

## Deimos-2/Dubaisat-2 VHR Constellation

**Benefits & Applications of  
Cost-Effective, Dependable  
Very-High-Resolution  
Multispectral Imagery**

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□ **The DEIMOS-2 System**

□ **DEIMOS-2 Program Status**

□ **VHR Constellation with DUBAISAT-2**

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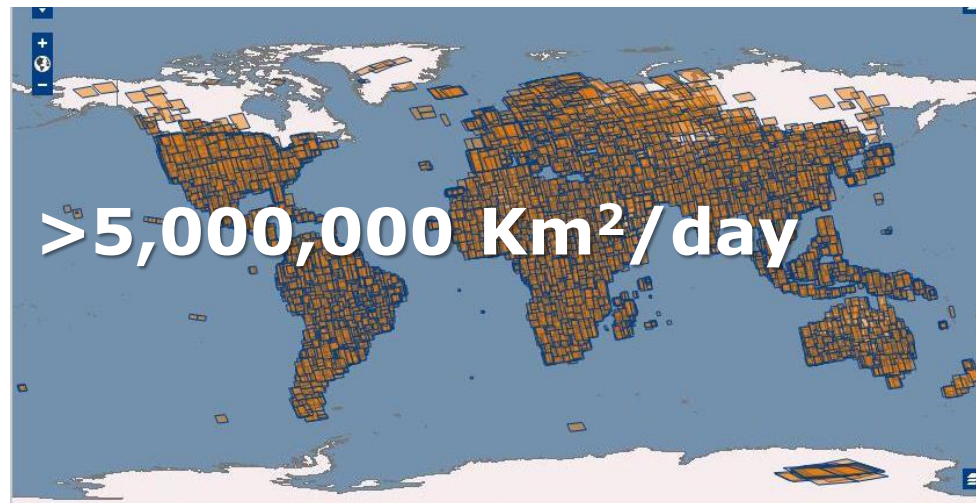
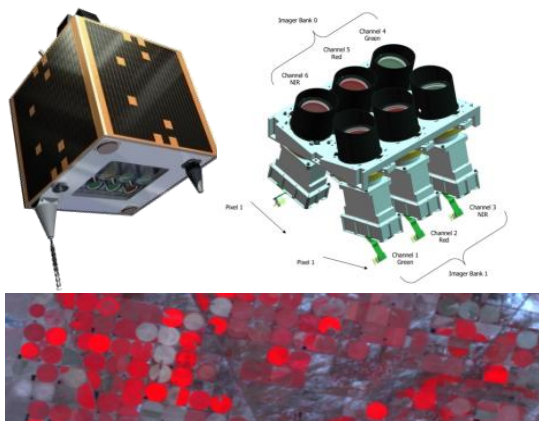
# 1

## DEIMOS-2 System Description



- ❑ **ELECNOR DEIMOS is the technology company of the ELECNOR Group** (one of the largest industrial groups in Spain, with 12,000 employees) operating in Aerospace & Defence, IT Systems, Telecommunication Networks, Security and Technological Infrastructures
- ❑ 6 companies in 4 countries, a staff of 350 engineers and 50 M€ of turnover in A&D in 2013
- ❑ **Relevant Involvement in the Majority of ESA Programs and Missions:** EO (Earth Explorers, Sentinels, MTG, Copernicus), GNSS (Galileo, EGNOS), Launchers (IXV), Exploration (Rosetta, BepiColombo, Exomars), SSA
- ❑ Involvement in **all phases of space missions** (design to operations)
- ❑ Awarded “**Best Newcomer Earth Observation Operator**” at the Euroconsult’s Earth Observation Business Week in Paris, in September 2013





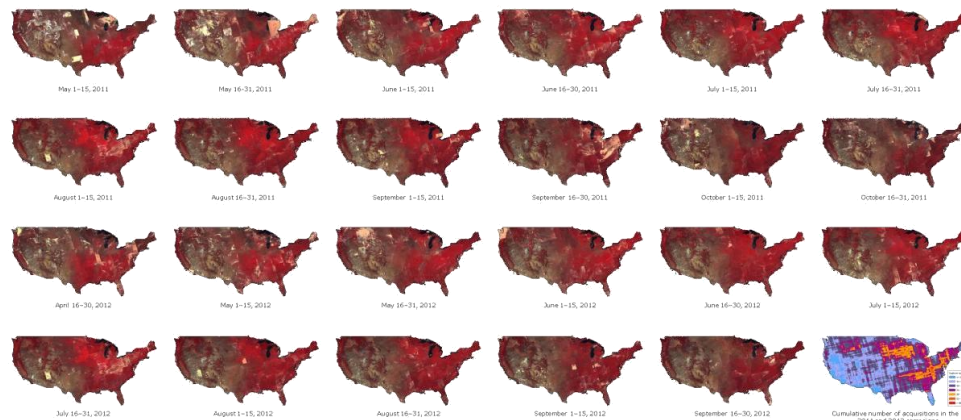
**Sudan & South Sudan**  
(2,506,000 Km<sup>2</sup>,  
43  
images)



**Uganda**  
(236,000 km<sup>2</sup>,  
14  
images)



**Somalia**  
(638,000 km<sup>2</sup>, 25  
images)



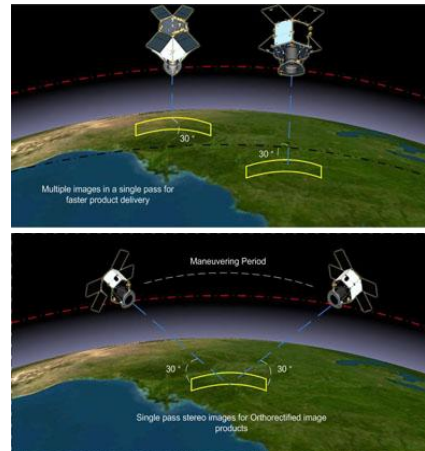
# The DEIMOS-2 System Concept

- ❑ **DEIMOS-1** (22m GSD, 3-band, 650 km swath), owned and operated by ELEC NOR DEIMOS, is the first Spanish Earth Observation satellite, launched in 2009
- ❑ ELEC NOR DEIMOS' EO system will be upgraded in **2014** with the launch of a **new satellite**, the **DEIMOS-2**
- ❑ **DEIMOS-2** will be a **multispectral optical** satellite with **very high resolution (75-cm Pan-sharp)**
- ❑ Designed and built by ELEC NOR DEIMOS in cooperation with SATREC-i (South Korea), it was integrated and tested in **ELEC NOR DEIMOS Satellite Systems'** premises in Puertollano, Spain



# The DEIMOS-2 System at a Glance

- ❑ **Very-high resolution (75-cm pan-sharpened) multispectral optical satellite**
- ❑ **Launch on June 19, 2014** on a 620-km ascending SSO, with lifetime > 7 years
- ❑ Push-broom camera with 5 spectral channels (1 pan, 4 multi-spectral bands) @ 10 bits
- ❑ 2-day revisit
- ❑ 12/24 km swath, stereo-par capability, **system capacity > 200,000 km<sup>2</sup>/day**
- ❑ Agile platform with  $\pm 45^\circ$  off-nadir tilting capacity (2-day average revisit time worldwide)
- ❑ Ground segment fully developed by ELECNO R DEIMOS, based on **gs4EO** product line
- ❑ Two ground stations (Spain+polar) assure one contact with up/download per orbit



## “Cost-effective, dependable, submetric imagery coupled with highest-quality end-to-end service to customers”

- ❑ **75 cm/pixel - the highest-resolution fully private multispectral satellite in Europe**
- ❑ **Dependable - no military stakeholders: we can assure acquisitions**
- ❑ **Total control over the Ground Segment, with fully-customised Direct or Virtual Receiving Stations**
- ❑ **Very cost-effective**





## Highest quality service to the customers:

- **24/7 service for ordering, tasking, downloading, processing, delivery**
- **Tasking up to few minutes before acquisition**
- **Download within minutes from acquisition**
- **Fast processing and delivery**
- **RUSH: few hours from ordering to deliver**



## ❑ Main DEIMOS-2 Products: Spatial Resolution and Spectral Bands

Level 1				
Product	Spatial Resolution	Spectral Bands		
Pansharpened (PMS)	75 cm	4 (B, G, R, NIR)	3 true color (B,G,R)	3 false color (G, R, NIR)
Panromatic (P)	75 cm	1 (grayscale)		
Multispectral (MS)	3 m	4 (B, G, R, NIR)		
Bundle (P+MS)	75 cm (P) / 3 m (MS)	1 Pan + 4 MS (B, G, R, NIR)		
Stereo Pair	75 cm	Pan (grayscale)	Pansharpened (color fused)	
Level 2				
Product	Resolution	Notes		
Spectral Indexes	3 m	NDVI, SAI, LAI, ...		
Spectral Indexes Pansharp	75 cm	Spectral Indexes fused with 75cm pan		
Digital Elevation Model	3 m	-		

## ❑ 24/7/365 Services

- ❑ Rush Tasking
- ❑ Rush Delivery
- ❑ Rush Processing

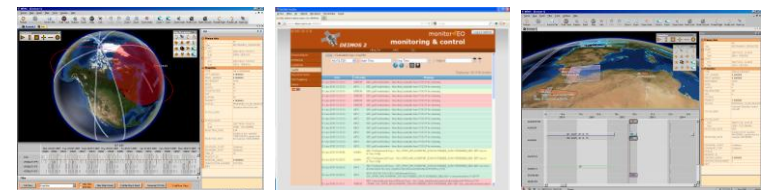
## ❑ DEIMOS-2 Receiving Station schemes

- ❑ Virtual Receiving Station
- ❑ Direct Receiving Station

The DEIMOS-2 Ground Segment is **fully developed in-house** by ELECNO R DEIMOS, based on its **gs4EO**<sup>®</sup> product line, and it is implemented on three sites:

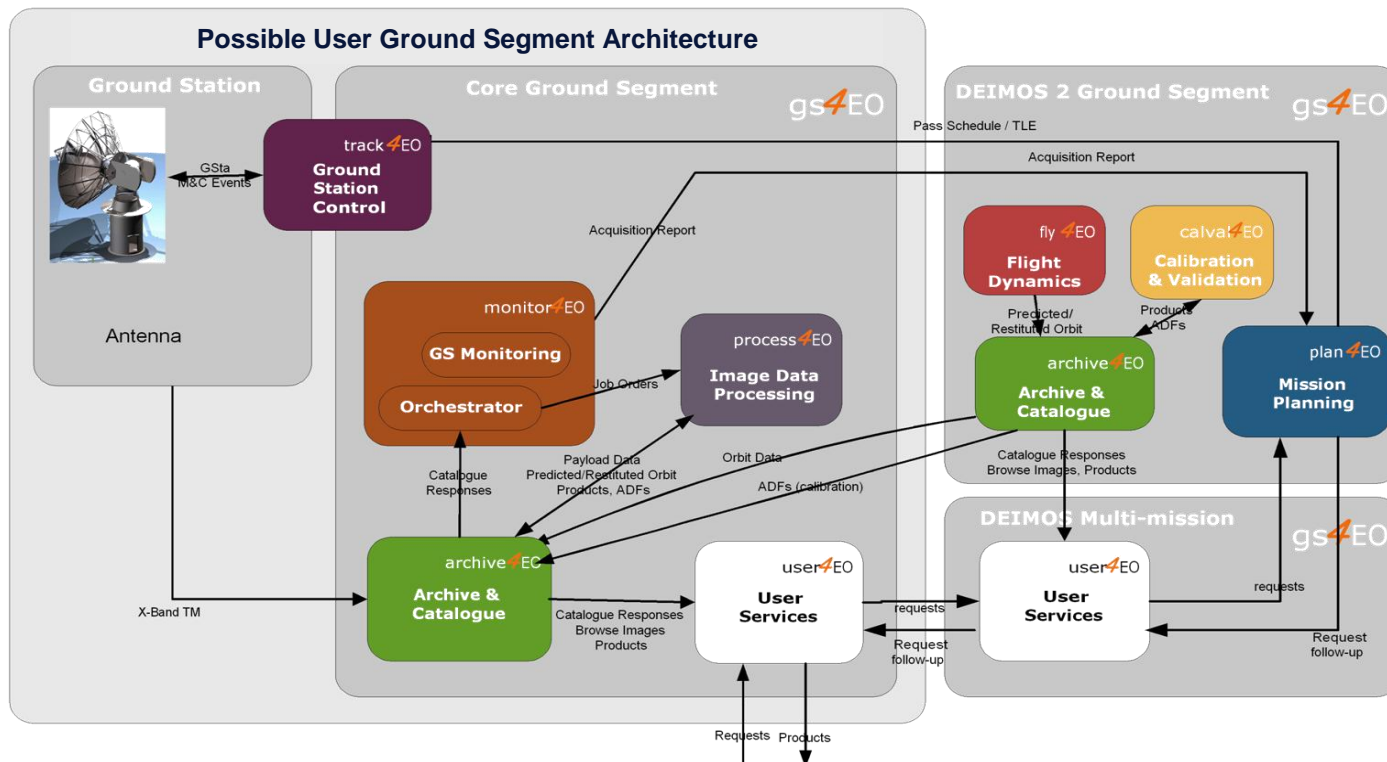
- ❑ A **primary station** (Puertollano, Spain) containing the complete FOS, PDS, M&C and Station elements, with 10-m antenna
  - ❑ A **secondary station** (polar) with a 10-m antenna for telecommands and data download
  - ❑ A **backup station** (Boecillo, Spain), with a 5-m antenna and containing a complete copy of the ground segment.
- 
- ❑ The system is designed to include various **User Ground Segments ("UGS")** around the world, with capability to send tasking requests to Spain and to download and process data.

## gs4EO ground segment



# Direct Receiving Stations

- ❑ A User Ground Segment (UGS) terminal allows the reception and processing of DEIMOS-2 data
- ❑ Both Direct and Virtual Receiving Stations are possible, and greatly customizable, to meet customer's needs



# 2

## DEIMOS-2 Program Status



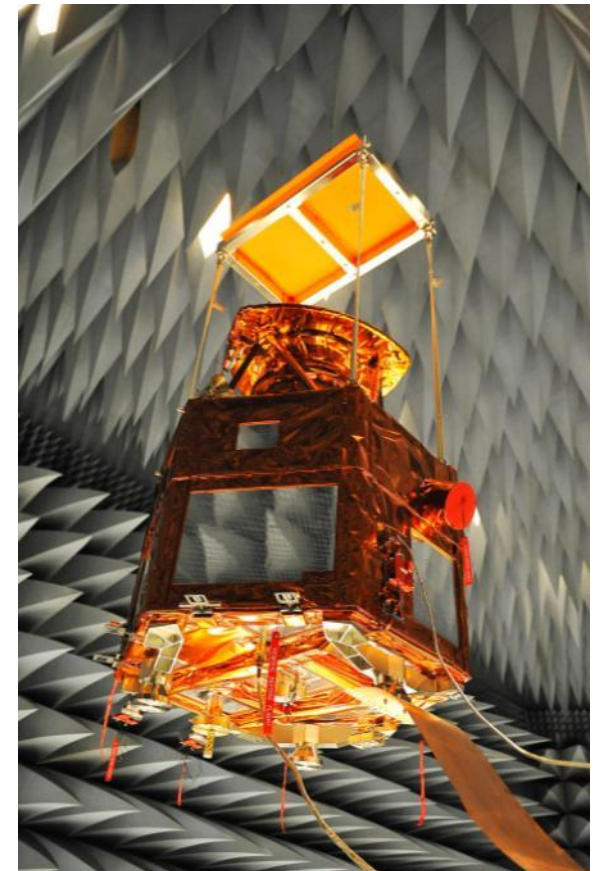
- **The DEIMOS-2 structural model in Elecnor Deimos' clean room in Puertollano, Spain (2012)**



- **The DEIMOS-2 flight model being tested in South Korea and Spain (2013)**



- ❑ **DEIMOS-2 flight model** during testing in INTA (Spain), Oct.2013



- ❑ **DEIMOS-2 flight model** during final assembly in Elecnor Deimos Satellite Systems facilities in Puertollano (Nov.2013)
- ❑ **The satellite is ready for its scheduled launch on June 19, 2014.**





# 3

## VHR Constellation with DUBAISAT-2



- ❑ **DEIMOS-2 almost-identical twin**
- ❑ **Operated by EIAST (UAE)**

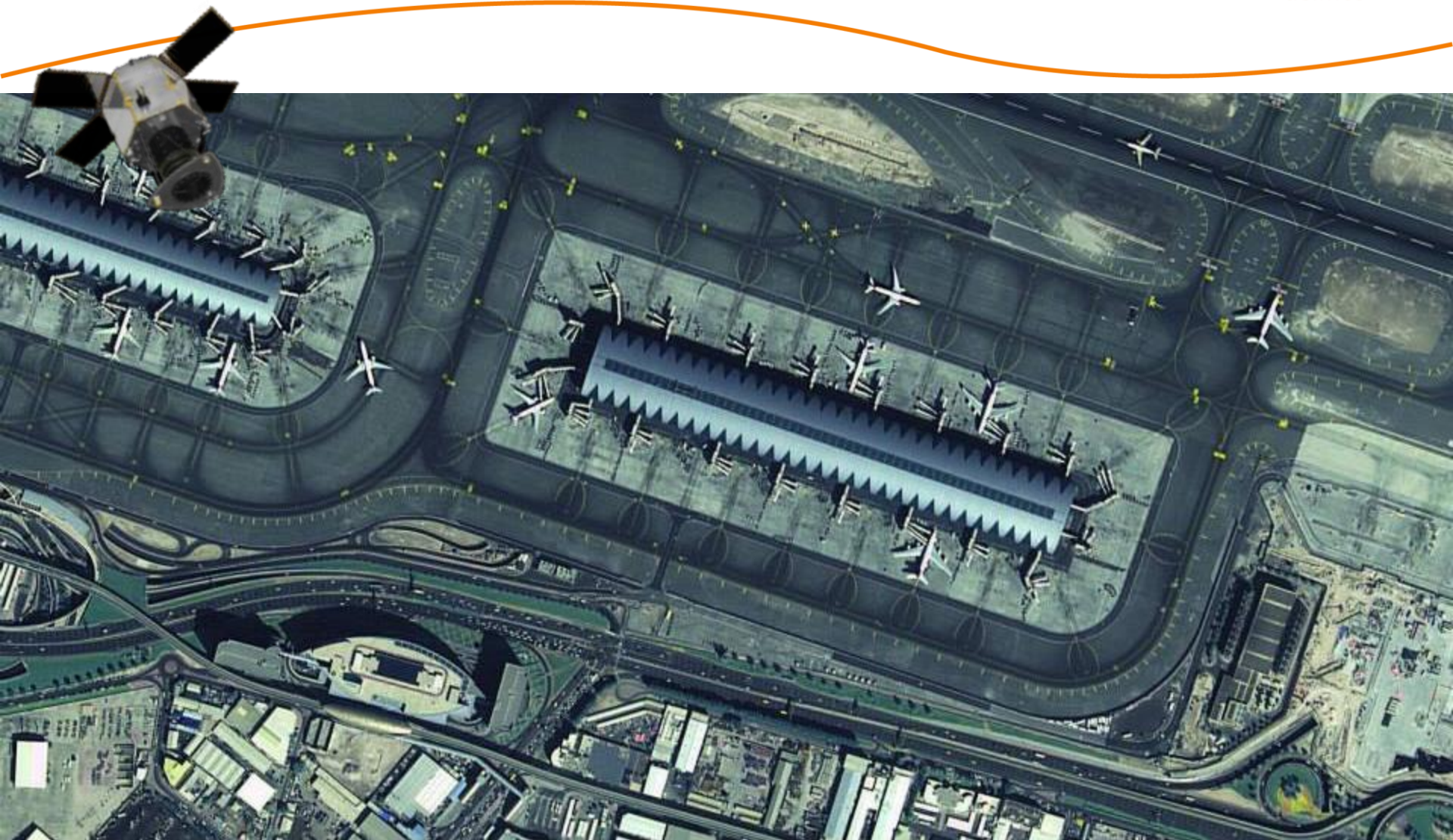


- ❑ Launched on November 22, 2013
- ❑ LTAN: 22h00 (descending orbit)
- ❑ Operated in constellation via coordination with DEIMOS
- ❑ Exactly the same DEIMOS-2 imagery product: fully compatible



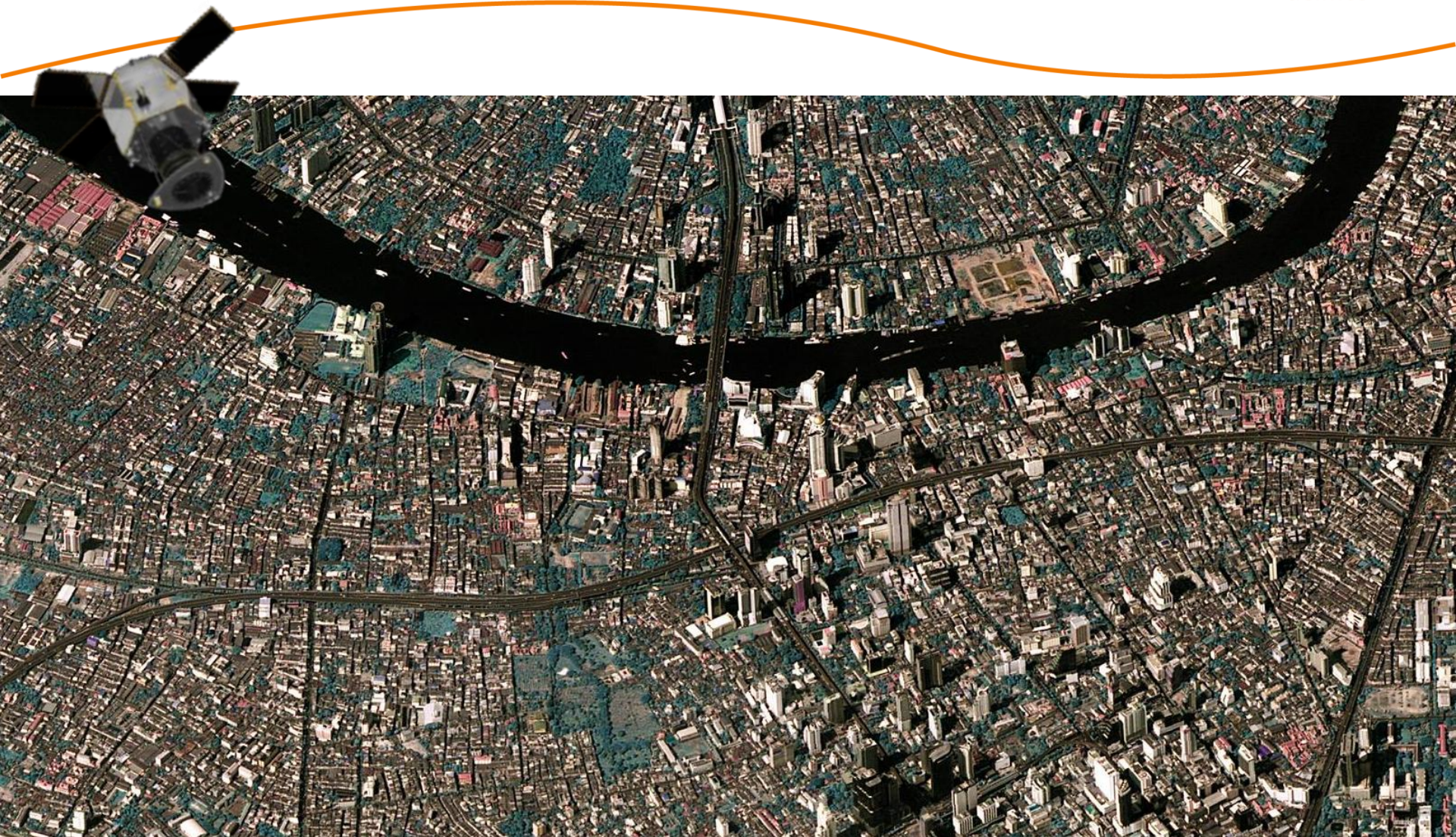
- ❑ **On average: daily revisit time worldwide with the 2 satellites**
- ❑ **Data can be downloaded and processed in DEIMOS-2 ground segment**
- ❑ **Dubaisat-2 is already operational and its imagery is available through DEIMOS**

# DUBAISAT-2 Imagery: Already Available



**DUBAISAT-2 Pan-sharpened Image of Narita Airport (Japan) © EIAST, All rights reserved**

# DUBAISAT-2 Imagery: Already Available



**DUBAISAT-2 Pan-sharpened Image of Bangkok (Thailand) acquired with 41° tilt © EIAST, All rights reserved**

# 4

## Benefits & Applications of a VHR Constellation

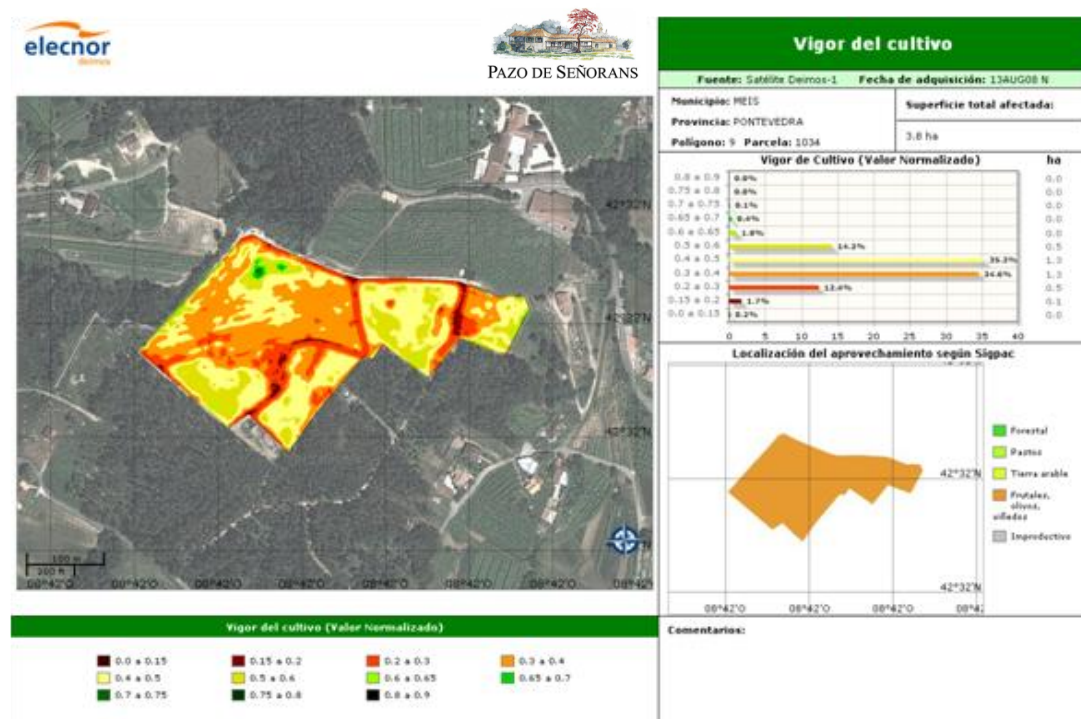


Area	Emergency			Agriculture		Forestry			Mapping			
	Fire Mapping	Flood Mapping	Man-made & natural crisis	Crop Monitoring	Crop Classification	Vegetation Status	Deforestation Monitoring	Tree Canopy extraction	Land cover mapping	Urban areas maps	Nation-wide cartography	Change Detection
Data Source	HR	HR	VHR	HR	HR	HR	HR	VHR	HR	VHR	VHR	VHR
Need for on-demand acquisitions	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Need for systematic acquisitions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Frequency of systematic acquisitions (weeks)	2	2	2	2	2	4	4	4	4	52	52	4

- ❑ Example of precision farming based on VHR multispectral data
- ❑ DEIMOS project for Albariño vineyards in Pontevedra (Spain)



Worldview-2 image



Output of the vegetation status monitoring service, August 2013

- ❑ **Example of change detection in construction works**
- ❑ DEIMOS project for Sabadell airport in Sabadell (Spain), using WV-2 imagery



Change identification and monitoring service using VHR imagery, Sabadell, 2012



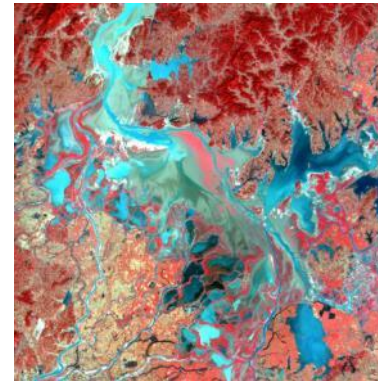


***Example of synthetic DEIMOS-2 image (75 cm pan-sharpened) of a Tornado aftermath***

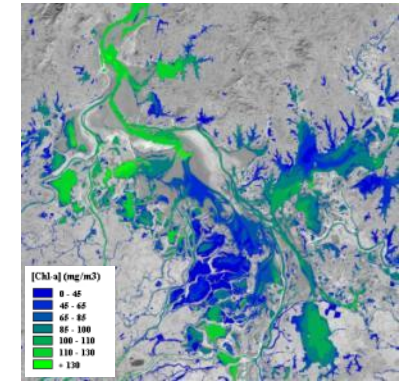
- VAP with **DEIMOS-1**- Poyang Lake (China), Nov.2010



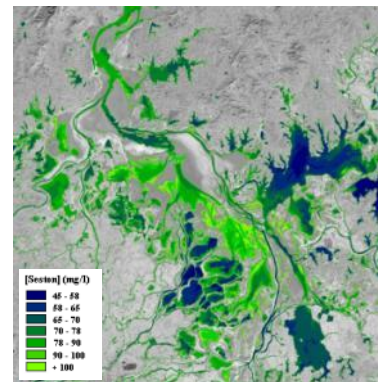
Natural color (RGB) DEIMOS-1 image



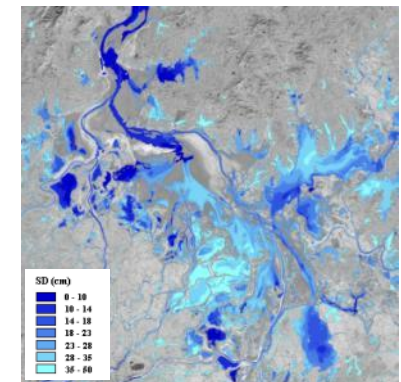
False color image (R,G,NIR)



Chlorophyll-a



Seston



Secchi Disk Transparency

# Deforestation

- DEIMOS-1, Brasil (natural color)



## □ Arizona (2011)

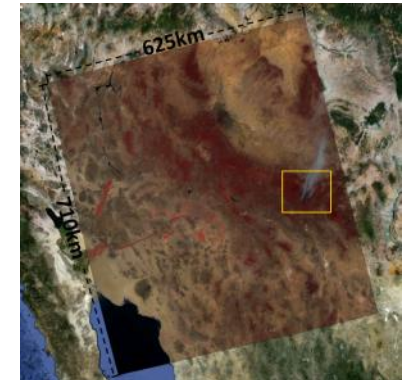
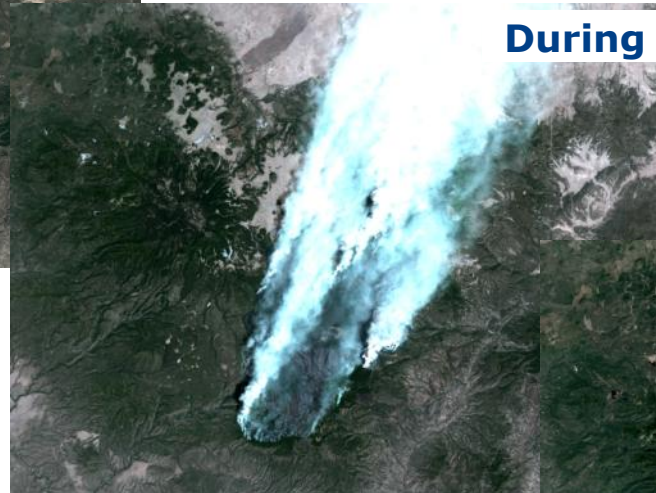
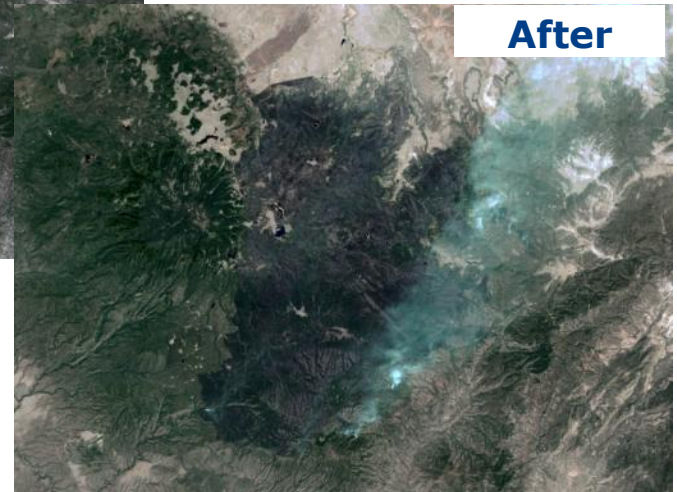
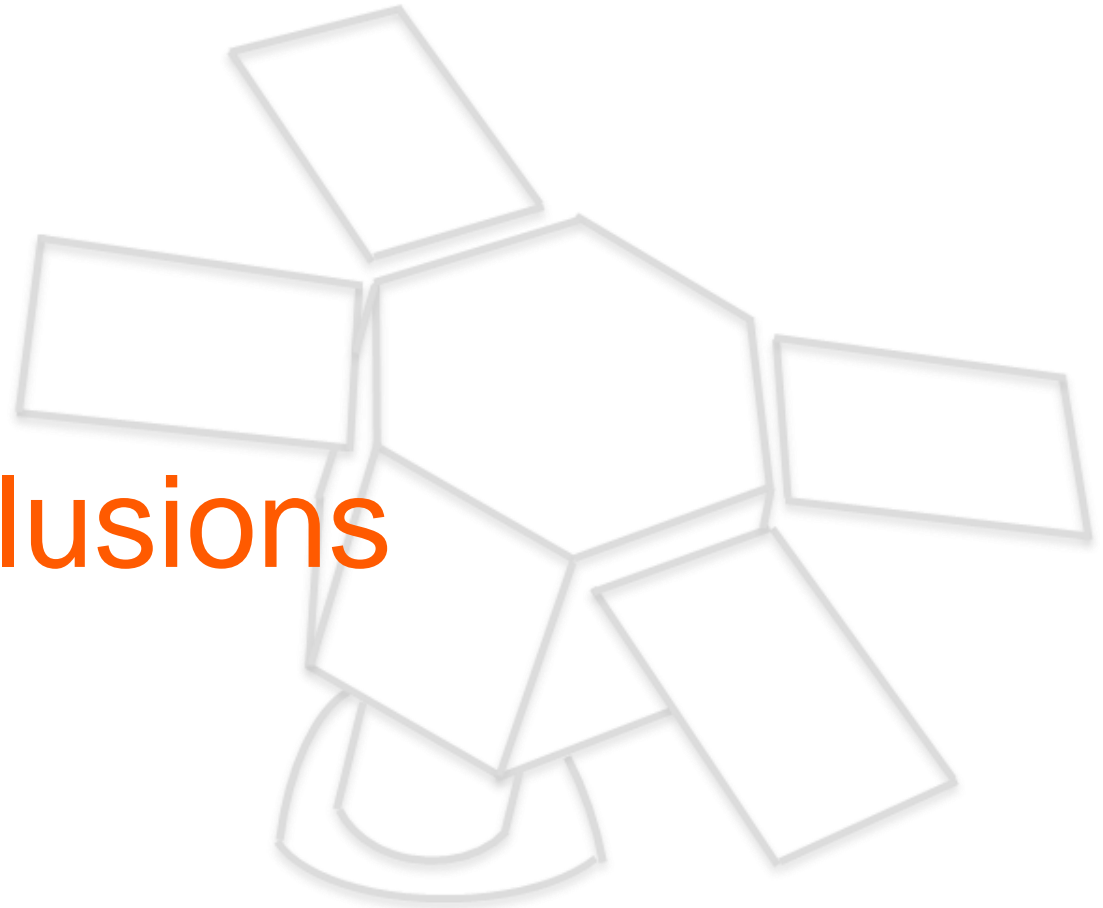


Imagen DEIMOS-1 capturada el 4 de junio, 2011



# 5

## Conclusions



# First DEIMOS-2 images coming very soon...

- ❑ DUBAISAT-2 launched in November 2013, already operational
- ❑ DEIMOS-2 launch: scheduled for June 19, 2014
- ❑ **Start of operational VHR Constellation commercial operations: end 2014**
- ❑ **Daily revisit time worldwide, with 75-cm cost-effective, dependable imagery**



**DUBAISAT-2 First Official Image, the Burj Khalifa building (Dubai, UAE) © EIAST, All rights reserved**



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