimeInterval = 3 decimal places	
EphemList	List of ephemeris data. This is a time-sequential list of records for point = 1,…,numPoints. Each record is a list with 13 fields in the following order (field type is in parenthesis): 1. point (I); Following is the spacecraft position and velocity for this point: 2. X position (D); 3. Y position (D); 4. Z position (D); 5. X velocity (D); 6. Y velocity (D); 7. Z velocity (D); Folowing are the upper-right elements of the position covariance matrix for this point: 8. (1,1) element (F); 9. (1,2) element (F); 10. (1,3) element (F); 11. (2,2) element (F); 12. (2,3) element (F); 13. (3,3) element (F); All measurements are in the ECF coordinate system. Positions are in meters and velocities in m/sec. Positon variances and covariances are in m^2.	EphemList = 16 decimal places	
END;			

Table 26. ISD Ephemeris File.

10.5.7 Geometric Calibration File

This file contains standard photogrammetric parameters of a virtual camera that models the imaging and optical system (the QuickBird camera). Most of these are intrinsic parameters that relate a ray inside the camera (behind the optics) to a particular pixel address on one of the linear detector arrays. The file also contains some information that is needed to compute the position and orientation of the QuickBird camera for any given line of an image. This information, also known as the exterior orientation of the camera, can be computed from the following sources:

(1) The position and orientation of the spacecraft coordinate system relative to the Earth Centered Fixed (ECF) coordinate system, as provided in the attitude file and the ephemeris file.

(2) The position and orientation of the camera with respect to the spacecraft coordinate system. This information is relatively constant, and is provided in the geometric calibration file.

The Basic Imagery camera models the system as a moving camera with a single continuous linear detector array on the focal plane for each spectral band.

Geometric Camera Calibration File			
FIELD	**DESCRIPTION**	**RANGE**	**CONDITIONS**
effectiveTime	Effective date and time of this calibration, in UTC.		
satId	Satellite Id.	QB02	
geoModelLevel	Specifies the geometric model. "LV1B" is for Basic Imagery products.	LV1B	
BEGIN_GROUP = PRINCIPAL_DISTANCE			
generationTime	Time of group generation, in UTC.		
PD	The principal distance of the camera, in millimeters. This is the perpendicular distance from the perspective center to the focal plane	PD = 3 decimal places	
END_GROUP = PRINCIPAL_DISTANCE			
BEGIN_GROUP = OPTICAL_DISTORTION			
generationTime	Time of group generation, in UTC.		
polyOrder	Order of each of the bivariate image correction polynomials. An N degree polynomial will have (N+1)*(N+2)/2 terms.	0,1,2,3,4,5	
aList	List of correction coefficient for the camera X coordinate of an image point. There are (polyOrder+1)*(polyOrder+2)/2 elements in the list.	AList = 6 decimal places	
bList	List of correction coefficient for the camera Y coordinate of an image point. There are (polyOrder+1)*(polyOrder+2)/2 elements in the list.	BList = 6 decimal places	
END_GROUP = OPTICAL_DISTORTION			
BEGIN_GROUP = PERSPECTIVE_CENTER			
generationTime	Time of group generation, in UTC.		
CX CY CZ	The perspective center of the camera in the spacecraft coordinate system, in meters. This is the origin of the camera coordinate system.	CX = 3 decimal places CY = 3 decimal places CZ = 3 decimal places	
END_GROUP = PERSPECTIVE_CENTER			
BEGIN_GROUP = CAMERA_ATTITUDE			
generationTime	Time of group generation, in UTC.		
qcs1 qcs2 qcs3 qcs4	The unit quaternion for the attitude of the camera coordinate system in the spacecraft body system, i.e., the quaternion for the rotation of the spacecraft body frame into the virtual frame. $\mathbf{q}^{c}_{s}$. qcs4 is the scalar part.	qcs1 = 16 decimal places qcs2 = 16 decimal places qcs3 = 16 decimal places qcs4 = 16 decimal places	
END_GROUP = CAMERA_ATTITUDE			
BEGIN_GROUP = DETECTOR_MOUNTING			
generationTime	Time of group generation, in UTC.		
The following group is repeated for each spectral band in the delivered image product. The index b in the group name is one of (P,N,R,G,B) to differentiate the band group names.			
BEGIN_GROUP = BAND_b			
bandId	Identifies the spectral band. "P" = Panchromatic, "N" = Near –IR, "R" = Red, "G" = Green, "B" = Blue.	P N R G B	

The following group is repeated for n = 1,…,numDetArr, i.e., for each of the linear detector arrays in the spectral band. For the Basic Imagery camera model, n = 1.			
BEGIN_GROUP = DETECTOR_ARRAY_n			
detArrId	Specifies the detector array Id. (1 for the Basic Imagery camera model.)	1	
detOriginX detOriginY	X and Y coordinates of the pixel 0 of the linear detector array in the camera coordinate system, in mm.	detOriginX = 16 decimal places detOriginY = 16 decimal places	
detRotAngle	Rotation of the detector coordinate system as measured in the camera coordinate system, in degrees. Positive values indicates a positive rotation of the detector coordinate system about the camera +Z axis.	detRotAngle = 16 decimal places	
detPitch	The pitch or pixel spacing of the detector in the detector Y direction, in mm. This is the distance between centers of adjacent pixels in the array.	detPitch = 16 decimal places	
END_GROUP = DETECTOR_ARRAY_n			
END_GROUP = BAND_b			
END_GROUP = DETECTOR_MOUNTING			
END;			

Table 27. ISD Geometric Calibration File.

10.5.8 Rational Polynomial Coefficients

This section describes the PVL format RPC00B file and part of the XML file. It contains the coefficients for Rapid Positioning Capability, also called Rational Polynomial Coefficients (RPC). This is a mathematical mapping from object space coordinates to image space coordinates. This mapping includes non-ideal imaging effects, such as lens distortion, light aberration, and atmospheric refraction.

RPC00Bs express the normalized column and row values in an image, (c_n, r_n) , as a ratio of polynomials of the normalized geodetic latitude, longitude, and height, *(P, L, H*). Normalized values are used instead of actual values in order to minimize numerical errors in the calculation. The scales and offset of each parameter are selected so that all normalized values fall in the range [-1, 1]. The normalization used is as follows:

P = (Latitude - LAT_OFF) / LAT_SCALE
L = (Longitude - LONG_OFF) / LONG_SCALE
H = (Height - HEIGHT_OFF) / HEIGHT_SCALE
r_n *= (ROW - LINE_OFF) / LINE_SCALE*
c_n *= (Column - SAMP_OFF) / SAMP_SCALE*

Each polynomial is up to third order in *(P, L, H*), having as many as 20 terms. The rational functions are

$$r_n = \frac{\sum_{i=1}^{20} LINE\_NUM\_COEF_i \bullet p_i(P,L,H)}{\sum_{i=1}^{20} LINE\_DEN\_COEF_i \bullet p_i(P,L,H)} \quad and \quad c_n = \frac{\sum_{i=1}^{20} SAMP\_NUM\_COEF_i \bullet p_i(P,L,H)}{\sum_{i=1}^{20} SAMP\_DEN\_COEF_i \bullet p_i(P,L,H)}$$

The image coordinates are expressed in pixels. The ground coordinates are latitude and longitude in decimal degrees, and geodetic elevations (height above the ellipsoid) in meters.

RPC00B Contents			
FIELD	**DESCRIPTION**	**RANGE**	**CONDITIONS**
satId	Satellite Id.	QB02	
bandId	Identifies the spectral band. "P" = Panchromatic, "Multi" = all Multi-spectral bands (Blue + Green + Red + Near-IR), "RGB" = Red + Green + Blue, "NRG" = Near-IR + Red + Green, "BGRN" = Blue + Green + Red + Near-IR. Both RGB and NRG are pan-sharpened color images, stored at the panchromatic spatial resolution.	P Multi RGB NRG BGRN	
SpecId	Identification of the specification which defines the RPC implementation used for generating and/or interpreting the coefficients	RPC00B	
BEGIN_GROUP = IMAGE			
errBias	Bias error, in meters. 68% non time-varying error estimate for correlated images.	See Note #1	
errRand	Random error, in meters. 68% time-varying error estimate for correlated images.	See Note #1	
lineOffset	LINE_OFFSET, in pixels.	See Note #1	
sampOffset	SAMP_OFFSET, in pixels.	See Note #1	
latOffset	LAT_OFFSET, in degrees.	See Note #1	
longOffset	LONG_OFFSET, in degrees.	See Note #1	
heightOffset	HEIGHT_OFFSET, in meters.	See Note #1	
lineScale	LINE_SCALE	See Note #1	
sampScale	SAMP_SCALE	See Note #1	
latScale	LAT_SCALE	See Note #1	
longScale	LONG_SCALE	See Note #1	
heightScale	HEIGHT_SCALE	See Note #1	
lineNumCoef	LINE_NUM_COEF. Twenty coefficients for the polynomial in the numerator of the r_n equation.	See Note #1	
lineDenCoef	LINE_DEN_COEF. Twenty coefficients for the polynomial in the denominator of the r_n equation.	See Note #1.	
sampNumCoef	SAMP_NUM_COEF. Twenty coefficients for the polynomial in the numerator of the c_n equation.	See Note #1	
sampDenCoef	SAMP_DEN_COEF. Twenty coefficients for the polynomial in the denominator of the c_n equation.	See Note #1	
END_GROUP = IMAGE			
END;			

Table 28. ISD RPC00B File.

Note 1: The range of values for each numeric parameter is as specified in The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF), NIMA document STDI-0002, Version 2.1, 16 November 2000. Out of range coefficients are set to zero.

10.5.9 Product Component XML File

The XML file contains the same information as the combined product component level README, Licensing, Image Metadata, Tile Map, and RPC00B files, except in XML format. For Basic Imagery Products, the attitude, ephemeris, and geometric calibration file are included as well. One Product Component XML file is provided for each product component of each delivery within the product component subdirectory.

Listed below is an example of this file for a Bundle Standard Imagery Product.

```
<?xml version="1.0" encoding="UTF-8" ?>
- <README>
  <VERSION>AA</VERSION>
  <COPYRIGHT>Use, duplication or disclosure by the government is subject to the restrictions as set forth in
     subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software Clause contained in
     D.F.A.R.S. 252.227-7013, and subparagraphs (c)(1) and (2) of the Commercial Computer Software-
     Restricted Rights contained in 48 C.F.R. 52.227-19. Contractor/manufacturer is DigitalGlobe,
     Incorporated at 1601 Dry Creek Drive, Suite 260, Longmont, CO 80503-6493. Copyright 2006
     DigitalGlobe Incorporated, Longmont CO USA 80503-6493 DigitalGlobe and the DigitalGlobe logo are
     trademarks of DigitalGlobe, Incorporated. The use and/or dissemination of this data and/or of any
     product in any way derived there from are restricted. Unauthorized use and/or dissemination is
     prohibited. DigitalGlobe WWW Reference: http://www.digitalglobe.com</COPYRIGHT>
  <MEDIACREATIONDATE>2006-01-18T23:03:43.492Z</MEDIACREATIONDATE>
  <ORDERNO>005366076010_01</ORDERNO>
- <FILELIST>
  <FILE>005366076010_01_README.TXT</FILE>
  <FILE>005366076010_01_README.XML</FILE>
  <FILE>005366076010_01_LAYOUT.JPG</FILE>
  <FILE>GIS_FILES/005366076010_01_ORDER_SHAPE.shx</FILE>
  <FILE>GIS_FILES/005366076010_01_ORDER_SHAPE.shp</FILE>
  <FILE>GIS_FILES/005366076010_01_ORDER_SHAPE.dbf</FILE>
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  <FILE>GIS_FILES/005366076010_01_PRODUCT_SHAPE.shp</FILE>
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  <FILE>GIS_FILES/005366076010_01_TILE_SHAPE.shp</FILE>
  <FILE>GIS_FILES/005366076010_01_TILE_SHAPE.dbf</FILE>
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     005366076010_01_P001_README.TXT</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.IMD</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.EPH</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.ATT</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.TIL</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.GEO</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.RPB</FILE>
  <FILE>005366076010_01_P001_MUL/CIVIL_ORG_EULA_SERVICES.TXT</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.XML</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001-
     BROWSE.JPG</FILE>
  <FILE>005366076010_01_P001_MUL/02DEC15023811-M1BS-005366076010_01_P001.TIF</FILE>
  <FILE>005366076010_01_P001_PAN/CIVIL_ORG_EULA_SERVICES.TXT</FILE>
  <FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-
     005366076010_01_P001_README.TXT</FILE>
  <FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-005366076010_01_P001.IMD</FILE>
  <FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-005366076010_01_P001.EPH</FILE>
  <FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-005366076010_01_P001.ATT</FILE>
  <FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-005366076010_01_P001.TIL</FILE>
  <FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-005366076010_01_P001.GEO</FILE>
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```
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<FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-005366076010_01_P001-
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<FILE>005366076010_01_P001_PAN/02DEC15023811-P1BS-005366076010_01_P001.TIF</FILE>
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   005366076010_01_P002_README.TXT</FILE>
<FILE>005366076010_01_P002_MUL/03AUG09021839-M1BS-005366076010_01_P002.IMD</FILE>
<FILE>005366076010_01_P002_MUL/03AUG09021839-M1BS-005366076010_01_P002.EPH</FILE>
<FILE>005366076010_01_P002_MUL/03AUG09021839-M1BS-005366076010_01_P002.ATT</FILE>
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<FILE>005366076010_01_P002_MUL/CIVIL_ORG_EULA_SERVICES.TXT</FILE>
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<FILE>005366076010_01_P002_PAN/03AUG09021839-P1BS-005366076010_01_P002.IMD</FILE>
<FILE>005366076010_01_P002_PAN/03AUG09021839-P1BS-005366076010_01_P002.EPH</FILE>
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<FILE>005366076010_01_P002_PAN/03AUG09021839-P1BS-005366076010_01_P002.RPB</FILE>
<FILE>005366076010_01_P002_PAN/03AUG09021839-P1BS-005366076010_01_P002.XML</FILE>
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   BROWSE.JPG</FILE>
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  </FILELIST>
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<DGORDERITEMNO>005366076010</DGORDERITEMNO>
<CUSTOMERORDERNO>PS_02 1B+ BA XML Taipei</CUSTOMERORDERNO>
<CUSTOMERORDERITEMNO>40009</CUSTOMERORDERITEMNO>
<COLLECTIONSTART>2002-12-15T02:38:08.618201Z</COLLECTIONSTART>
<COLLECTIONSTOP>2003-08-09T02:18:48.385340Z</COLLECTIONSTOP>
<COUNTRYCODE>TW</COUNTRYCODE>
<NUMBEROFLOOKS>1</NUMBEROFLOOKS>
<CLOUDCOVER>-999.0</CLOUDCOVER>
<NWLAT>25.12000000</NWLAT>
<NWLONG>121.60000000</NWLONG>
<SELAT>25.04000000</SELAT>
<SELONG>121.73000000</SELONG>
  </README>
```

10.5.10 Manifest File

The manifest file outlines the directory structure for products delivered by FTP. Below is an example of the manifest file delivered for a Standard Pansharpened Imagery product.

```
./005510916010_01.MAN
./005510916010_01
./005510916010_01/005510916010_01_README.TXT
./005510916010_01/005510916010_01_README.XML
./005510916010_01/005510916010_01_LAYOUT.JPG
./005510916010_01/GIS_FILES
./005510916010_01/GIS_FILES/005510916010_01_ORDER_SHAPE.shx
./005510916010_01/GIS_FILES/005510916010_01_ORDER_SHAPE.shp
```

./005510916010_01/GIS_FILES/005510916010_01_ORDER_SHAPE.dbf
./005510916010_01/GIS_FILES/005510916010_01_PRODUCT_SHAPE.shx
./005510916010_01/GIS_FILES/005510916010_01_PRODUCT_SHAPE.shp
./005510916010_01/GIS_FILES/005510916010_01_PRODUCT_SHAPE.dbf
./005510916010_01/GIS_FILES/005510916010_01_STRIP_SHAPE.shx
./005510916010_01/GIS_FILES/005510916010_01_STRIP_SHAPE.shp
./005510916010_01/GIS_FILES/005510916010_01_STRIP_SHAPE.dbf
./005510916010_01/GIS_FILES/005510916010_01_TILE_SHAPE.shx
./005510916010_01/GIS_FILES/005510916010_01_TILE_SHAPE.shp
./005510916010_01/GIS_FILES/005510916010_01_TILE_SHAPE.dbf
./005510916010_01/005510916010_01_P001_PSH
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS-005510916010_01_P001_README.TXT
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS-005510916010_01_P001.IMD
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS-005510916010_01_P001.TIL
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS-005510916010_01_P001.RPB
./005510916010_01/005510916010_01_P001_PSH/COMMERCIAL.TXT
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS-005510916010_01_P001.XML
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS-005510916010_01_P001-BROWSE.JPG
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R1C1-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R1C2-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R1C3-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R2C1-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R2C3-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R3C2-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R4C1-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R4C3-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R4C2-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R3C3-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R3C1-005510916010_01_P001.TIF
./005510916010_01/005510916010_01_P001_PSH/03MAR13174755-S2AS_R2C2-005510916010_01_P001.TIF

11. ISD Coordinate Conventions

For geolocation purposes, ISD files for all product levels must reference both image coordinates and earth coordinates. In addition, ISD files for Basic Imagery products contain information about the position and orientation of the spacecraft, camera, and the linear detector arrays on the focal plane. This section describes the coordinate systems that are associated with each of these entities.

11.1 Earth Coordinates (E)

Earth coordinates are expressed relative to an earth-centered fixed (ECF) reference system that rotates with the earth. In particular, all ECF coordinates in ISD files are given in the WGS 84 reference system, including geocentric cartesian coordinates (X_E , Y_E , Z_E) and geodetic coordinates (latitude, longitude). The WGS 84 Z_E-axis points in the direction of the Conventional Terrestrial Pole (CTP); the X_E-axis lies along the intersection of the meridian plane and the CTP equator, pointing outward at Greenwich; the Y_E-axis completes the right-handed orthogonal coordinate system.

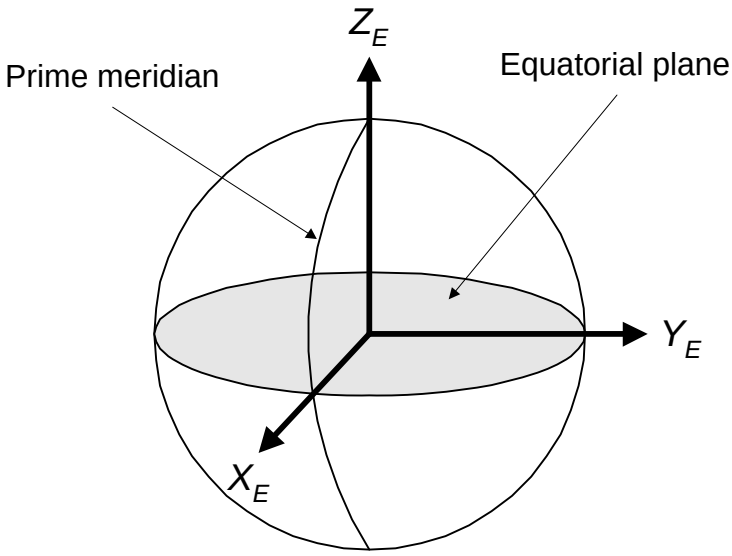

Figure 13. Earth Coordinate System.

All heights are in meters with respect to the WGS 84 ellipsoid. All easting and northing values in any of the ISD files are specified in the projection determined by the datum and map projection fields in the image metadata file.

11.2 Spacecraft Coordinates (S)

The spacecraft coordinate system has its origin near the spacecraft center of mass, and its axes roughly aligned with the camera frame. The Z_S-axis is approximately parallel to the line-of-sight vector and points toward the ground; the X_S-axis points roughly in the along-track imaging direction; the Y_S-axis completes the right-handed orthogonal coordinate system and points toward the across-track direction. To an imaginary viewer riding on the spacecraft and facing forward, the X_S-axis points forward in the direction of the imaging scan, the Y_S-axis points toward the right, and the Z_S-axis points down.

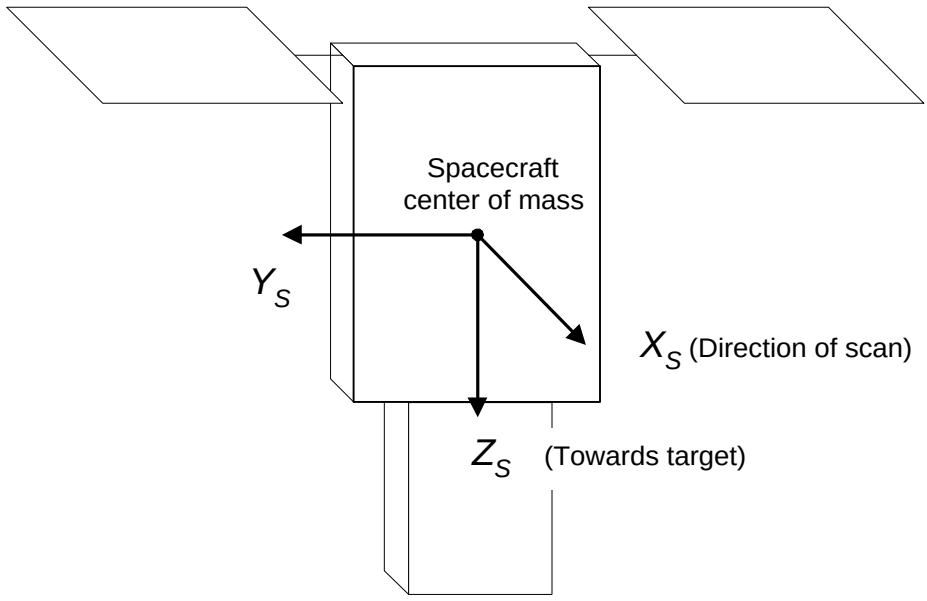

Figure 14. Spacecraft Coordinate System.

11.3 Camera Coordinates (C)

The term "camera" is used here to include the telescope and image detectors. The camera coordinate system is fixed relative to the spacecraft body frame. The origin is the perspective center of the telescope for rays on the object or ground side of the optics. The Z_C-axis is parallel to the optic axis of the telescope and points toward the ground; the X_C-axis points in the direction of the scan; the Y_C-axis completes the right-handed orthogonal coordinate system and is parallel to the long axis of the detector arrays.

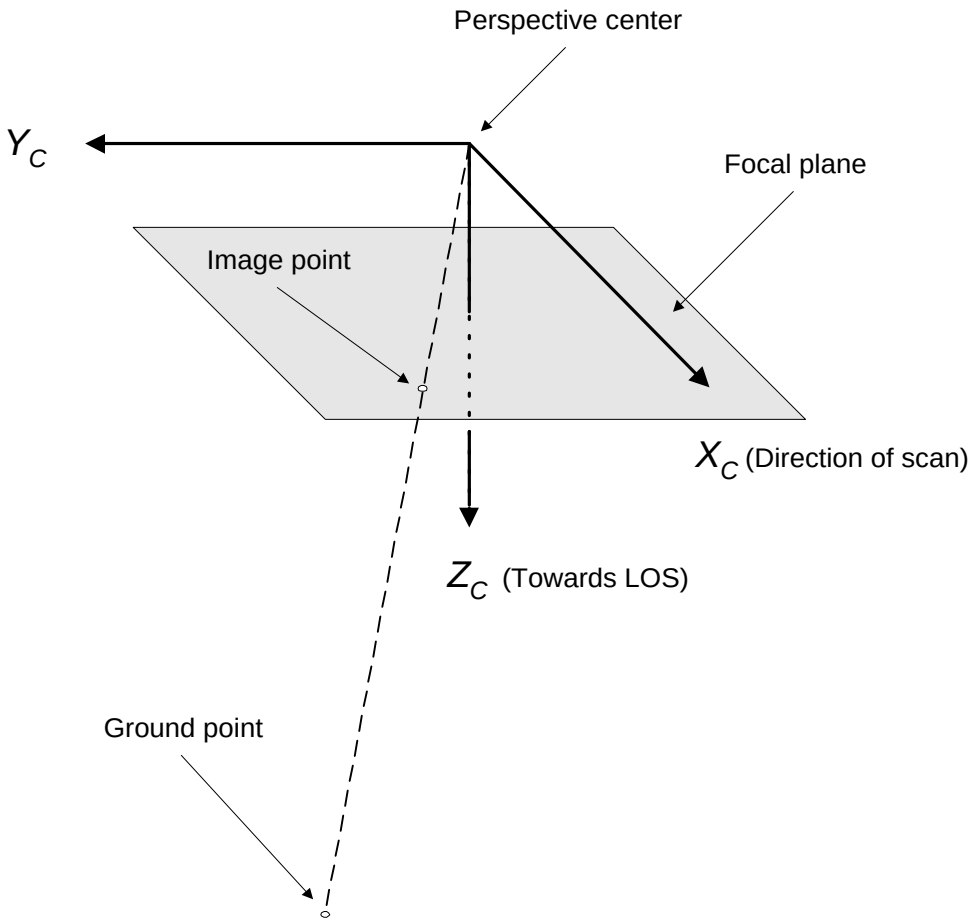

Figure 15. Camera Coordinate System.

11.4 Detector Coordinates (D)

Each photosensitive detector in one of the N-element linear detector arrays on the focal plane has an integer column coordinate, ranging from 0 to N-1. The detector coordinate numbers increase in the direction of decreasing Y_C.

A detector coordinate system can be erected for each of the linear detector arrays. The origin of each such coordinate system is the center of the detector in column 0 of the corresponding detector array. The Z_D-axis of the detector system is parallel to the camera Z_C-axis; the Y_D-axis of the array is parallel to the long axis of the array, pointing approximately in the $+Y_C$ direction; the X_D-axis completes the right-handed orthogonal coordinate system. The X_D-axis is perpendicular to the linear array and points approximately in the direction of the image scan.

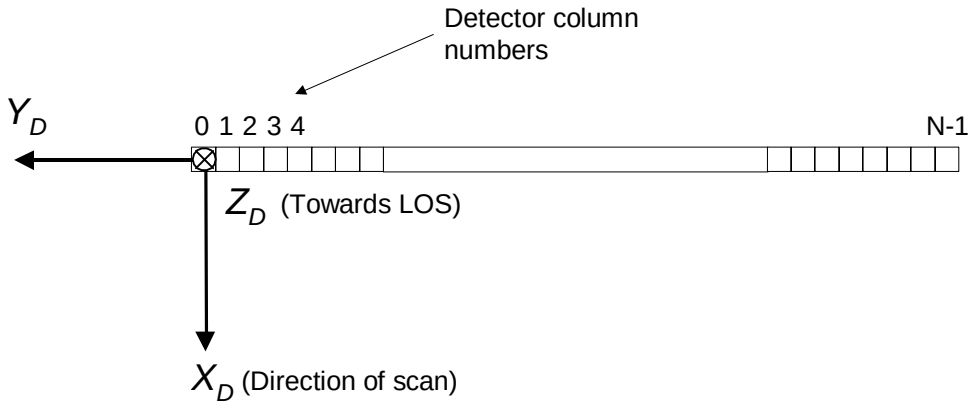

Figure 16. Detector Coordinate System.

11.5 Image Coordinates

An image address is specified as a (column, row) pair. When the image is displayed, column numbers should increase toward the right and row numbers should increase in the downward direction. Address (0, 0) corresponds to the pixel displayed in the upper left corner. Adherence to these display conventions ensures that a displayed image will have the same sense as an aerial view of the ground—differing from an aerial view by a proper rotation.

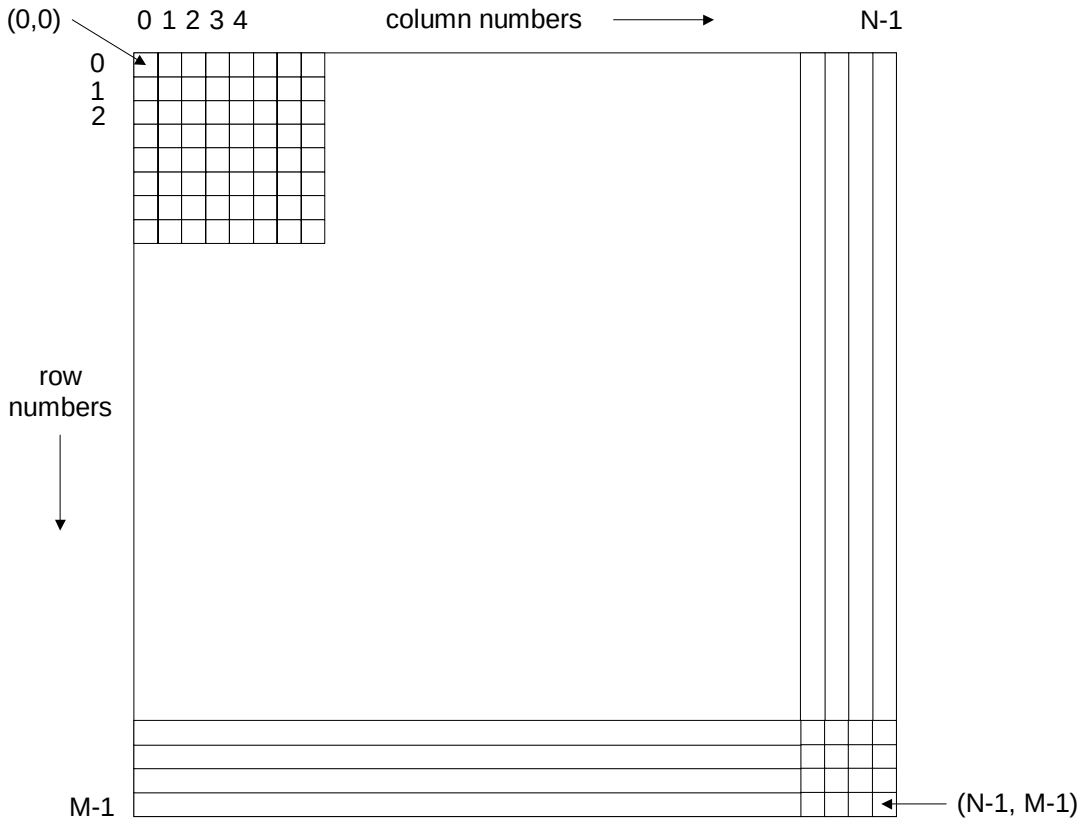

Figure 17. Image Coordinate System.

The detector in column 0 of a detector array produces the pixels in column 0 of the corresponding Basic image. The ground location of a specific pixel in the image is the geolocation of the center of that pixel.

11.6 Time

All absolute times are in UTC in the format YYYY-MM-DDThh:mm:ss.dddddddZ.

Relative time offsets from a fixed absolute time are measured in seconds, unless specified otherwise.

An example of both absolute UTC time and relative time is the time-tagged line count (TLC) data in the image metadata file. The TLC data, which are pairs of line numbers and the associated exposure times, provide a way to accurately estimate the time of exposure of any line in the image. The first such timing event for an image is reported in the image metadata file as an absolute UTC time, but subsequent events are reported as time offsets, in seconds, relative to this initial time.

12. Appendix A - Abbreviations, Acronyms, and Terms

Table 29, Abbreviations and Acronyms, contains a listing of the abbreviations and acronyms and their associated meaning as used in this document.

Abbreviation or Acronym	Meaning/Definition
CE	Circular Error
DEM	Digital Elevation Model
DN	Digital Number
ECF	Earth Centered Fixed
FOR	Field of Regard
ftp	File Transfer Protocol
GCP	Ground Control Point
GPS	Global Positioning System
GSD	Ground Sample Distance
IOC	Initial Operating Capability
ISD	Image Support Data
km	Kilometers
LE	Linear Error
m	Meters
MBR	Minimum Bounding Rectangle
mm	Millimeters
NIIRS	National Image Interpretability Rating Scales
NITF	National Imagery Transmission Format
nm	Nanometers
NRG	Near-Infrared, Red, Green
MS	Multispectral
Pan	Panchromatic
PanMS	Panchromatic and Multispectral
PanSh	Pan-sharpened Natural Color or Color Infrared
PD	Principal Distance
PNIIRS	Predicted National Image Interpretability Rating Scales
PVL	Physical Volume Library
QB	QuickBird
RGB	Red, Green, Blue
RMSE	Root Mean Square Error
RPC	Rational Polynomial Coefficient Rapid Positioning Capability
TDI	Time Delay Integration
TIFF	Tagged Image Format File
TLC	Time-tagged Line Count
UTC	Coordinated Unversal Time
WGS	World Geodetic System

Table 29. Abbreviations and Acronyms.

The following section contains a listing of QuickBird Imagery Products terms and associated definitions as used in this document.

Digital Elevation Model – A digital model of terrain relief, usually derived from stereo imagery. A DEM is used to remove terrain distortions from Orthorectified Imagery products.

Digital Number (DN) – Value assigned to a pixel in a digital image. This gray density number represents the intensity of reflected light from a feature collected by the sensor for a particular spectral range.

Digitization Scaling Method – The method used to scale 11-bit data to 8-bit data.

Dynamic Range – The number of possible DN values for each band in an image. QuickBird has an 11-bit dynamic range which translates into 2048 possible DN values.

Field of Regard – The area on the ground visible to the QuickBird satellite. Also known as the sensor footprint.

Ground Control Point (GCP) – A known geographic coordinate location on the ground. Can be collected from ground survey or maps (Primary GCP), or derived via triangulation of primary GCPs (Secondary GCP). GCPs can be planimetric (x, y; latitude, longitude) or vertical (x, y, z; latitude, longitude, elevation).

Ground Sample Distance (GSD) – The size of one pixel, as measured on the ground.

Image Support Data (ISD) – A set of files which contain all the necessary data necessary to use and process QuickBird Imagery Products. These files can be viewed as a collection point for all ancillary data that is expected to be useful to a customer.

Metadata – Ancillary data that describes and defines the imagery product. DigitalGlobe provides metadata in a set of Image Support Data files.

Multispectral – QuickBird imagery with data recorded in 4 discrete spectral bands.

Nadir – The point on the ground which is directly below the QuickBird spacecraft.

Off-nadir Angle – The angle between nadir and the point on the ground that the QuickBird sensor is pointing. Off-nadir angle can be measured in the along-track (forward) direction or across-track (sideways) direction.

Orthorectification – The correction of distortions caused by terrain relief displacement.

Panchromatic – A wide spectral band which is comprised of reflected light in the visible spectrum (blue, green, red and NIR). It is displayed as a black and white image.

Photogrammetry – The art, science, and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring, and interpreting photographic images and patterns of electromagnetic radiant imagery.

Pixel – Picture Element – smallest element comprising a digital image.

Product Framing – The manner in which QuickBird Imagery Products are delivered. Products are either Scene-based or Area-based.

Radiometric Correction – The correction of variations in data that are not caused by the object or scene being scanned, such as non-responsive detectors, scanner inconsistencies, and atmospheric interference.

Remote Sensing – The measurement or acquisition of data about an object by an instrument not in contact with the object. Satellite imagery, aerial photography, and radar are all types of remote sensing.

Repeat Coverage – The amount of time it takes to image the same spot on the ground.

Resolution – The resampled image pixel size derived from GSD.

Scale – The ratio of distance on a map as related to the true distance on the ground. Products with a larger scale have higher geometric accuracies than products with a smaller scale.

Sensor Correction – The correction of variations in data that are caused by variations in sensor geometry, attitude, and ephemeris.

Spatial Mosaic – The assembly of multiple scenes, each of which shows a portion of the order polygon, into a single image. Usually involves edge matching adjacent scenes.

Sun Azimuth – The azimuth of the sun as seen by an observer sitting on the target measured in a clockwise direction from north.

Sun Elevation – The angle of the sun above the horizon.

Sun-Synchronous – An orbit which rotates around the Earth at the same rate as the Earth rotates on its axis.

Swath Width – The width of an image. The QuickBird satellite has a Swath Width of 16.5 km at nadir.

Target Azimuth – The azimuth of the target as seen by an observer sitting on the spacecraft measured in a clockwise direction from north.

Terrain Correction – The correction for variations in data caused by terrain displacement due to off-nadir viewing.