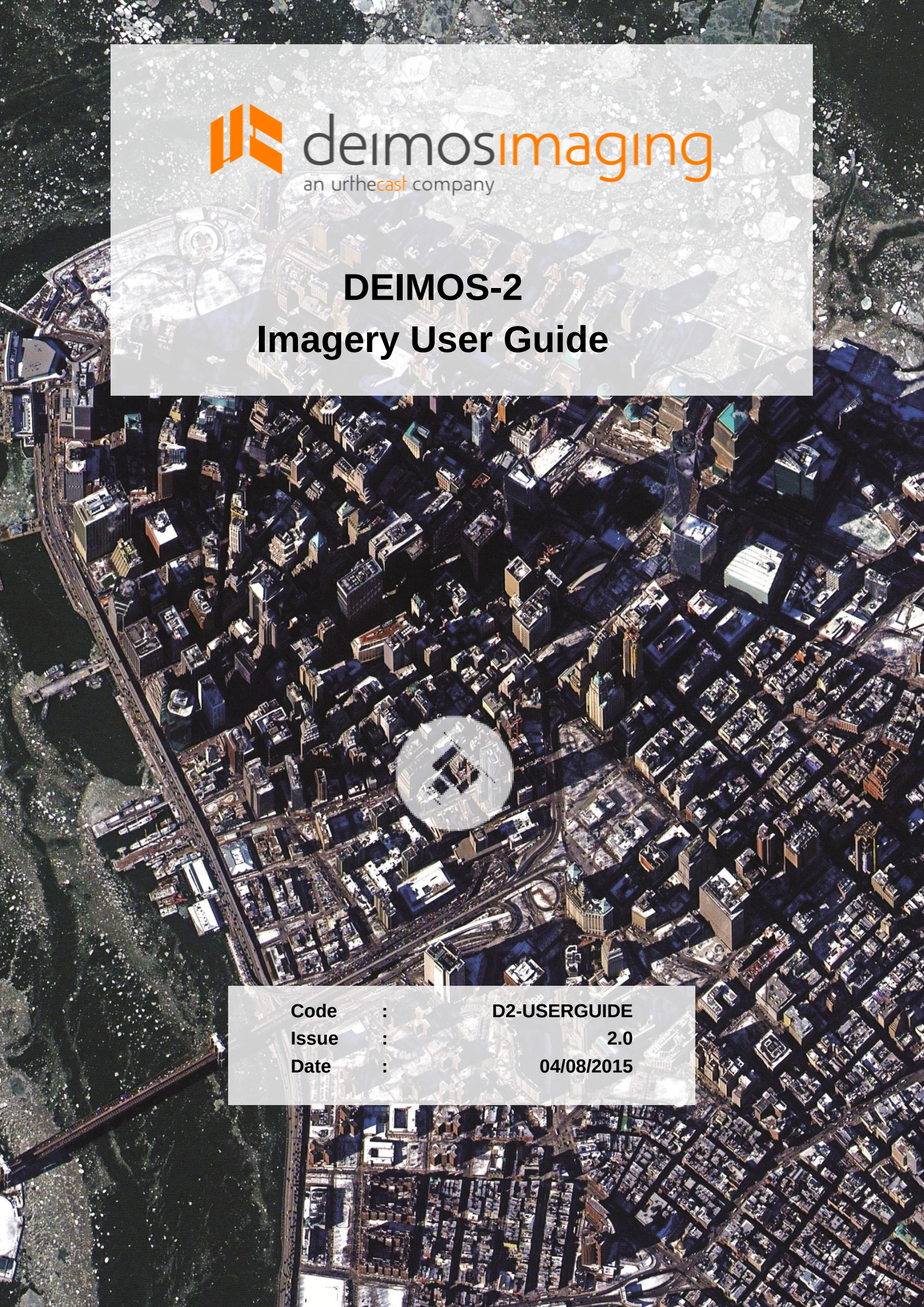

deimosimaging
an urthecast company

DEIMOS-2
Imagery User Guide

Code	**:**	**D2-USERGUIDE**
Issue	**:**	**2.0**
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Table of Contents

1. INTRODUCTION

This DEIMOS-2 Imagery User Guide provides the essential information about DEIMOS-2 products and services to its users.

It is organized as follows:

- **The DEIMOS-2 System**, provides background information about the satellite and the mission, with details on spatial and temporal resolution, spectral bands, acquisition modes and system capacity.
- **Products and Services** describes DEIMOS-2 standard products and the available processing levels, providing further details on the main production processes: orthorectification and radiometric calibration.
- **Product Ordering** explains how to access the DEIMOS-2 on-line catalogue to explore archive data, and how to order New Programming imagery through DEIMOS-2 Customer Service.
- **Data Package** details the format and file naming conventions of DEIMOS-2 standard products.
- **Product Delivery** explains delivery terms and methods.
- Finally, the **two appendixes** contains examples of HTML metadata and DEIMOS-2 DIMAP metadata.

2. THE DEIMOS-2 SYSTEM

2.1. Satellite and Mission

DEIMOS-2 is a very-high resolution (75cm pan-sharpened) multispectral optical satellite, fully owned and operated by Deimos Imaging, an UrtheCast company. The DEIMOS-2 end-to-end system has been designed to provide a **cost-effective** yet **highly responsive** service to customers worldwide.

DEIMOS-2 is the second satellite of the DEIMOS Earth Observation system, following the DEIMOS-1, which was launched in 2009 and provides mid-resolution, very-wide-swath imagery.

DEIMOS-2 has been launched on June 19, 2014, with a **mission lifetime of at least seven years**. It operates from a Sun-synchronous orbit at a mean altitude of 620 km, with a local time of ascending node (LTAN) of 10h30, which allows an average revisit time of two days worldwide (one day at mid-latitudes).

The spacecraft design is based on an **agile platform** for fast and precise off-nadir imaging (up to ±30º over nominal scenarios and up to ±45º in emergency cases), and it carries a push-broom very-high resolution camera with **5 spectral channels (1 panchromatic, 4 multispectral)**.

Deimos Imaging manages all uplink and downlink activities, as well as satellite control and image processing and archiving facilities. DEIMOS-2 makes use of **four ground stations** located in Puertollano and Boecillo (**Spain**), Kiruna (**Sweden**) and Inuvik (**Canada**) in order to maximise redundancy and availability, and to **guarantee at least one contact with the satellite at each orbit**. Secondary ground stations could be used for uplink and downlink activities, thus allowing an even better performance in terms of response time and imaging capabilities.

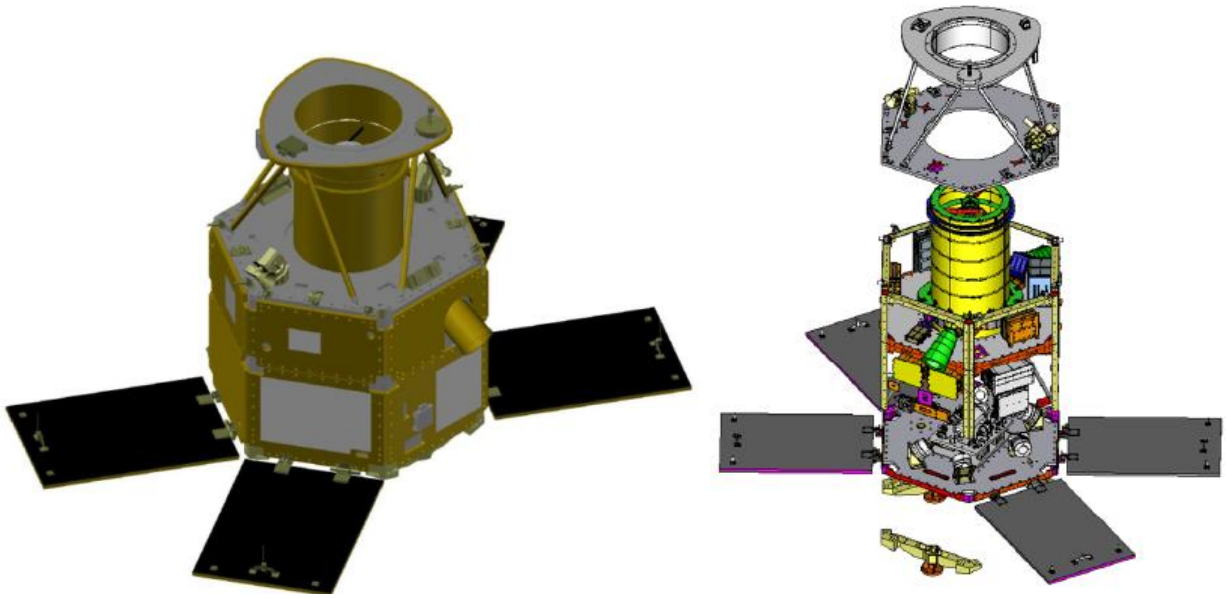


Figure 1: External and cutaway views of the DEIMOS-2 satellite

Table 1: DEIMOS-2 Main Characteristics

Satellite name	DEIMOS-2
International designations	2014-033D / 40013 (NORAD)
Date of launch	June 19, 2014
Expected life time	At least7 years
Orbit altitude	620 km (Sun-Synchronous)
Local time at ascending node	10:30 (ascending orbit)
Average revisit time	2days worldwide (with ±45º viewing angle)
Sensor name	HiRAIS / EOS-D
Sensor type	Optical
Bands and spectral ranges	λ @ FWHM (nm) PAN: min 560, max 900 Blue: min 466, max 525 Green: min 532, max 599 Red: min 640, max 697 NIR: min 770, max 892
Spatial resolution	PAN/Pan-sharpenedon nadir conditions: • 1 m GSD (PAN) • 75 cm in Pan-Sharpened products after ground processing Multispectral: • 4 m GSD (Multispectral bands)
Depth of imaging (bits of radiometric resolution)	10
Swath width	12 km
Along-track imaging capacity	Up to 1,400 km
Viewing/incidence angles	Agile platform allows up to ±30º pitch and ±45º roll down emergency scenarios
Geometric accuracy	100 m CE90 without GCP
Stereo-pair capacity	Capable of single-pass stereo-pair acquisitions
System capacity	Up to 200,000 km2 per day

The DEIMOS-2 platform has been designed and integrated by Elecnor Deimos Satellite Systems in Spain in collaboration with SATREC Initiative (South Korea). The functionality of its design has been already demonstrated with DUBAISAT-1 and DUBAISAT-2.

The main features of DEIMOS-2 platform are:

- ❑ Agile platform (±45º across-track, ±30º on nominal conditions)
- ❑ High-performance Attitude Control Subsystem for pointing accuracy & stability: three-axis stabilization using five reaction wheels
- ❑ Xenon gas engines for orbit maintenance

- The external panels consist of four solar panels and six honeycomb structured closure panels. The solar panel skins are made of CFRP composite material to increase stiffness. The power generation by solar panels is more than 450 Watts at the end of life.

DEIMOS-2 has a hexagonal shape with a philosophy of separating the Bus from the Payload. The mechanical bus consists of 2 decks and an upper Sun shield. The electronics are distributed on the decks and on the side panels. 4 solar panels are attached to the sides of the satellite. Longerons and rails are making the bus structure frame. On the top, CFRP struts hold the Sun shield at the baffle of the payload camera

The mechanical configuration of the satellite has an envelope of 200cm in height and 154cm in diameter.

The Attitude and Orbit Control Subsystem (AOCS) is designed to assure advanced agility and stability performance of the satellite during mission operations, and to satisfy TDI sensor operations requirements. With a relatively high Moment of Inertia (MoI) values, the satellite is designed to perform several imaging modes as described next. The agility of the satellite can reach up to 60° maneuver within 60 sec, including the tranquillization time needed in order to achieve the proper attitude stability desired.

The pointing accuracy is <0.01° (3σ) and stability is < 0.005°/sec.

The main actuators and sensors involved in the imaging acquisitions are five reaction wheels in constant operation, six Fiber Optic Gyros in dual redundancy and two star trackers with a high accuracy of less than 30 arc sec (3σ). For the attitude determination during other operational modes, fine sun sensor and magnetometers are used.

Also, a Hall Effect propulsion system is used to perform orbit maneuvers. It uses electric propulsion with Xenon gas and utilizes a Microwave Cathode.

2.2. Spatial Resolution

The Ground Sampling Distance (GSD) is 1.0 m for the Panchromatic channel and 4.0 m for the Multispectral channels.

DEIMOS-2 standard pan-sharpened product (ortho) has a pixel size of 75 cm, after re-sampling.

All resolutions refer to Nadir observation conditions. See following figure for off-nadir values.

Products with other spatial resolutions at resampling are available under request.

Roll (º) \ Pitch (º)	0	5	10	15	20	25	30
0	0,75	0,75	0,80	0,85	0,90	0,95	1,00
5	0,75	0,75	0,80	0,85	0,90	0,95	1,00
10	0,80	0,80	0,85	0,90	0,95	1,00	1,05
15	0,85	0,85	0,90	0,95	1,00	1,05	1,15
20	0,90	0,90	0,95	1,00	1,05	1,10	1,20
25	0,95	0,95	1,00	1,05	1,10	1,15	1,30
30	1,00	1,00	1,05	1,15	1,20	1,30	1,45
35	1,15	1,15	1,20	1,30	1,35	1,45	1,60
40	1,35	1,40	1,40	1,45	1,50	1,65	1,90
45	1,50	1,60	1,65	1,75	1,80	2,00	2,25

Figure 2: Resolution of DEIMOS-2 Pan-Sharpened Ortho product as a function of the observation angle

2.3. Temporal Resolution: Revisit Time

In order to minimise the revisit time, the satellite is configured to have ±45° off nadir pointing capability. With maximum tilt, the field of regard (FOR) can be extended to more than 600 km from nadir.

The average global revisit time (±45°) is 2 days. See the figure below for more details.

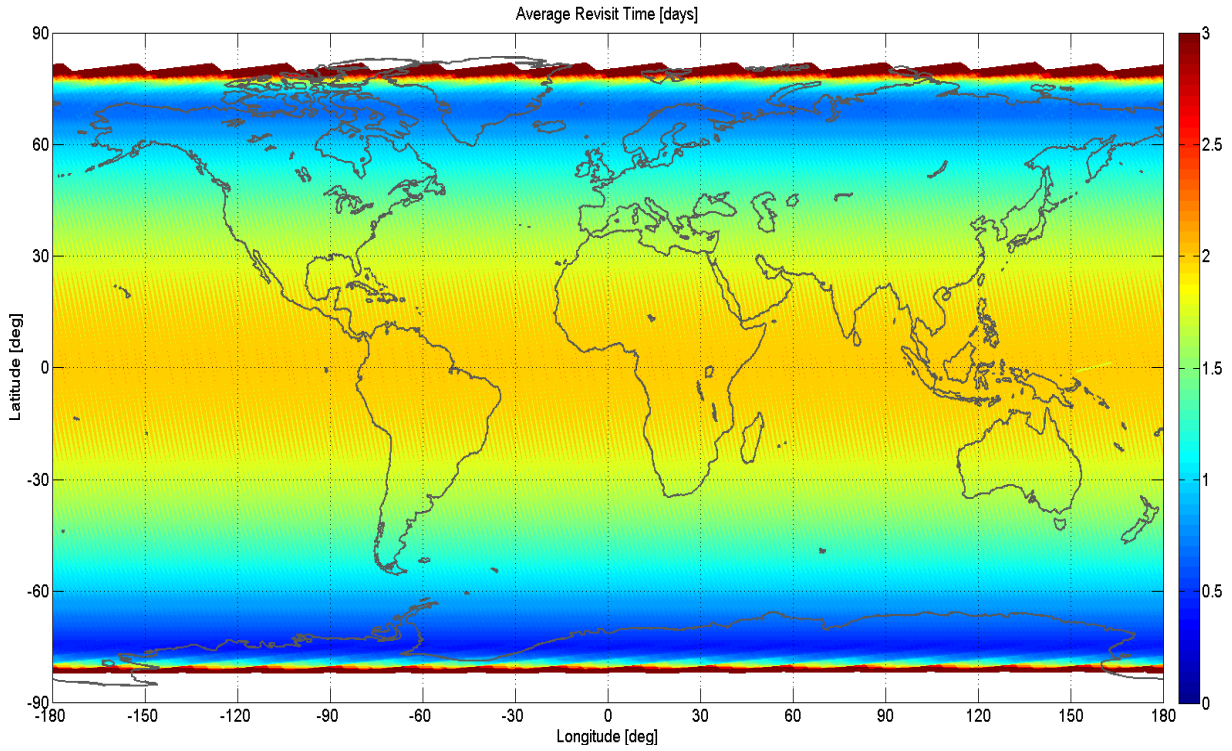


Figure 3: DEIMOS-2 Average Revisit Time (days)

2.4. Spectral Bands

The DEIMOS-2 system includes panchromatic and multispectral cameras, acquiring data simultaneously.

The multispectral capability includes 4 channels in visible and near infrared spectral range (red, green, blue, and NIR). The spectral range of each band is listed below:

- ❑ Panchromatic Mode: 560 nm to 900 nm
- ❑ Multispectral Mode:
  - **Blue:** 466 nm - 525 nm
  - **Green:** 532 nm - 599 nm
  - **Red:** 640 nm - 697 nm
  - **NIR:** 770 nm - 892 nm

2.5. Adquisition Modes

DEIMOS-2 has four imaging modes: single strip imaging, multi-pointing imaging, single-pass stereo imaging and tessellation imaging

- ❑ **Single Strip Imaging:** 12 km wide and up to 1,400 km long image. The satellite has a ±45º accross-track tilting capability (being ±30º the nominal range).
- ❑ **Multi-pointing Imaging:** DEIMOS-2 is capable of performing multi-pointing imaging, switching from one target to another with minimum idle time.

- **Single Pass Stereo Imaging:** Two acquisitions of the same area in the same orbit, with different pitch angles. Images are 12-km wide and up to 200 km long. The viewing angles are different for the two images, in order to allow the generation of 3D models.
- **Tessellation Imaging:**Two acquisitions of the same area in the same orbit, with different pitch and roll angles. Images are 24-km wide and up to 200 km long (composed from the acquisition of two adjacent strips, 12-km wide each, and captured with a lag of a few seconds).

The following pictures illustrate two of these four imaging modes, multi-pointing imaging and stereo pass imaging:

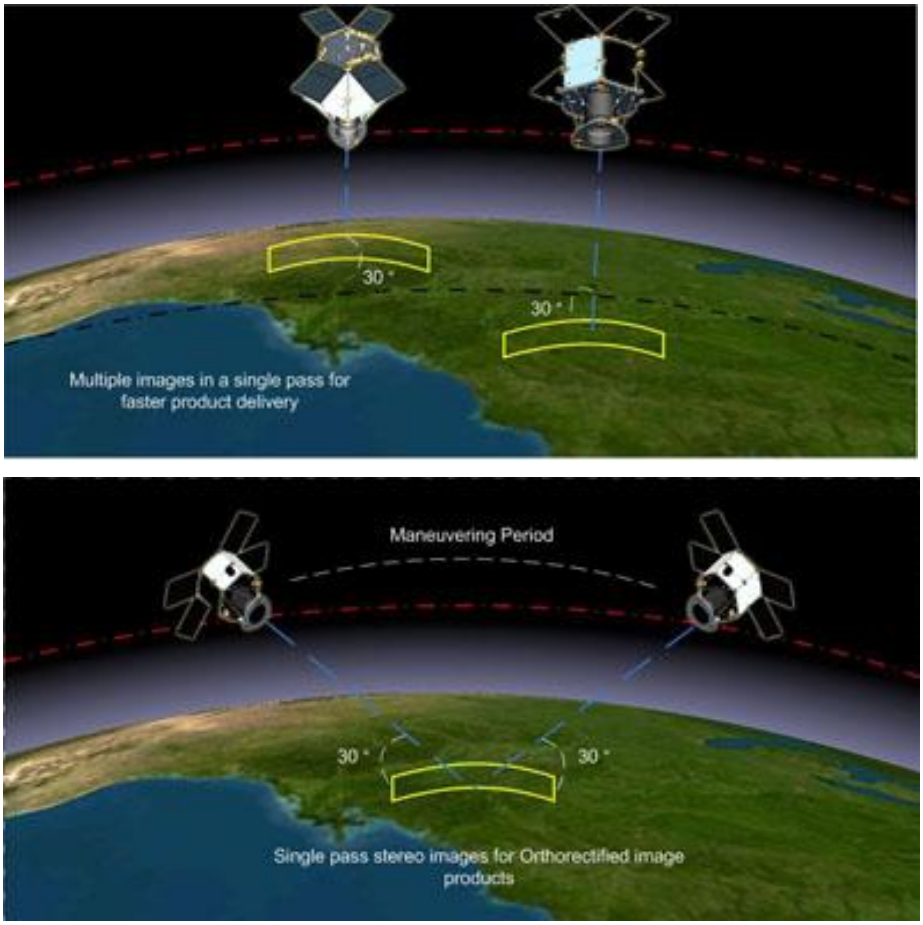


Figure 4: DEIMOS-2 imaging modes

2.6. System Capacity

DEIMOS-2 has capacity to capture up to **200,000 Km^2 per day**.

This data volume is managed thanks to a 256 Gbits (32 Gbytes) of storage capacity using SDRAM memory devices, which allows to image a ground strip longer than 1,400 km in a single pass.

Data is downloaded using the 160 Mbps X-band Image Transmission Unit (ITU).

3. PRODUCTS AND SERVICES

3.1. Standard Products

DEIMOS-2 standard products offered are:

- **Pan-sharpened**: a four-band image, resulting from adding the information of each multispectral band to the panchromatic band. The fusion does not preserves all spectral features of the multispectral bands, so it should not be used for radiometric purposes.
- **Panchromatic**: a single-band image coming from the panchromatic sensor.
- **Multispectral**: a four-band image coming for the multispectral sensor, with band co-registration.
- **Bundle** (Panchromatic + Multispectral bands): a five-band image containg the panchromatic and multispectral products packaged together, with band co-registration.
- **Stereo Pair**:The image products obtained from two acquisitions of the same target performed from different viewpoints in the same pass by using the agility feature of the platform. It can be provided as a pair of pan-sharpened or panchromatic images.

All procuts are generated at **10 bits**, but can be provided in 8-bit format upon Customer's request.

The following nomenclature is using to define DEIMOS-2 standard products.

Table 2: DEIMOS-2 Product Type Naming Convention

Product Type	Name	Description
Pan-sharpened	PSH	Pan-sharpened 4 bands
	PS3	Pan-sharpened 321 Natural Colors
	PS4	Pan-sharpened 432 False Colors
Panchromatic	PAN	Panchromatic only
Multispectral	MS4	4 Multispectral files only
Bundle	PM4	Bundle (Pan +Multispectral)

3.2. Processing Levels

DEIMOS-2 products are available in two different processing levels:

- **Level 1B**: A calibrated and radiometrically corrected product, but not resampled. The geometric information is contained in a rational polynomial.

  The product includes: the Rational Polynomial Coefficients (RPC); the metadata with gain and bias values for each band, needed to convert the digital numbers into radiances at pixel level, and information about geographic projection (EPGS), corners geolocation, etc.

- **Level 1C**: A calibrated and radiometrically corrected product, manually orthorectified and resampled to a map grid. The geometric information is contained in the GeoTIFF tags.

  By default, the reference base for orthorectification is Google Earth. Other user-provided bases can be used on demand.

  Typical geometric error of this product (RMSE) is < 20 m.

JPEG-2000 format is also available on demand for all processing levels.

The spectral band combination of DEIMOS-2 image products is summarized in the following table. Note that Spatial Resolution refers to resolution at Nadir, and will vary with observation agle (see Sec.2.2).

Table 3: DEIMOS-2 Products Characteristics vs. Processing Level

Product Type	Processing Level and Spatial Resolution		Spectral Bands		
	L1B (native)	L1C (ortho)			
Pan-sharpened	1.0 m	75 cm	All	R, G, B	NIR, R, G
Pan	1.0 m	75 cm	Only Pan Band		
MS	4.0 m	3.0 m	Only MS Bands		
Bundle (Pan+MS)	1.0 m (P), 4.0 m (MS)	75 cm (P), 3.0 m (MS)	All		

PAN L1B

PS3 L1C

PS4 L1C

Figure 5: Example of DEIMOS-2 products.

3.3. Orthorectification

The orthorectification process is a three-stage process: Ground Control Points (GCP) collection, image rectification and validation.

The first stage involves manual**GCP collection** by human operators in L1C, against a standard reference data set and DEM using an application called *GCP Tools*, developed by Deimos Imaging. Each GCP refines the sensor model's coefficients and includes the height information from the DEM, thus correcting image distortions due to the Earth's topography and sensor characteristics. The output from the GCP collection is a rigorous image model to pass on to the next stage of the process.

Deimos Imagingmanages an internal GCP database, storing those GCPs used in the orthorectification process regardless of the involved project. This database has been used operationally with DEIMOS-1 since 2009. Features defining the GCP (id of the subject and reference image, location of the GCP in each image, processing date, etc) are stored in a geodatabase and delivered as a text file facilitating the activity of the operators.

In addition to storing and managing GCPs, Deimos Imaging' orthorectification tools allow the human operator to spatially check the expected shift for each GCP associated with the geometric fit to be applied.

The second stage of the process is **image rectification**; the L1B product is projected using the updated image model produced in the first stage.

Finally, **validation** is performed by calculating the geometric error relating the rectified image and a set of independent validation points defined by human operators. Quality assurance and monitoring is of prime importance for Deimos Imaging. Thus, for each orthorectified image a dedicated report is generated and stored. This report is informative about:

- ❑ Error rate at the GCP level, measured as Root Mean Square Error (RMSE) in X and Y spatial dimensions.
- ❑ Error rate at the image level, accounting for general in X and Y, as well as radial RMSE. In addition the mean and standard deviation of the observed RMSE values at pixel level are provided.

The final output from the orthorectification process is the L1C product rectified to the defined projection. The orthorectification process is a flexible process whereby GCP collection can be performed using any reference data set and DEM provided, and the final L1C product can be rectified to any projection requested.

DEIMOS-2 ortho L1C products are projected to WGS84 UTM by default. In any case, the image products can be tailored to the specific requirements for projection. The table below summarises some of the options available.

Table 4: DEIMOS-2 Geographic and Map Projections

Mapping Projection (Default)	WGS84 / UTM (EPSG)
Mapping Projection (On demand)	Most of the projections registered by the EPSG
Geographic Projection (On demand)	WGS84 – latitude / longitude sampling
Ground Control Points (GCP)	Landsat by default; other reference datasets can be used as reference if available
Digital Elevation Model (DEM)	SRTM v4.1. by default; other DEMs can be integrated into the processing chain if available

3.4. Radiometric Calibration

DEIMOS-2 instrument is calibrated by Deimos Imaging. Absolute and relative calibration campaigns are performed yearly, whereas trend monitoring and analysis are undertaken every fifteen days using CEOS pseudo-invariant calibration sites. If an anomaly is detected, a new calibration campaign would be scheduled.

During the processing, the images are radiometrically corrected and calibrated. Prior to delivery they are rescaled to fit into a 16bits unsigned integer data type. The DNs can be converted to TOA radiances in W m^{-2} sr^{-1} μm^{-1} using the following equation:

$$Radiance_B = DN_B * Gain_B + Bias_B$$

Where B denotesthe band.

The Gain and Bias coefficients can be found in the HTML file and in the DIMAP file tagged as "Radiance_Mult" and "Radiance_Add" respectively.

4. PRODUCT ORDERING

Note: The DEIMOS-2 Archive Catalogue is currently in Beta testing, and it will be opened to public soon.

4.1. Archive Data: DEIMOS-2 Catalogue

The catalogue allows to consult the availability of DEIMOS-2 images. The user can select an area of interest, a time window and/or a cloud coverage threshold and perform a tailored search. The results are represented as footprints in a world map, including a list of quicklooks and metadata on the right side.

The functionality of this tool allows downloading a quicklook or a set of quicklooks in several formats, including KMZ, which allows the representation in Google Earth or in the “Image requests” function. It is also possible to configure the access to the catalogue, in order to filter the results depending on the user for instance. The following figure is an example of the tool accessing the DEIMOS-2 catalogue

The catalogue performs visualization and dissemination of datasets. The following points can be highlighted:

- ❑ Information sets can be browsed according to (i) sensor acquiring the image, (ii) processing level, (iii) cloud cover, (iv) acquisition date, (v) acquisition area, (vi) image id and (vii) roll angle.
- ❑ Map browsing is enabled by means of a 2D approach. Thanks to direct link between designers, developers and final users, an iterative definition process has led to a flexible and highly useful tool.
- ❑ For each image, a polygon is drawn in the 2D map. User can navigate through this map with an iterative zoom, a movement “hand” tool and a coordinate locator. For a given image, the acquisition date and time, the percentage of cloud-free pixels and the image id are provided. Besides, a quicklook of the original set is provided in KMZ or TIFF format, as well as a quicklook of the cloud mask and the metadata in a standard format. This flexibility is warmly welcomed by final users due to simplicity in the access to geographical information.
- ❑ Massive imagery search can be performed jointly or separately considering:
  - **Spatial framework**. A polygon can be drawn on-screen defining the searching area. Positive matching elements are shown in different ways depending on the zoom level. If the view is too far to allow the user to easily spot the images’ footprints, then a circle with a colour code and the number of acquisitions will be shown over the area. When the user zooms in, the circles are replaced with the footprints.
  - **Temporal window**. Start date and end date are defined by the user, so that they system shows on-screen the available images within that temporal window. Again, individual information of each image can be easily accessed by the final user.
  - **Processing status**. For final user of the image sets it is advisable to easily consult the processing level of the sets, since most applications rely on radiometrically and geometrically processed data. The catalogue allows for searching all the available images meeting the searching criteria and then refines the search for the identification of those images fully corrected.

Other filtering criteria can be also used, such as estimated cloud coverage and viewing angle.

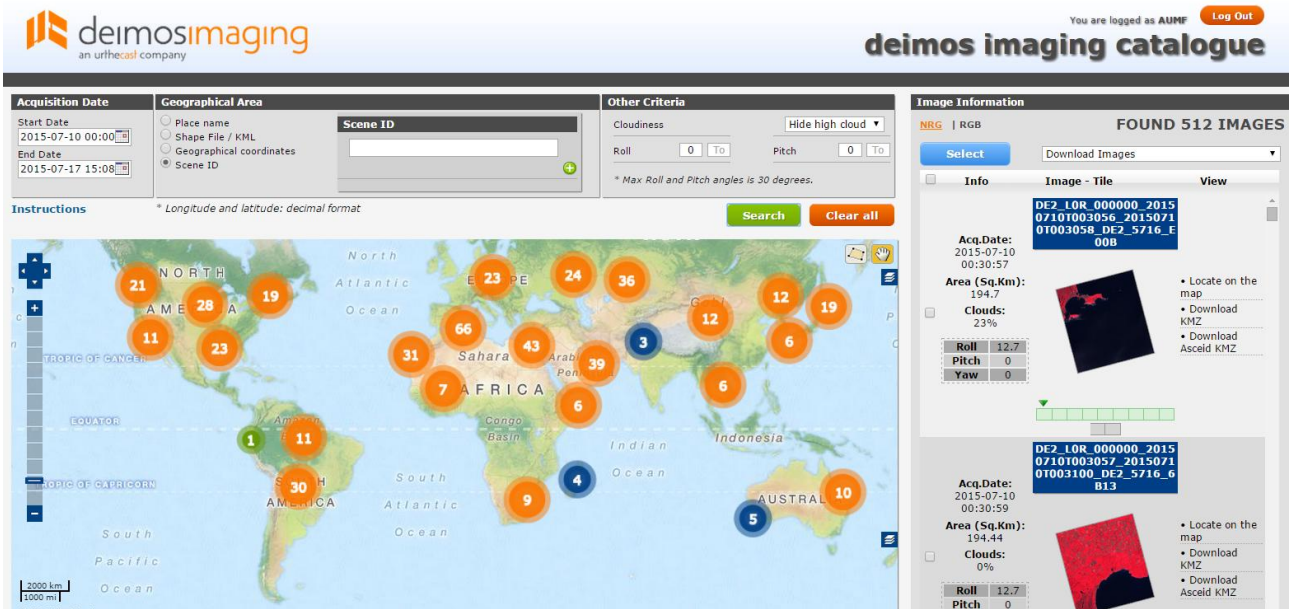


Figure 6: Catalogue, visualization of DEIMOS-2 acquisitions on map (left) and its details (right).

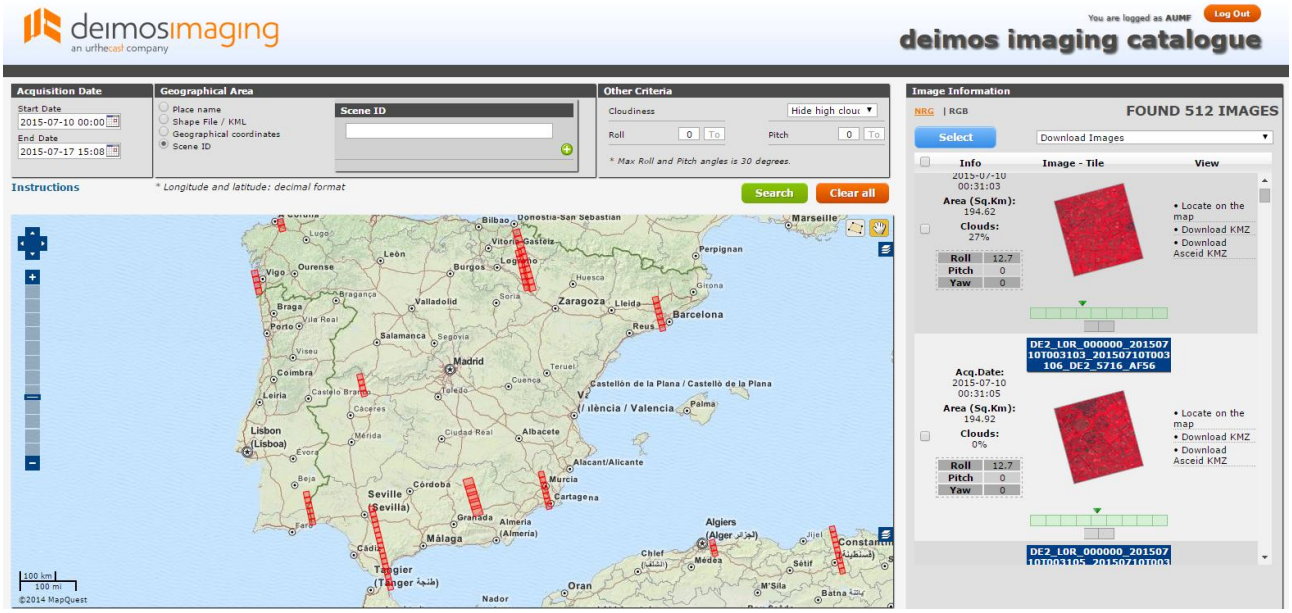


Figure 7: Catalogue search by AOI. Quicklooks are shown in false colour.

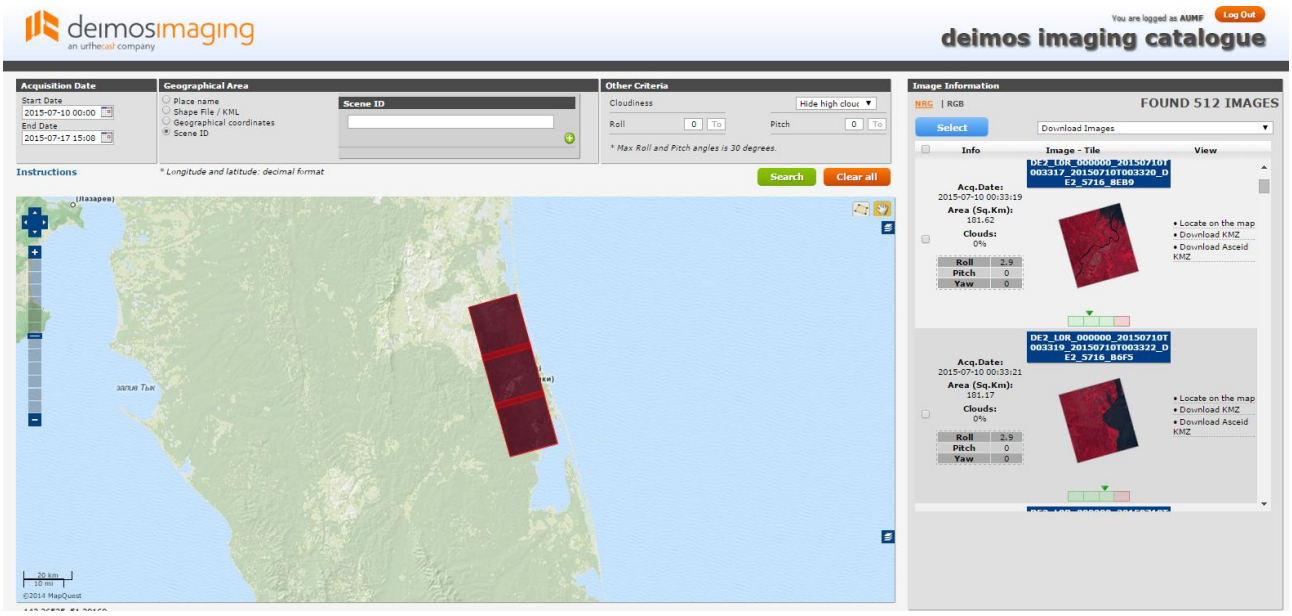


Figure 8: Catalogue, visualization of a false colour quicklook as a map overlay

The catalogue allows to select images for a specific area of interest and create a Request for Quotation for the Customer Service.

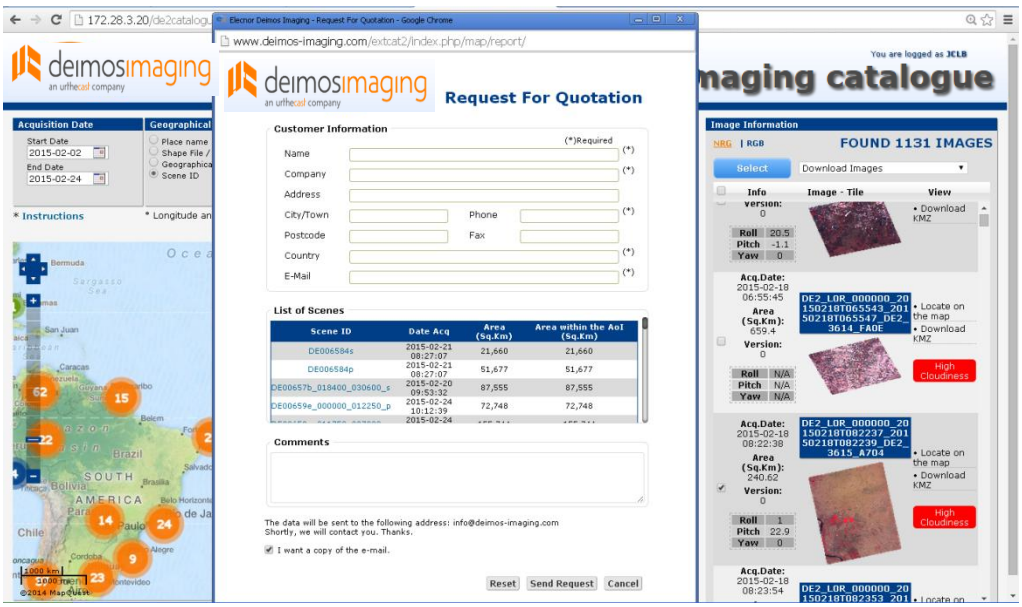


Figure 9: Request for Quotation for Archive data

4.2. New Programming: DEIMOS-2 Customer Service

4.2.1. *Order Desk Availability*

Deimos Imaging runs an order desk during office hours. On weekdays is available during the following hours (CET time):

- Monday to Thursday: 9h to 18h
- Friday: 9h to 15h

Help and order desk will not available on Spanish holidays.

4.2.2. *Emergency Service 24/7*

Deimos Imaging is also offering an emergency service on a 24/7/365[1] basis.

The 24/7 emergency service is offered only to selected customers. If interested, please contact comercial@deimos-imaging.com.

The following tasks are included in the 24/7 emergency service:

- Request acknowledge: Request acknowledgement is sent back to the client as soon as Deimos Imaging receives an image request
- Feasibility study: Upon reception of an imaging request, Deimos Imaging will perform the corresponding feasibility study, and will send it to eth customer asking for an order confirmation.
- System programming: Once the potential capture is formally accepted by the customer, system programming is performed.
- Command compilation: the mission planning software automatically prepares and compiles the uplink command to be transferred and sends it to the satellite control facility.
- Command uplink: The updated schedule is uploaded to the satellite.
- Image acquisition: The time elapsed between command uplink and image capturing, depends on the image target and the reception time of the request.
- Data download: The download is performed during the same orbit after the capture has been performed.
- Data processing: This part of the process ends with a product ready on the ground station. Processing level depends on user request.
- Product delivery: The final product is sent to the client through the specified channel (usually, FTP).

[1] 24 hours, 7 days a week, 365 days a year.

5. DATA PACKAGE

5.1. Format

DEIMOS-2 products are provided in DIMAP format. It consist of two parts, one for the image and the other for a description of the image (Metadata):

The image products for DEIMOS-2 are provided by default in GeoTIFF:

- TIFF is an image format widely used and recognised by all available software
- Geo part, recognised by all geographic information processing software. It adds georeferencing information for the image file (coordinates in the upper left-hand corner of the image and pixel size) to the basic TIFF file and may also describe the map projection used and its corresponding geographic system.

DEIMOS-2 products are provided as datasets of several files summarized in the following table:

Table 5: DEIMOS-2 product dataset files

File	Description	Product Level
dim	DIMAP v1 metadata http://www.spotimage.fr/dimap/spec/documentation/refdoc.htm	L1B, L1C
html	Human readable metadata in HTML http://www.w3.org/TR/html401/	L1B, L1C
jpg	JPEG image data, JFIF standard 1.01 quicklook http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=54989	L1B, L1C
tif	GeoTIFF image data http://www.remotesensing.org/geotiff/spec/geotiffhome.html	L1B, L1C
_RPC.txt	Rational polynomial coefficients http://geotiff.maptools.org/STDI-0002_v2.1.pdf	L1B

5.2. File Naming Convention

Image files are provided with a standard file naming convention and the user could recognize the products type per the nomenclature file.

Example:

DE02_PSH_L1B_000000_20141224T022812_20141224T022817_DE2_3708_E71F.tif

Convention meaning:

- DE02: Mission
- PSH: Type of product(see Table 2 for product type naming conventions)
- L1B: Processing level(see Sec.3.2 for available processing levels)
- 000000: Spare code
- 20141224T022812: date and hour of the beginning of the image capture
- 20141224T022817: date and hour of the end of the image capture
- DE2: Mission
- 3708: number of the orbit
- E71F: CRC

Several examples are provided below:

- Pan-Sharpen, non-ortho, 4 bands (10 bits):

  DE2_PSH_L1B_000000_20150224T150137_20150224T150140_DE2_3708_E71F.tif

- Pan-sharpen, non-ortho, 3 (true color) bands (8 bits):

  DE2_PS3_L1B_000000_20150224T150137_20150224T150140_DE2_3708_E71F.tif

- Pan-sharpen, ortho, 3 (false color) bands (8 bits):

  DE2_PS4_L1C_000000_20150224T150137_20150224T150140_DE2_3708_E71F.tif

5.3. DEIMOS-2 DIMAP

The metadata for image products are contained within the DIMAP (.dim) files. Deimos Imaging DIMAP is based upon the DIMAP generic profile version 1.1 developed by SpotImage and CNES, and is implemented through the use of XML.

Some elements of the DIMAP are not clearly defined and open for data providers to define their own parameters. A detailed description of the DEIMOS-2-specific DIMAP elements is provided in Appendix II of this document.

Documentation on DIMAP version 1.1 and the DIMAP XML implementation can be found at the following URL: http://www.spotimage.fr/dimap/spec/documentation/refdoc.htm.

6. PRODUCT DELIVERY

6.1. Delivery Methods

Deimos Imaging offers a wide variety of delivery methods for DEIMOS-2 products, to better suite the Customer's needs:

- FTP Pull (default method)
- FTP Push
- USB memory stick
- USB hard disk
- DVD

Usually, products are delivered via FTP Pull, being placed in an FTP hosted by Deimos Imaging.

On Customer's request, data can be delivered via FTP Push (i.e. on an FTP set up by the Customer), or via a physical mean sent by courier (USB stick, hard disk or DVD).

6.2. Delivery Terms

Delivery terms are agreed with the Customer depending on its needs. Typically three types od delivery terms are used:

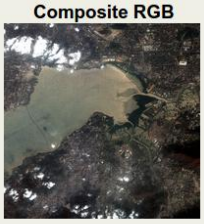
- **Once off**: single products (or batch of products) are delivered once off after single requests.
- **Stream**: products are made available to the clients as a repetitive and regular flow of data delivered with regular frequency. A typical example is the systematic provision of products for monitoring a given area.
- **Cumulative**: products are created during a given time window, and are delivered only after the completion of the window. A typical example is the gap-free coverage of given geographical areas.

APPENDIX I: HTML METADATA EXAMPLE

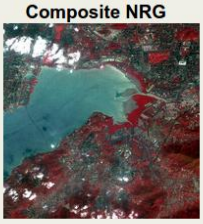
deimosimaging
an urthecast company

DE2_PSH_L1B_20150210T025805

Composite RGB



Composite NRG



Source

Start Time	2015-02-10 02:58:08.073033
Stop Time	2015-02-10 02:58:10.307369
Mission	Deimos 2
Instrument	HiRAIS
Incidence Angle	-9.5 (DEG)
Pixel Resolution	W-E 1.0 (M)
	N-S 1.0 (M)
Sun Elevation	45.6358 (DEG)

Raster Dimensions

Columns	11712
Rows	11712
Bands	4

Raster Encoding

Data Type	Unsigned Int
Number of Bits	16
Byteorder	I

Data Access

Format	GEOTIFF
Data file	DE2_PSH_L1B_20150210T025805.tif

Dataset ID

Copyright	(C) DEIMOS Imaging 2015

Production

Producer	Deimos Imaging S.L.U. Edificio Galileo, Modulo Gris, Oficina 103. Parque Tecnologico de Boecillo 47151 Boecillo, Valladolid, Spain. Tlf. +34 983 548 923 Fax +34 983 548 123 Contact Email: comercial@deimos-imaging.com
Url:	http://www.elecnor-deimos.com/
Production Date	03/03/2015 11:33:25.303
Type	L1B
Job ID	commercialRawImage DE2_PSH_L1B_20150210T025805

Data Processing

Geometric	GEOLOCATED

Coordinate Reference System

```
GEOGCS["WGS 84",
    DATUM["WGS 1984",
        SPHEROID["WGS 84",6378137,298.257223563,
                AUTHORITY["EPSG","7030"]],
        AUTHORITY["EPSG","6326"]],
    PRIMEM["Greenwich",0,
        AUTHORITY["EPSG","8901"]],
    UNIT["degree",0.0174532925199433,
        AUTHORITY["EPSG","9122"]],
    AUTHORITY["EPSG","4326"]]
```

Raster Coordinate System

Type	POINT

Image Interpretation

	Description
1	NIR
2	RED
3	GREEN
4	BLUE

	Gain	Bias	Unit
1	1	0	N/A
2	1	0	N/A
3	1	0	N/A
4	1	0	N/A

Image Display

Red	2
Green	3
Blue	4

Image Statistics

	Min	Max	Mean	Stdv
1	317.0	1022.0	496.96	77.4
2	222.0	1022.0	504.81	76.47
3	219.0	1022.0	504.25	74.92
4	151.0	1022.0	503.4	73.69

Dataset Frame

X	Y
113.91504910(DEG)	22.55600390(DEG)
114.06072147(DEG)	22.56916794(DEG)
114.09453890(DEG)	22.41566092(DEG)
113.94893795(DEG)	22.40261194(DEG)

APPENDIX II: DEIMOS-2 DIMAP METADATA

The following elements and sub-elements DIMAP have values and attributes that are unique to products Deimos Imaging.

Details about the values and attributes of the elements and sub elements that are unique to the Deimos Imaging data are shown below.

<PROJECTION>

Element	Element Value	Attribute	Attribute Value
<PROJECTION>	Projection in WKT	N/A	N/A
Description			
Projection in HTML encoded OGC WKT			

```
<PROJECTION>PROJCS[&quot;WGS 84 / UTM zone 37N&quot;,GEOGCS[&quot;WGS 84&quot;,DATUM[
&quot;WGS_1984&quot;,SPHEROID[&quot;WGS 84&quot;,6378137,298.257223563,AUTHORITY[
&quot;EPSG&quot;,&quot;7030&quot;]],AUTHORITY[&quot;EPSG&quot;,&quot;6326&quot;]],PRIMEM[
&quot;Greenwich&quot;,0,AUTHORITY[&quot;EPSG&quot;,&quot;8901&quot;]],UNIT[&quot;degree&quot;,0.
0174532925199433,AUTHORITY[&quot;EPSG&quot;,&quot;9122&quot;]],AUTHORITY[&quot;EPSG&quot;,&quot;4326&quot;]
],UNIT[&quot;metre&quot;,1,AUTHORITY[&quot;EPSG&quot;,&quot;9001&quot;]],PROJECTION[
&quot;Transverse_Mercator&quot;],PARAMETER[&quot;latitude_of_origin&quot;,0],PARAMETER[
&quot;central_meridian&quot;,39],PARAMETER[&quot;scale_factor&quot;,0.9996],PARAMETER[
&quot;false_easting&quot;,500000],PARAMETER[&quot;false_northing&quot;,0],AUTHORITY[
&quot;EPSG&quot;,&quot;32637&quot;],AXIS[&quot;Easting&quot;,EAST],AXIS[&quot;Northing&quot;,NORTH]]<
/PROJECTION>
```

Figure 10: Element <PROJECTION>

<SENSOR_VIEWING>

Element	Element Value	Attribute	Attribute Value
<SENSOR_VIEWING>	variable	unit	*DEGREES*
Description			
Sensor viewing angle in degrees			

```
<SENSOR_VIEWING unit="DEG">32</SENSOR_VIEWING>
```

Figure 11: Element <SENSOR_VIEWING>

<START_TIME>

Element	Element Value	Attribute	Attribute Value
<START_TIME>	Datetime	N/A	N/A
Description			
Start time of the Scene			

```
<START_TIME>2014-10-29 07:39:07.098846</START_TIME>
```

Figure 12: Element <START_TIME>

<STOP_TIME>

Element	Element Value	Attribute	Attribute Value
<STOP_TIME>	Datetime	N/A	N/A
Description			
Stop time of the Scene			

```
<STOP_TIME>2014-10-29 07:39:08.737918</STOP_TIME>
```

Figure 13: Element <STOP_TIME>

<PIXEL_RESOLUTION_X>

Element	Element Value	Attribute	Attribute Value
<PIXEL_RESOLUTION_X>	W-E Value	unit	M or Deg.
Description			
Real Pixel Resolution in X axis			

```
<PIXEL_RESOLUTION_X unit="M">W-E 0.75</PIXEL_RESOLUTION_X>
```

Figure 14: Element <PIXEL_RESOLUTION_X>

<PIXEL_RESOLUTION_Y>

Element	Element Value	Attribute	Attribute Value
<PIXEL_RESOLUTION_Y>	N-S Value	unit	M or Deg.
Description			
Real Pixel Resolution in Y axis			

```
<PIXEL_RESOLUTION_Y unit="M">N-S -0.75</PIXEL_RESOLUTION_Y>
```

Figure 15:<PIXEL_RESOLUTION_Y>

END OF DOCUMENT