RapidEye™
geo facts
turned into knowledge

RapidEye™ Image Product Specifications

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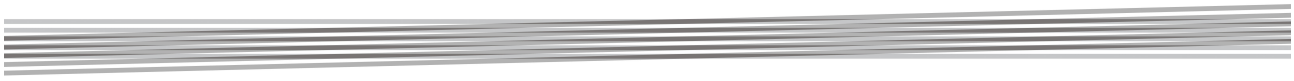


Table of Contents

Index of Tables

Abbreviations

DEM	Digital Elevation Model
DTED	Digital Terrain Elevation Data
GCP	Ground Control Point
GS	Ground Segment
JFIF	JPEG File Interchange Format
JPEG	Joint Photographic Experts Group
IFOV	Instantaneous Field of View
MTF	Modulation Transfer Function
N/A	Not Applicable
NITF	National Imagery Transmission Format
TBC	To Be Confirmed
TBD	To Be Defined
TIFF	Tagged Image File Format
UDM	Unusable Data Mask
UTM	Universal Transverse Mercator
WGS	World Geodetic System

Introduction

This document provides at a high-level the main characteristics of the RapidEye system and details the specifications of the generated imagery products.

The RapidEye constellation of five satellites will provide conditional daily coverage around the globe. The table below outlines general mission characteristics for the RapidEye system.

Mission characteristic	Information
Number of Satellites	5
Spacecraft Lifetime	7 years
Orbit Altitude	630 km in Sun-synchronous orbit
Equator Crossing Time	11:00 am (approximately)
Sensor Type	Multi-spectral push broom imager
Spectral Bands	Capable of capturing any of the following spectral bands: Name — Spectral Bands (nm) Blue — 440 – 510 Green — 520 – 590 Red — 630 – 685 Red Edge — 690 – 730 NIR — 760 – 850
Ground sampling distance (nadir)	6.5 m
Pixel size (orthorectified)	5 m
Swath Width	77 km
On board data storage	1500 km of image data per orbit
Revisit time	Daily (off-nadir) / 5.5 days (at nadir)
Image capture capacity	4 million sq km/day
Dynamic Range	12 bit

Table 1: RapidEye System Specifications

RapidEye Image Products

RapidEye image products are provided in different processing levels to be directly applicable to customer needs. The table below summarizes the various processing levels of image products.

Level	Description
0	Raw image data, metadata and calibration data. These data are for internal use only.
1	**Sensor-Level Product** - Radiometric sensor corrections applied to the data. On-board spacecraft attitude and ephemeris applied to the data.
2A	**Systematic Geo-corrected Product** - Radiometric sensor corrections applied to the data, but no ground control points are used for positional accuracy. Images are map- projected (North facing).
3A	**Orthorectified Product** - Radiometric sensor corrections applied to the data. All products have been rectified using a DTED Level 1 SRTM DEM or better, and with appropriate ground control can meet an accuracy of 6m 1-sigma (12.7 m CE90). The highest accuracy achieved by these products will meet 1:25,000 NMAS standards.

Table 2: RapidEye Image Processing Levels

All levels of RapidEye image products can be ordered with or without atmospheric correction.[1]

Sensor-Level Product Specifications

Sensor-level products consist of radiometrically[2] corrected (level 1) image products. These products provide the imagery as seen from the spacecraft without correction for any geometric distortions inherent in the imaging process. The imagery data is accompanied by all spacecraft telemetry necessary for the processing of the data into a geo-corrected form, or, when matched with a stereo pair, for the generation of digital elevation data. The table below lists the product attributes for the sensor-level products.

1 Please see Appendix C for more information.
2 For an explanation of specific technical terms, please refer to Appendix A.

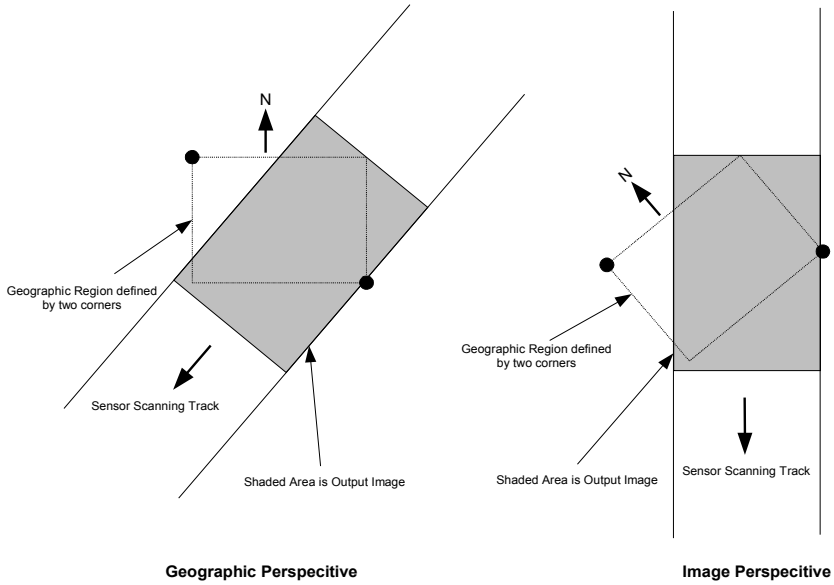
Product Attribute	Description
Product Components and Format	Sensor-level image product consists of the following physical components: - Image File(s) – Each file contains the image data for one spectral band and some basic image metadata. Delivered as NITF. - Metadata File – XML format metadata file containing product metadata, spacecraft attitude, spacecraft position/velocity, spacecraft temperature measurements, line imaging times, radiometric calibration data. - Browse image in JFIF format - Unusable data mask in GeoTIFF Format[4].
Product Orientation	Spacecraft/sensor orientation
Product Framing Geographic based framing – a geographic region is defined by two corners. The product width is the full image swath (77 km at nadir) and the length is such as to cover the specified geographic region entirely.  	
Pixel Spacing	Native camera pixel spacing, nominally 6.5 m at nadir.
Bit Depth	For radiometrically corrected products, 16-bit unsigned integer. For atmospherically corrected products, 16-bit signed integer.
Product Size	Variable. Up to 5 bands 462 Mbytes/25 km along track for 5 bands. Maximum 1848 Mbytes.
Geometric Corrections	None
Horizontal Datum	WGS84
Map Projection	n/a
Resampling kernel	n/a

Table 3: Product attributes for sensor-level products

[4] Please see Appendix D for more information.

Geo-corrected and Ortho-corrected Product Specifications

Geo-corrected products comprising level 2 and 3 products are radiometrically corrected to a standard radiance or reflectance scale, and are geometrically aligned to a map projection. The processing levels of products differ in the amount of geometric correction that is applied to them:

- Systematic Geo-corrected products (level 2A) are corrected using spacecraft derived data only with a course DEM applied but no GCPs are used. Geo-corrected image products are output as UTM tiles in the standard RapidEye image tile grid system.
- Orthorectified products (level 3A) offer the highest level of processing available in the RapidEye system with a DEM and GCPs being used to correct the image. Orthorectified image products are output as UTM tiles in the standard RapidEye image tile grid system.

The table below lists the attributes for the Geo-corrected products.

Product Attribute	Description
Product Components and Format	Geo-corrected image product consists of the following physical components: • Image File – GeoTIFF file that contains image data and geolocation information • Metadata File – XML format metadata file • Browse Image – JFIF format • Unusable Data Mask – GeoTIFF Format
Product Orientation	Map North up
Product Framing	Image Tile (image tiles are based on a worldwide, 24km by 24km fixed grid system (see Appendix B for full tile grid definition). To each 24km by 24km grid square a 500m overlap is added to produce a 25km by 25km image tile. Image tiles that are only partially covered by an image take will be black-filled in areas with no data.)
Pixel Spacing	5m
Bit Depth	• For radiometrically corrected products, 16-bit unsigned integers. • For atmospherically corrected products, 16-bit signed integers.
Product Size	Tile size is 25km by 25km. 250 Mbytes/Tile for 5 bands at 5m pixel spacing, plus a small amount for the metadata file, the browse image file and the unusable data mask file.
Geometric Corrections	• Sensor-related effects are corrected using sensor telemetry and a sensor model, bands are co-registered, and spacecraft-related effects are corrected using attitude telemetry and best available ephemeris data for all Level 2 and 3 products. • Ortho-rectified using GCPs and DEMs (level 3A)
Horizontal Datum	WGS84
Map Projection	Universal Transverse Mercator
Resampling Kernel	Cubic Convolution (default); or MTF

Table 4: Attributes for Geo-corrected Products

Processing Options

The table below summarizes the processing options available for all level 1 through level 3A products.

Processing Option	Discussion
Atmospheric Correction (see Appendix C for more information)	The ATCOR 3 atmospheric correction algorithm can be applied to all product levels. For atmospherically corrected products: • Corrected from at-aperture radiance to at-surface reflectance • Output digital numbers can be converted to reflectance units using the scaling factors provided in the metadata.
Processing Kernel (for Levels 2A and 3A only)	MTF or Cubic Convolution (default)
Delivery Format	• GeoTIFF (default for levels 2A and 3A); • NITF (default for level 1); • customer specified.
Projection	UTM (standard) or customer specified

Table 5: Processing Options

Appendix A – Glossary of Terms

The following list defines terms used to describe RapidEye image products.

Bidirectional Reflectance Distribution Function (BRDF)	• Describes the directional dependence of reflected energy (light). BRDF is a fundamental optical property. It characterizes the energy scattered into the hemisphere above a surface as a result of incident radiation.
Digital Elevation Model (DEM)	• A digital model of the terrain surface, usually derived from stereo imagery. A DEM is used to remove terrain distortions from the imagery for the geo-corrected products.
Digital Number (DN)	• The value assigned to a pixel in a digital image. This gray density value represents the intensity of reflected light from a feature collected by the sensor for a particular spectral range.
Dynamic Range	• The number of possible DN values for each pixel in a band of an image. RapidEye has an 12-bit dynamic range which translates into 4096 possible values.
Ground Control Point (GCP)	• A visible point on the ground with known geographic coordinates. GCPs can be planimetric (latitude, longitude) or vertical (latitude, longitude, elevation). GCPs can be collected from a ground survey, maps, or orthorectified imagery.
Ground Sample Distance (GSD)	• The size of one pixel, as measured on the ground.
Instantaneous Field of View (IFOV)	• The area on the ground visible to the satellite.
Metadata	• Ancillary data that describes and defines the RapidEye imagery product. Metadata files differ for the two image processing types. See Appendix C for a complete breakdown of metadata files and the fields within them.
Nadir	• The point on the ground that is directly below the satellite.
Off-nadir Angle	• The angle between nadir and the point on the ground that the satellite is pointing to.
Orthorectification	• The correction of distortions caused by terrain relief displacement on the image.
Pixel	• The smallest element comprising a digital image.
Radiometric Correction	• The correction of variations in data that are not caused by the object or scene being scanned. These include non-

	responsive detectors and scanner inconsistencies.
Resolution	• The resampled image pixel size derived from the GSD.
Revisit Time	• The amount of time it takes to image the same point on the ground.
Sensor Correction	• The correction of variations in the data that are caused by sensor geometry, attitude and ephemeris.
Sun Azimuth	• The azimuth of the sun as seen by an observer located at the target point, measured in a clockwise direction from the 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 the ground area that is recorded by one image strip.
Terrain Correction	• The correction for variations in data caused by terrain displacement due to off-nadir viewing.

Appendix B – Tile Grid Definition

RapidEye image tiles are based on the UTM map grid as shown in Figure B-1 and B-2. The grid is defined in 24km by 24km tile centers, with 1km of overlap, resulting in 25km by 25km tiles.

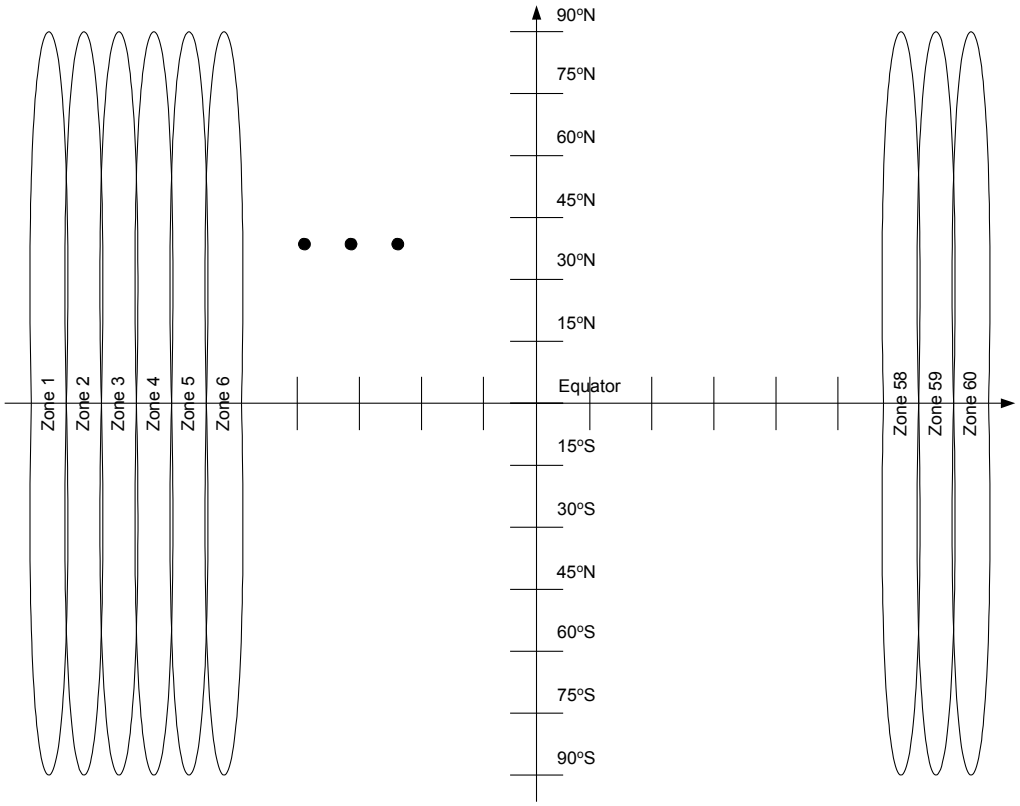


Figure B-1 Layout of UTM Zones

A tile is identified by the UTM zone number, the grid column number within the UTM zone, and the grid row number.

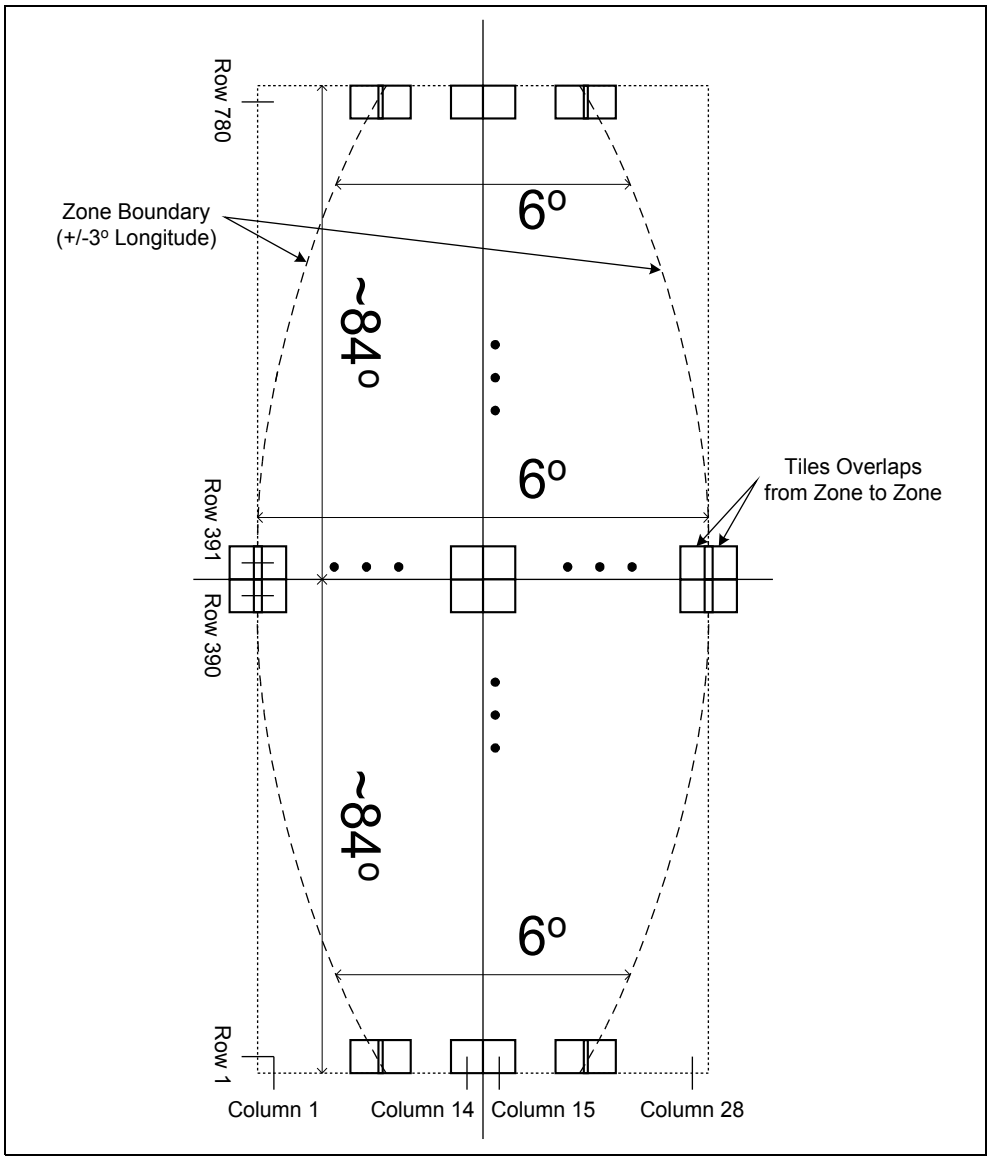


Figure B-2 Layout of Tile Grid within a single UTM Zone

Due to the convergence at the poles, the number of grid columns varies with grid row as illustrated in Figure B-3.

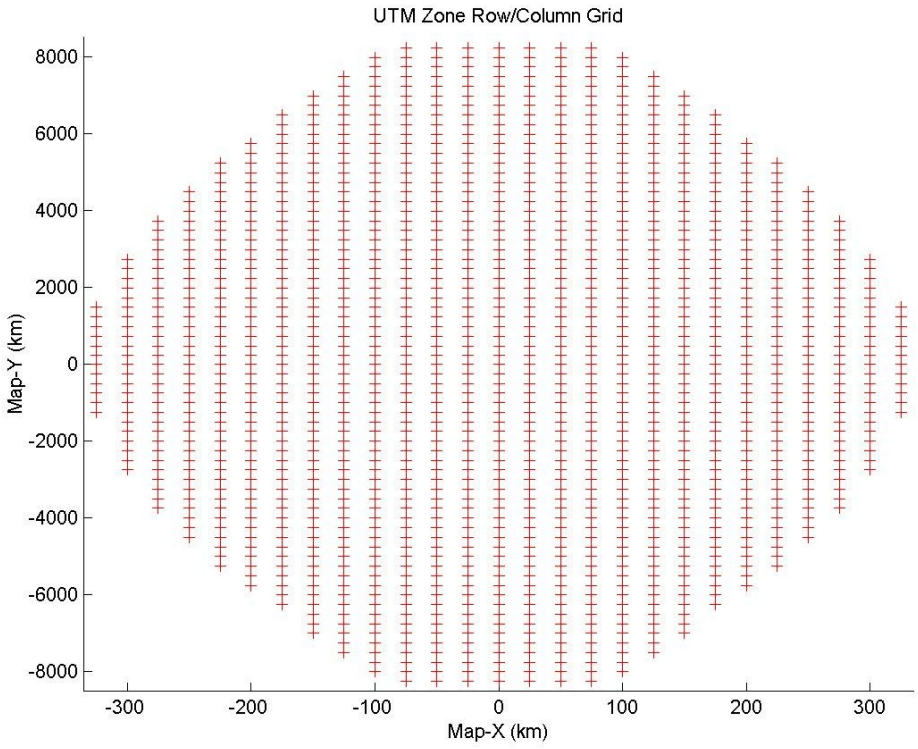


Figure B-3 Illustration of grid layout of Rows and Columns for a single UTM Zone

The center point of the tiles within a single UTM zone are defined in the UTM map projection to which standard transformations from UTM map coordinates (x,y) to WGS84 geodetic coordinates (latitude and longitude) can be applied.

col = 1..29

row = 1..780

X_{col} = False Easting + (col –15) x Tile Width + Tile Width/2

Y_{row} = (row – 391) x Tile Height + Tile Height/2

Where:

X and Y are in metres

False Easting = 500,000m

Tile Width = 24,000m

Tile Height = 24,000m

The numbers 15 and 391 are needed to align to the UTM zone origin.

Appendix C – Atmospheric Correction

The atmospheric correction algorithm applied, as an option, to image products is ATCOR-3[1,2] The ATCOR-3 corrections that are included are specified in the table below.

ATCOR 3 Corrections Included in Image Products

ATCOR-3 Supported Correction/Processing Option	Whether Included in GS Image Products
Calculate Visibility from Red/NIR Bands	**GS Sensor-level image products**: No, default value used. Lack of geometric correction of the product prevents this calculation. **GS Geo-corrected image products**: • When Red and NIR bands are present: Yes • Otherwise: No, system-wide default value used.

Basic Atmospheric Correction (Water vapor / Aerosol / Visibility)	Yes. Source of input data is as follows:
	• **Water Vapor**: Measured/estimated value for each tile provided daily to the ground segment. Value converted to ATCOR-3 supported values are follows:
	  • < 0.6 cm: Dry
	  • 0.6 cm to 1.0 cm: Mid-latitude Winter
	  • 1.0 cm to 1.25 cm: Fall
	  • 1.25 cm to 1.75 cm: US Standard
	  • 1.75 cm to 2.5 cm: Subarctic Summer
	  • 2.5 cm to 3.5 cm: Mid-latitude Summer
	  • > 3.5 cm: Tropical
	• **Aerosol**: One of “Rural”, “Urban”, “Maritime”, or “Desert” extracted from a static database that holds a value for each tile grid node (see Appendix B). The value used for atmospheric correction is the value for the tile grid node that is closest to the product centre.
	• **Visibility**: See previous row in this table.

Terrain Shadow Effects	**GS Sensor-Level Image Products**: No **GS Geocorrected Image Products**: • Orthorectified (level 3) products where > 10% of the product has a slope > 8 degrees: Yes • Otherwise: No
Building/Cloud Shadow (requires operator interaction)	No
Sky View Factor	No

[1] Richter, R., 1998. Correction of satellite imagery over mountainous terrain. Applied Optics, 37(18):4004-4015.

[2] Richter, R., 2005. Atmospheric/Topographic Correction for Satellite Imagery, ATCOR-2/3 User Guide, Version 6.1, DLR-1B 565-01/051

Appendix D – Image Support Data

Each image product is accompanied by three image support data files. These are:

1. Metadata File
2. Browse Image File
3. Unusable Data Mask File

• Metadata File Description

Each RapidEye image product will have a single accompanying metadata file. The contents of the metadata file will vary depending on the product type.

Sensor Level Product (Level 0 and 1) Metadata

Content

The following table describes the fields present in a sensor level product metadata file. Note that the metadata file is divided into six sections which cover the following areas of information:

1. General Product
2. Spacecraft Attitude
3. Spacecraft Ephemeris
4. Image Line Time
5. Spacecraft Temperature
6. Radiometric Calibration

Attribute		Description
General Product Metadata		
Satellite		Identifier of the satellite that imaged the data.
Acquisition Date Time		UTC date and time at which the data was imaged. Note that the imaging times will be somewhat different for each spectral band. This field is not intended to provide accurate image time tagging and hence is simply the imaging time of some (unspecified) part of the image.
Geographic Location		The geographic coverage of the product provided as 4 corners in WGS84 geodetic latitude / longitude.
Product Size		The size of the product in Mbytes.
Radiometric Correction Applied		Indicates whether radiometric correction has been applied.
Atmospheric Correction Applied		Indicates whether atmospheric correction has been applied.
Atmospheric Correction Parameters		Present when atmospheric correction was performed.
	Auto Visibility	Indicates whether the visibility was automatically calculated or defaulted.
	Visibility	The visibility value used for atmospheric correction in km.
	Aerosol Type	The aerosol type (“Rural”, “Urban”, “Maritime”, or “Desert”) used for atmospheric correction.
	Water Vapor	The water vapor category used:

Attribute		Description
		"Dry" "Mid-latitude Winter" "Fall" "US Standard" "Subarctic Summer" "Mid-latitude Summer" "Tropical"
	Haze Removal	Indicates whether haze removal was performed.
	Rough Terrain Correction	Indicates whether rough terrain correction was performed.
	BRDF	Indicates whether BRDF correction was performed.
Spacecraft View Angle		Spacecraft across-track off-nadir angle used for imaging.
Num Bands		Number of spectral bands included in the product.
Band Specific Metadata		Metadata specific to each spectral band. There will be one record for each spectral band in the product.
	Band Number	Number (1-5) by which this spectral band is identified. 1 = Blue, 2 = Green, 3 = Red, 4 = Red edge, and 5 = Near IR
	Start Date Time	UTC Date and Time the first line of this band was imaged (μs precision)
	End Date Time	UTC Date and Time the last line of this band was imaged (μs precision)
	Percent Missing Lines	Percentage of missing lines in this band.
	Percent Suspect Lines	Percentage of suspect lines (lines that contained downlink errors) in the source data of this band.
	Binning	Indicates the sensor-applied binning (across track x along track): 1x1, 2x2, 3x3, 1x2, or 2x1
	Shifting	Indicates the sensor-applied right shifting: none, 1bit, 2bits, 3bits, or 4bits.
	Masking	Indicates the sensor-applied masking of the least significant bits: 111, 110, 100, or 000.
	Radiometric Scale Factor	Present for radiometrically / atmospherically corrected products. Provides the parameter to convert the pixel value to radiance (for radiance product) or reflectance (for a reflectance product). To convert to radiance/reflectance engineering units, the pixel values should be multiplied by this scale factor. Hence the pixel values in the product are: **Radiance product**: (W/m^2 sr μm) / (Radiometric Scale Factor). The Radiometric Scale Factor is expected to be 1/100. For instance, a product pixel value of 1510 would represent radiance units of 15.1 W/m^2 sr μm **Reflectance product:** Percentage / (Radiometric Scale Factor). The Radiometric Scale Factor is expected to be 1/100. For instance, a product pixel value of 1510 would represent 15.1% reflectance.
Spacecraft Attitude Metadata		
Attitude Measurement		Record for attitude measurement. Attitude measurements are provided for the time period during which the image data

Attribute		Description
		was captured. The time interval between measurements is 1 second.
	Measurement Time	UTC Time of measurement
	Attitude Measurement	Attitude measurement (roll, pitch, yaw) in radians.
Spacecraft Ephemeris Metadata		
Ephemeris Measurement		Record for ephemeris measurement. Ephemeris measurements are provided for the time period during which the image data was captured. The time interval between measurements is 1 second. The coordinate system for the ephemeris measurements is WGS-84 (Earth Centered Earth Fixed) Cartesian co-ordinates.
	Measurement Time	UTC Time of measurement
	Position	Position Measurement (x,y,z) in metres
	Velocity	Velocity Measurement (x,y,z) in metres/sec
Image Line Time Metadata		
Band Number		Number (1-5) by which this spectral band is identified. There will be a record for each spectral band in the product.
Line Information		Record for each line in the image file for this band
	Imaging Time	UTC Date/Time line imaged
	Missing Flag	Indicates whether the line was missing from the input data
Spacecraft Temperature Metadata		
Temperature Measurement		Record for each temperature measurement.
	Average Focal Plane Temperature – temp. sensor n,n=1,…,4	Average temperature (over imaging time) from each of the temperature sensors on the focal plane. There are 4 temperature sensors.
	Average Telescope Temperature – temp. sensor n,n=1,…,4	Average temperature (over imaging time) from each of the temperature sensors in the telescope. There are 4 temperature sensors.
Radiometric Calibration Metadata		
Band Number		Number (1-5) by which this spectral band is identified. There will be a record for each spectral band in the product.
Per Detector Data		Record for each detector.
	Gain	Identifies the gain used to radiometrically correct the product.
	Offset	Identifies the offset used to radiometrically correct the product.
	Dead Detector Indication	Indicates where the detector is performing outside of its specifications and hence considered to be dead.

Format
The data will be formatted in XML.

File Naming Convention
The file will be named "<xxx..xx>__metadata.xml" where "<xxx..xx> is the identifier of the image generation request.

• Geo-corrected and Ortho-corrected Product (Levels 2 and 3) Metadata

The following table describes the fields present in a geo- or ortho-corrected level product

metadata file.

Content

Attribute	Description
Satellite	Identifier of the satellite that imaged the data.
Acquisition Date Time	Date and Time at which the data was imaged. Note that the imaging times will be somewhat different for each spectral band. This field is not intended to provide accurate image time tagging and hence is simply the imaging time of some (unspecified) part of the image.
Geographic Location	The geographic coverage of the product provided as 4 corners in WGS84 Latitude/Longitude.
Product Size	The size of the Product in Mbytes.
Atmospheric Correction Applied	Indicates whether Atmospheric Correction has been applied and hence the product is a reflectance product. If not applied, product is a radiance product.
Atmospheric Correction Parameters	Present when atmospheric correction was performed
Auto Visibility	Indicates whether the visibility was automatically calculated or defaulted.
Visibility	The visibility value used for atmospheric correction in km.
Aerosol Type	The aerosol type (“Rural”, “Urban”, “Maritime”, or “Desert”) used for atmospheric correction.
Water Vapor	The water vapor category used for the measurement: “Dry” “Mid-latitude Winter” “Fall” “US Standard” “Subarctic Summer” “Mid-latitude Summer” “Tropical”
Haze Removal	Indicates whether haze removal was performed.
Rough Terrain Correction	Indicates whether rough terrain correction was performed.
BRDF	Indicates whether BRDF correction was performed.
Elevation Correction Applied	Type of elevation correction applied – either Coarse or Fine.
Correction Level	Indicates whether correction level is systematic or precision.
Resampling Kernel	Resampling Kernel used.
Product Accuracy	Estimated product horizontal CE90 accuracy
Sun Azimuth/Elevation Angles	Sun azimuth and elevation at the product center.
Spacecraft View Angle	Spacecraft across-track off-nadir angle used for imaging.
Num Bands	Number of spectral bands included in the product.
Band Specific Metadata	Metadata specific to each spectral band.
Band Number	Number (1-5) by which this spectral band is identified. . 1 = Blue, 2 = Green, 3 = Red, 4 = Red Edge, and 5 = Near IR
Percent Missing Lines	Percentage of missing lines in the source data of this band.
Percent Suspect Lines	Percentage of suspect lines (lines that contained downlink errors) in the source data of this band.
Binning	Indicates the binning used (across track x along track): 1x1, 2x2, 3x3, 1x2, or 2x1

Attribute		Description
	Shifting	Indicates the sensor applied right shifting: none, 1bit, 2bits, 3bits, or 4bits.
	Masking	Indicates the sensor applied masking: 111, 110, 100, or 000.
	Radiometric Scale Factor	Provides the parameter to convert the pixel value to radiance (for radiance product) or reflectance (for a reflectance product). To convert to radiance/reflectance engineering units, the pixel values should be multiplied by this scale factor. Hence the pixel values in the product are: **Radiance product**: (W/m^2 sr μm) / (Radiometric Scale Factor). The Radiometric Scale Factor is expected to be 1/100. For instance, a product pixel value of 1510 would represent radiance units of 15.1 W/m^2 sr μm. **Reflectance product:** Percentage / (Radiometric Scale Factor). The Radiometric Scale Factor is expected to be 1/100. For instance, a product pixel value of 1510 would represent 15.1% reflectance.

Format
The metadata will be formatted in XML.

File Naming Convention
The metadata file will be named "<xxx..xx>__metadata.xml" where "<xxx..xx> is the identifier of the image generation request.

• Browse Image File

All images regardless of processing level will have an accompanying browse image file.

Contents
The browse image file contains a reduced-resolution representation of the product. It has the same aspect ratio and radiometric corrections as the product. The pixel/line spacing of the browse image will be roughly 48m. The file will contain 1 or 3 bands and pixels will be 8-bit. The 3-band browse image contains the Red, Green, and Blue bands. The 1 band browse image will contain the first available band in the following list: Red, Red Edge, Green, Blue, NIR.

Format
The browse image is a JFIF (JPEG) file.

File Naming Convention
The browse image file will be named "<xxx..xx>__browse.jpg" where "<xxx..xx> is the identifier of the image generation request.

• Unusable Data Mask File

All images regardless of processing level will have an accompanying unusable data mask file.

Contents
The unusable data mask file provides information on areas of unusable data within an image (i.e. cloud and non-imaged areas). The pixel/line spacing of this file will each be roughly 48m. Each 8-bit pixel identifies whether the corresponding part of the product contains useful imagery:

- Bit 0: Identifies whether the area contains blackfill in all bands (this area was not imaged by the spacecraft). A value of 1 indicates blackfill.
- Bit 1: Identifies whether the area is cloud covered. A value of 1 indicates cloud covered. Cloud detection is performed on a decimated version of the image (i.e. the browse image) and hence small clouds may be missed. Cloud areas are those that have pixel values in the assessed band (Red, NIR or Green) that are above a configurable threshold. This algorithm will:
  - Assess snow as cloud;
  - Assess cloud shadow as cloud free;
  - Assess haze as cloud free.
- Bit 2: Identifies whether the area contains missing (lost during downlink) or suspect (contains downlink errors) data in the Blue band. A value of 1 indicates missing/suspect data. If the product does not include this band, the value is set to zero.
- Bit 3: Identifies whether the area contains missing (lost during downlink and hence blackfilled) or suspect (contains downlink errors) data in the Green band. A value of 1 indicates missing/suspect data. If the product does not include this band, the value is set to zero.
- Bit 4: Identifies whether the area contains missing (lost during downlink) or suspect (contains downlink errors) data in the Red band. A value of 1 indicates missing/suspect data. If the product does not include this band, the value is set to zero.
- Bit 5: Identifies whether the area contains missing (lost during downlink) or suspect (contains downlink errors) data in the Red Edge band. A value of 1 indicates missing/suspect data. If the product does not include this band, the value is set to zero.
- Bit 6: Identifies whether the area contains missing (lost during downlink) or suspect (contains downlink errors) data in the NIR band. A value of 1 indicates missing/suspect data. If the product does not include this band, the value is set to zero.

Format
The unusable data mask file is in a GeoTIFF format file with run-length compression.

File Naming Convention
The unusable data mask file will be named “<xxx..xx>__mask.tif” where “<xxx..xx> is the identifier of the image generation request.