

Deimos-2 cross calibration with Dubaisat-2

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The Deimos-2 Mission Concept

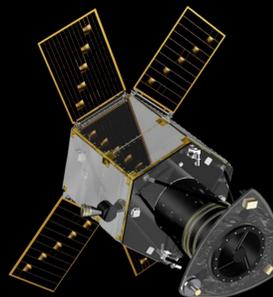
- The Deimos-2 end-to-end system has been designed to provide a **cost-effective** and **highly responsive** service to cope with the increasing need of fast access to very-high resolution imagery
- It **expands Elecnor Deimos Imaging portfolio**, complementing DEIMOS-1 with VHR multispectral imagery (**75 cm Pan-sharpened**)
- The combined use of DEIMOS-1 (22 m) and Deimos-2 (75 cm) will provide a wide range of capabilities for the generation of products in all optical Earth Observation market segments



- With Deimos-2, Elecnor Deimos expands its capabilities into satellite integration with the creation of a new subsidiary: **Elecnor Deimos Satellite Systems**
- Its **brand new facilities**, built in Puertollano (Spain) in 2012, include more than 4,000 m² office space, a 430-m² **clean room** and a complete **control centre** with a 10-m X-band antenna

The Satellite

- The satellite is being developed together with **Satrec Initiative** (South Korea)
- Based on SpaceEye-1 concept (heritage from DubaiSat-1 and -2)
- The Deimos-2 has been **integrated and tested in Elecnor Deimos Satellite Systems** premises in Spain in 2013
- Launch foreseen for Q2 2014**



- Mass: 300 kg
- Size: Ø 1.5 m x 2.0 m
- Agile platform ($\pm 45^\circ$ across-track)
- High-performance AOCS for pointing accuracy & stability
- Dual redundancy in all critical systems
- Xenon gas thrusters (HEPS) for orbit control
- X-band antenna for 160 Mbps data transmission
- S-band antenna for telemetry & telecommand



The Payload

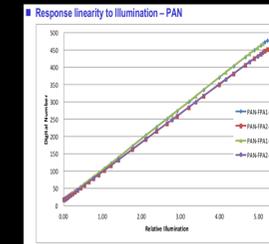
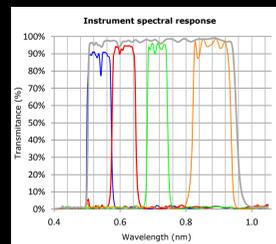
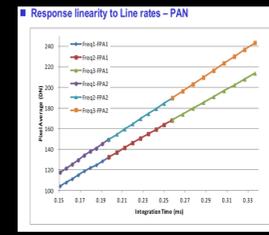
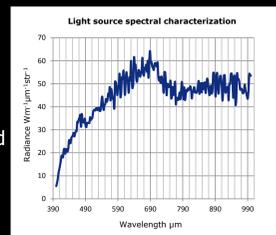
- EOS-D pushbroom camera with multi-linear TDI sensor
- 40-cm Korsch telescope (5.75 m focal length, 1.2° FoV)
- Ground spatial resolution of 1m Pan, 4m MS
- 75-cm GSD pan-sharpened products**
- Swath >12 km** (24 km in wide-area mode)
- Pan** (450-900 nm) + **4 bands** (R,G,B, NIR)
- Radiometric resolution **10 bits**
- Images are stored on a high-capacity solid-state recorder
- During transmission of the stored image data via X-band, **data are compressed, encrypted and encoded in real time**
- No on-board calibration devices

Dubaisat-2

- Developed by **EIAST, the Emirates Institution for Advanced Science and Technology** (United Arab Emirates) and **Satrec Initiative** (South Korea)
- Dubaisat-2 is an almost exact Deimos-2 **twin**
- Owned and operated by EIAST
- Launched in November 2013. Currently is completing its **commissioning** phase

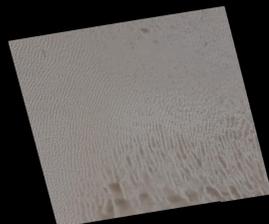
Pre-launch characterization & calibration

- Both systems have been thoroughly characterized in lab:
 - Response Linearity
 - Dark Signal and Non-uniformity
 - Pixel Response and Non-uniformity
 - Signal-to-Noise Ratio (SNR)
 - Pixel Saturation
 - Spectral response
 - MTF
- Deimos-2 was also characterized for **absolute calibration**

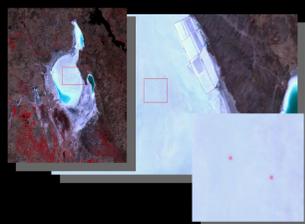


Deimos-2 Post-launch Radiometric Cal/Val

- Closely follow **CEOS** Cal/Val recommendations and **sites**
- PRNU measurements using uniform and high reflectivity Land Non Equipped Sites (**LNES**)
- Dark signal measurements using night images over the ocean
- Libya-4 LNES (pseudo-invariant) for sensor trending
- Vicarious measurements for **absolute** Cal/Val using CEOS Land Equipped Sites (**LES**) and **CIBA** (low atmosphere research center)
- Managed by the University of Valladolid (Spain)
- Planned to enhance instrumentation to comply with CEOS LES sites



Libya-4
Deimos-1 image



Tuz Gölü vicarious calibration campaign
Deimos-1 image

Post-launch cross-calibration workflow

- Deimos-2 absolutely calibrated data will be used as reference
- Data acquired on **LNES** for sensor trending will be used to cross-compare with Dubaisat-2
- Absolute calibration coefficients will be generated for Dubaisat-2 based on the data comparison
- Vicarious validation campaign for the absolute calibrated Dubaisat-2
- If the validation campaign is successful, both sensors will be considered absolutely calibrated and validated

calval4EO: Centralized management

- Part of the **gs4EO** suite
- Fully developed in-house
- Systematic extraction of calibration data
- Systematic generation of calibration reports
- Interactive
- Calibration database

