



DEIMOS Earth Observation System

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The DEIMOS-1 System



Fully owned and operated by **ELECNOR DEIMOS IMAGING** Launched in July 2009, operational since March 2010 5 years nominal lifetime, >7 years expected DMC constellation ESA Third Party Mission





DEIMOS-1 Satellite



Built by SSTL (UK)
100 Kg
Nadir-pointing platform
Sun-Synchronous orbit at 650 km
8-Gb on-board solid state recorder
X-band antenna for data transmission
S-band antenna for telemetry & telecommand
Pushbroom CCD, 3 cameras per bank
Spatial Dual-bank resolution of 22m GSD at 10 bits
650 km swath

R,G,NIR similar to Landsat to assure continuity with existing tools and harmonization with historical data









DEIMOS-1 System capacity





DEIMOS-1 On-Line Image Catalog (20,000+ images)





Mission Planning simulation for Brazil coverage – 13 to 28 June

2-3 images of Brazil per day





Latin America mosaic using DEIMOS-1 data



2-3 images per day over US

(~1 million km² per day)

Complete coverage of the US and Europe every 2 weeks





Main features



Rapid coverage and revisit of large areas given by:

Wide swath – 600km Very large images up to 620 x 1240 km Data download each orbit Near-real time capacity





Large areas with great detail





Ground Segment



ELECNOR DEIMOS premises host a control centre integrated with the user segment:

Mission Planning Flight Operations Image Processing Archive and Dissemination

Advanced mission planning system, based on ELECNOR DEIMOS expertise as a well-known European leader in Mission Planning for Earth Observation missions



optimization of large coverage campaigns







qs4EO

ground segment

Near-real time capacity



Data can be delivered in less than 2 hours after acquisition

Three ground stations in Spain and Norway for data download in each orbit

Communication with satellite and data download every 100 minutes











Natural color mosaic of CONUS using DEIMOS-1 data from June 2011



Worldwide Coverage



Yearly cloud-free coverages of Africa



Worldwide Coverage



BRAZIL COVERAGES







DEIMOS-1/Landsat



Region	Deimos-1	Landsat ETM+	Landsat TM
G	510-618 nm	508-618 nm	507-619 nm
R	614-698 nm	615-701 nm	622-704 nm
NIR	755-906 nm	750-910 nm	750-912 nm

Transmissivity



Wavelength (nm)

- Permanent Cross-calibration with Landsat-7 (Δ< 3%)
- Cross-Calibration with Landsat-8 from Q3 2013

DEIMOS-1/Landsat



Spain coverage with Landsat-8 (16 days) and DEIMOS-1 (2 days)

 \rightarrow indicated for emergencies or applications with frequent revisits

Landsat-8, 16 days



DEIMOS-1, 2 days



Real data - 1/16 June 2013 acquisition campaign

DEIMOS-1 archive





http://www.deimos-imaging.com/extcat2/





DEIMOS-1 Products & Services

Products and Services



22 m Imagery

Country Coverage and Maps

22m Natural Color Imagery

Spectral Indices

Fire Mapping

Flood Mapping

LULC

...and several applications supporting:

Agriculture

Environment

Forestry

Crisis Management

Maritime Security



DEIMOS-1 Natural Color Product: wetland in Volga catchment, Russia 2012

Agriculture



Optimal Satellite for Large-Scale Agriculture Applications





Variação temporal de NDVI - Parcelas JCL

Cliente: (Cultura: Jaropha curcas Linnaeus Localização: C Descrição: Parcelas A1; A2; A3; B1; B2; B3 Superfície: 67.8 Ha



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Aquisição: DEIMOS-1 (28 Janeiro 2012)



Comentário: NDVI mais elevado nas aquisições de Janeiro 2012 e Maio 2012. Por a planta estar em dormência, os NDVI nas aquisições de Setembro e Agosto 2012 são baixos. São notórios valores mais baixos de NDVI nas parcelas A1/A2 e valores mais elevados nas parcelas A3 (sub-parcela CC2), B1 e B2 (especialmente em Janeiro e Maio). No centro do conjunto formado pelas parcelas A2/A3/B1/B2 existe um menor vigor, mais notório em Maio e Janeiro 2012, que se deve à incidência de Fusariose. A málise da evolução temporal da Fusariose nas parcelas necessitaria de levantamento de pontos ao longo de todo o período de malise. Contudo é notório um menor vigor na área referida ateriormente, que deixa de ser visvel em Agosto por a planta entre em dormência.



Data provider United States Department Agriculture since 2011 DEIMOS-1 and **UK-DMC2** data (75%-25%)





- □ More than **150 MKm² cloud-free** have been delivered every 6 months
- □ Cloud-free coverage requirements (>70%) greatly exceeded, on average >90%
- □ 99.5% of images delivered, ortho, in less than 72hr from acquisition



Number of images acquired, real campaign observations. September 1–15, 2012



Final product: 30-m Cropland Data Layers with 9 billion pixels



Agriculture Land Use



□ Land use analysis with DEIMOS-1 multi-temporal analysis

□ Starting from land use maps, the multi-temporal analysis allows to determine which parcels have been used in the various crop seasons



Agriculture Crop Analysis



Crop condition estimation with DEIMOS-1 multi-temporal analysis
 Starting from land use maps, the multi-temporal analysis allows to determine the condition of the crop in each parcel with respect other



reference years

Crop Condition Estimation Example of analysis of wheat crop conditions near La Campana, Sevilla (Spain)

DEIMOS-1 data from 2010, 2011 and 2012



Agriculture Insurance



Accumulated drought assessment in agriculture and pasture

Damage and compensation assessment

Low temperatures monitoring and crops damages assessment





LA LINEA CONTINUA CORRESPONDE AL AÑO PROMEDIO

Precision farming



- Irrigation Support Services (Rio Sorraia Portugal)
 - Weekly forecasts and warnings on irrigation needs, via sms
 - Periodic reports on vegetation status and growth during crop season
 - Early detection of growth anomalies and equipment malfunctions







Forestry



- The stands are the basic unit of forest management. It is defined as a farming area with a good homogeneity in terms of species composition and trees' age and condition.
- DEIMOS-1 Stands Product has been conceived as a decision support tool for the design and implementation of forest management strategies.



Plantation Monitoring - Vegetation Status



- Map of state of vegetation planting, informative about the relative photosynthetic activity of the plant.
- Map of relative status within stands, information on the areas of the stand with a more advanced or delayed growth.
- Map of temporal evolution of vegetation, with information about the observed change in each point of the stand between two observation dates.
- Map of relative temporal evolution within stands, with information on the stand areas with higher or lower growth in the last period of study.



Forest Fires



Example of forest fires monitoring using DEIMOS-1

- DEIMOS-1 images acquired on April 15th and May 4th, 2011 near San Diego
- □ Multi-temporal analysis to derive and analyze the affected area



Forest fires maps



Step 1: Multi-temporal analysis (false color)





Unburned



Step 2: Perimeter identification



Step 3: Analysis



Perimeter: 9.7 km Area: 138,873 acres

Perimeter: 71.4 km Area: 1,960,912 acres

Deforestation - Monitoring



□ DEIMOS-1 images comparison, Brazil (natural color)





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Support to Crisis Management

Oklahoma, USA, May 2013

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Support to Crisis Management



Japan tsunami in Sendai (March 2011)





Missouri floods near the Fort Calhoun nuclear plant, Nebraska (June 2011)



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DEIMOS EO System Evolution: DEIMOS-2

The DEIMOS-2 System



Multispectral optical satellite with very high resolution (1m Pan, 4m MS) Launch End 2013

Cost-effective and highly responsive

Fast access to very-high resolution imagery

Designed and built in cooperation with SATREC Initiative (South Korea)

Integrated and tested by ELECNOR DEIMOS SATELLITE SYSTEMS



Satellite and Payload



The Satellite

- Built by ELECNOR DEIMOS in Spain, in collaboration with SATRECi (South Korea)
- Proven design with significant heritage (Dubaisat-1, -2)
- To be launched in 2013, lifetime >7 years
- Mass: 310 Kg
- Agile platform (±45° across-track)
- High-performance AOCS for pointing accuracy & stability
- Xenon gas engines for orbit maintenance

The Payload

- Pan/Multispectral high-res camera (1m Pan, 4m MS GSD)
- Main image product: 75-cm pan-sharpened
- 40-cm Korsch 4-mirror telescope (5.75 m focal length, 1.2° FoV
- Pan (450-900 nm) + 4 bands (R,G,B, NIR)
- 12 km swath (24 km in wide-area mode)
- Capacity for stereo-pair acquisitions
- Radiometric resolution 10 bits



- □ Up to **150,000 Km²/day**
- □ Global average revisit time: 2 days (±45° ACT)
- □ Average revisit time at 45° Lat: 1 day (±45° ACT)









GS fully developed by ELECNOR DEIMOS (all components including FOS, PDGS, Ground Station).

Primary GS in Puertollano, backup GS in Boecillo.

Two 10.2 m X/S band antennas: Puertollano and Svalbard (Norway)



Program Status (I)



□ **DEIMOS-2 structural model** in the clean room of ELECNOR DEIMOS Satellite Systems facilities in Puertollano (Oct.2012)



Program Status (II)



- □ **DEIMOS-2 flight model** during assembly and testing in South Korea before shipment to Spain (Apr.2013)
- □ The satellite will be ready for launch, as scheduled, in Q4 2013







ELECNOR DEIMOS Satellite Systems facilities , south of Madrid (Spain)

More than 4,000 m² office space Clean room (430 m²) & control centre 10.2-m antenna by Vertex, Germany







Thank you!

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