AGENCE SPATIALE ALGERIENNE

Recent achievements of the Algerian Space Program

National Space Program

the National Space Program (PSN) horizon 2020 planned to put in place space infrastructures, space systems and increase the specialized human resources in space technologies and their applications.

Among the space systems planned in the PSN (EO satellites : Alsat-2A, Alsat-2B, Alsat-1B, Alsat-3, Alsat-4, African Resources Management ARM, and the communication satellite Alcomsat-1), of which a significant number shall be partly or totally integrated in the Algerian Center for Satellite Development “CDS”.

CDS offers the technological environment for national competences to develop the future Algerian satellite systems.

CDS in the National Space Program

Satellite Development Centre has been inaugurated on Thursday 23th of Februray 2012 by his excellency ***President of Republic Abdelaziz Bouteflika***

Main Missions of the CDS

Missions:

- Development of satellites (up to 1000 kg).
- Integration of space subsystems and solar panels (class 100.000).
- Integration of Space Optics (class 100).
- Functional and environmental tests.
- Quality insurance of the AIT and test activities on space systems.
- Regroup the national experts in the space technology fields;
- Give the adequate environment to experts to develop future space sub systems and systems planned in the PSN ;
- Stimulate Algerian industries in the fields of mechanics, electronics, optics, Information Technology, …

CDS in the National Space Program

CDS comprises:

- A satellite integration hall : clean room of 27m x 11m.
- A Satellite Environmental tests building.
- Rooms and Equipments for the components storage, cleaning, inspection, assembly and integration equipment, etc.
- ALSAT-2 S-band Antenna System & Control Ground Segment
- ALSAT-1B S/X band Antenna System & Control Ground Segment

The CDS is organized in 6 Departments:

- Space Systems and Missions,
- Satellite Engineering,
- Satellites AIT,
- Environment testing,
- Quality & Process,
- Research on Space Technology.

These departments house Mechanical & thermal, electrical, electronic and optics research and development laboratories.

Satellite integration building

The satellite integration building consists of a large clean room of class 100000 , with four sub-areas dedicated to:

- Satellite integration
- Satellite Subsystems assembly
- Solar panels integration
- Sub-area for optical integration/alignment, class 100 , on a seismic block.

These areas are separated by sliding curtains.

Satellite environnemental test building

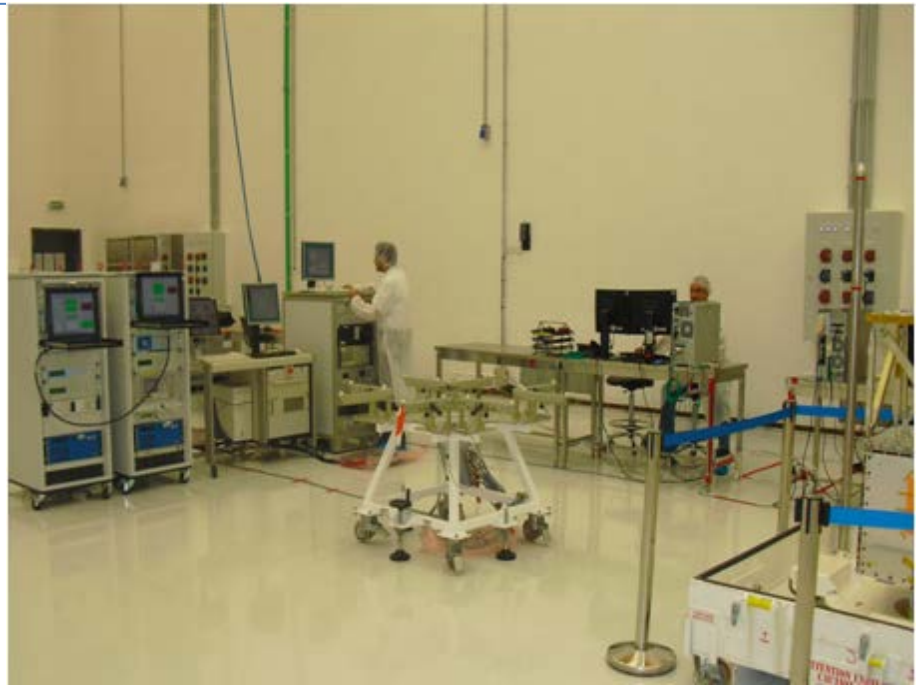
The Satellite Environmental tests building is also planned for the future. This building shall consist of:

- Anechoic chamber for EMC tests
- Thermal vacuum chamber
- Vibration test chamber
- Acoustic test chamber

The building shall also house a preparation area, a test control room, an EGSE room, a container area, a personnel Airlock and satellite equipment Airlock.

The level of cleanliness 100000.

Technological Infrastructures



Technological Infrastructures


Salle de contrôle ALSAT-2, Oran


Salle des baies CGS, Oran

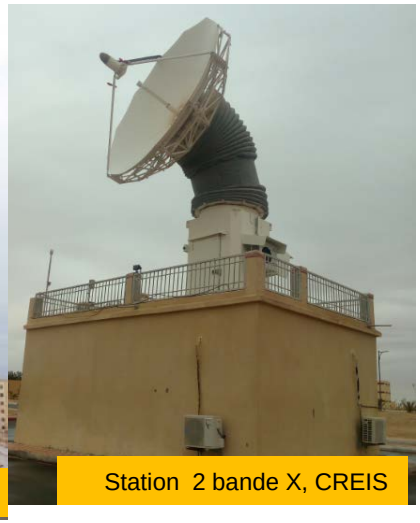

Station 1 bande X, CREIS


Centre de contrôle et de commande, Ouargla


Station bande S, Ouargla


Station bande S, Oran


Station de réception et de control Oran


Station 2 bande X, CREIS


Salle de contrôle ALSAT-1B, Oran


Antenne ALSAT-1N, Oran

Surveillance and Security in CDS

Centralised Video Surveillance Control Office for HDI

Video Surveillance Control Office for CDS

Commodities in CDS

Conference Theatre

Meeting room

Human Potential in CDS

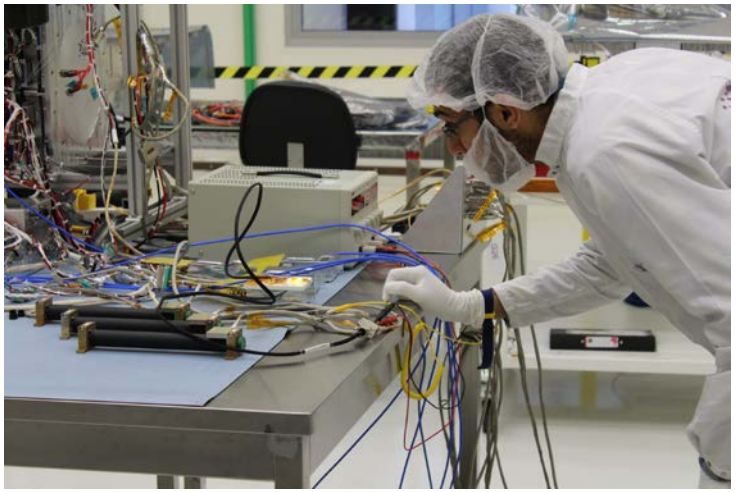
Active involvement in the manufacturing of Alsat-1B solar panels and other satellite electronic modules.



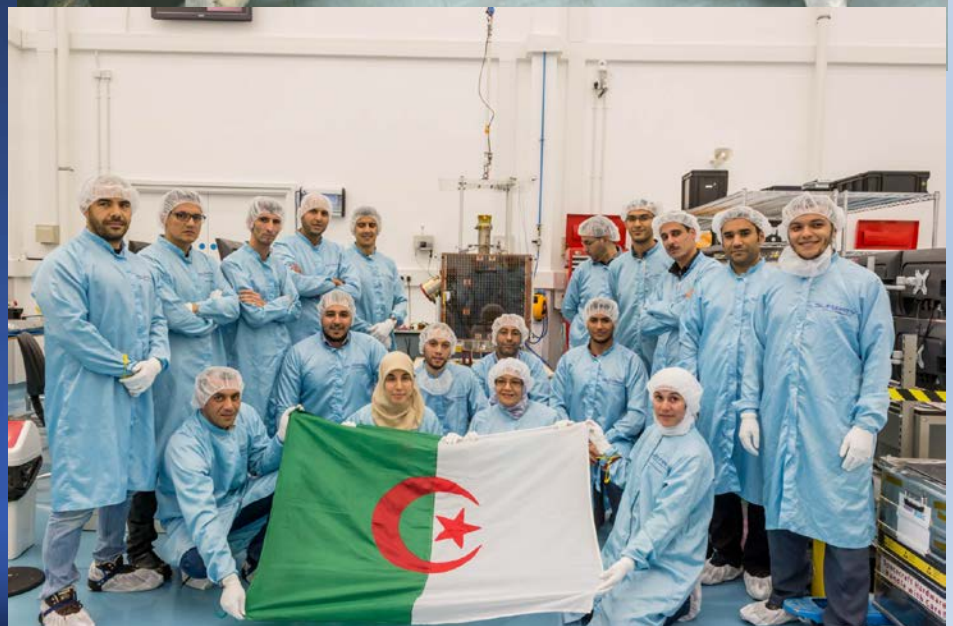



Human Potential in CDS

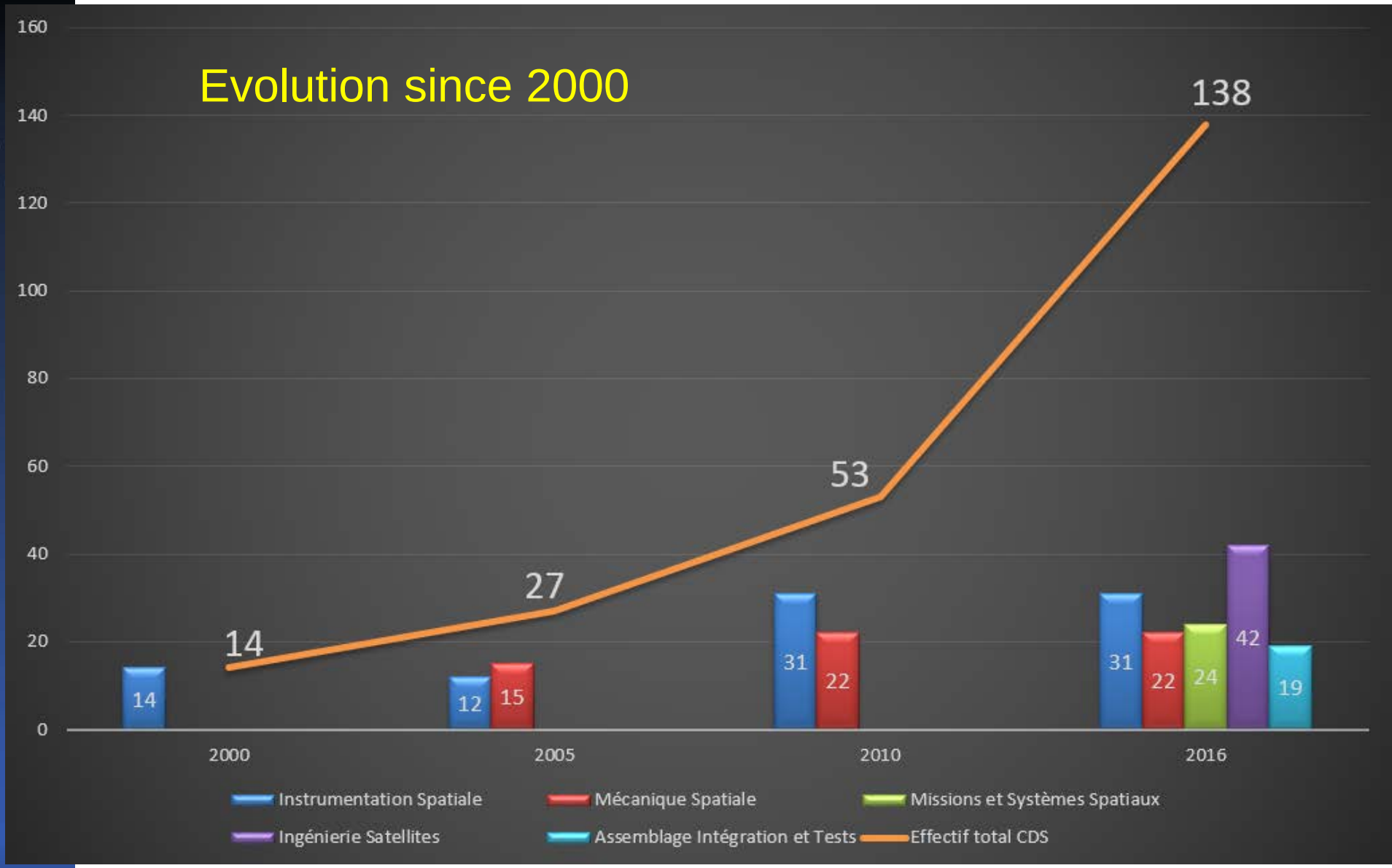
- AIT activities at CDS conducted by CDS/ASAL engineers



Human Potential in CDS



Human Potential in CDS



Engineering Activities

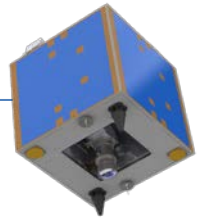
Space segments

Alsat-1B

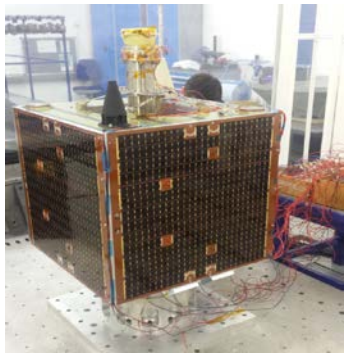
Alsat-1N

Alsat-1B

Launched on September 26th, 2016



ALSAT-1B
Medium Resolution Earth Observation Mission with Know How Technology Transfer



Introduction

- Within the framework of Algerian Space Program ‘PSN 2020’ ASAL performed a Medium Resolution EO mission with KHTT program called Alsat-1B
- Key Objectives

❑ Former Alsat-1 mission outcomes handover

❑ Fulfill National users needs of space applications

❑ Enhance national capabilities of Disaster monitonring

❑ Reinforce National skills of space technology mastering

Alsat-1B Program Objectives

- Know how technology transfer
  - Training 18 Algerian engineers
  - Algerian-led program activities
  - Spacecraft AIT performed by Algerian engineers at CDS

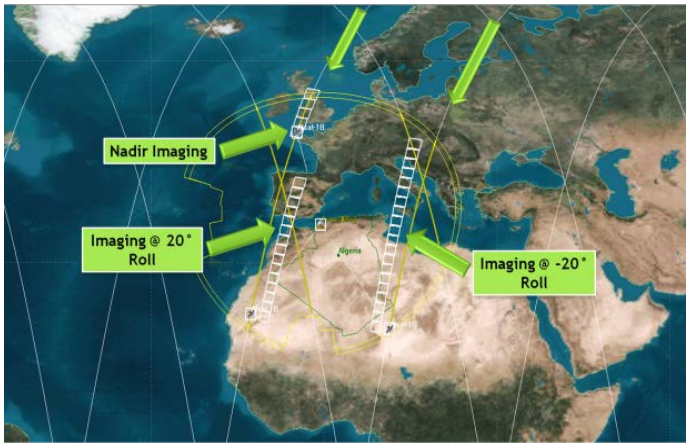
- Academic Program
  - Surrey Space Centre of UniS (UK)
  - 18 Master & PhD ongoing in Space Technology

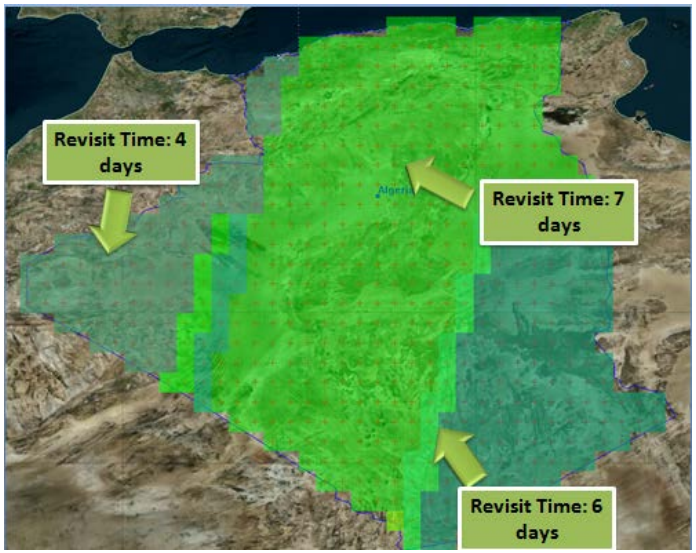
- **Alsat-1N** Cubesat Projet under an **ASAL** and **UKSA** Framework
- MicroSat Propulsion system development with SSTL support
  - Design by Algerian engineers
  - Manufacturing and test by Algerian engineers

ALSAT-1B Mission

Alsat-1B designed to provide :

- ✓ Imaging flexibiliy of any point
- ✓ Nadir and off pointing imaging of any point over Algeria and worldwide
- ✓ A Revisit time of any algerian target optimised within 7 days maximum





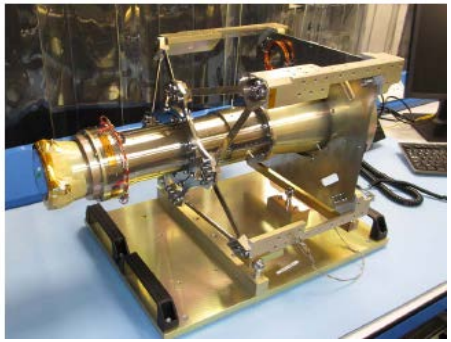
ALSAT-1B Mission

ALSAT-1B Mission Characteristics

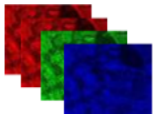
Mission and system	
Orbit	700km, heliosynchronous, LTDN 10:30
Lifetime (minimum)	5 years
Mission Product characteristics	
Ground Smapling Distance	12m Panchromatic
	24m Multispectral Nominal (Blue, Green, Red & NIR) 12m Multispectral Enhanced
Swath	150 km
Signal to noise ratio (SNR)	PAN ≥ 100 , MS ≥ 110
Modulation Transfert Function (MTF)	PAN ≥ 0.1, MS ≥ 0.3
Mosaïcking	140km x 140 (2100km), PAN, MS, PAN + MS
Imaging Capability	40 scenes per day (standard mode)

ALSAT-1B Paylod

- **ALITE** : Algerian Imager Telescope
- Aluminium &Titanium barrel with lenses
- Focal plan assembly with 5 CCD



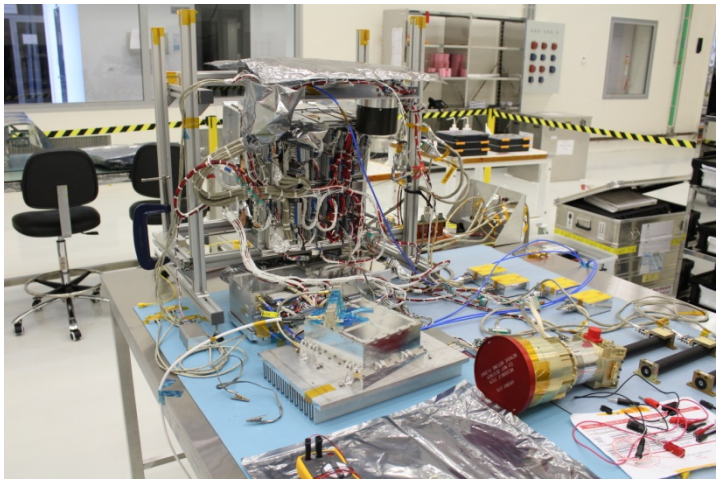
Panchromatique 12 m GSD

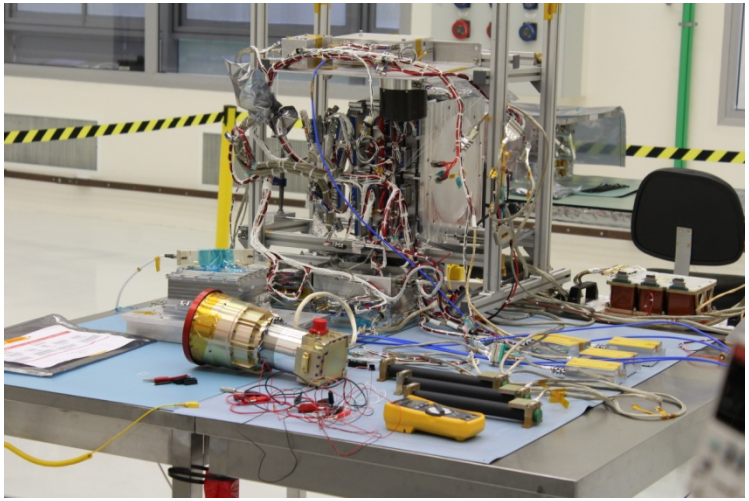


Multi-spectrale 24 m GSD (12m GSD enhanced) "B,G,R,NIR"

Alsat-1B AIT Set up at ASAL-CDS

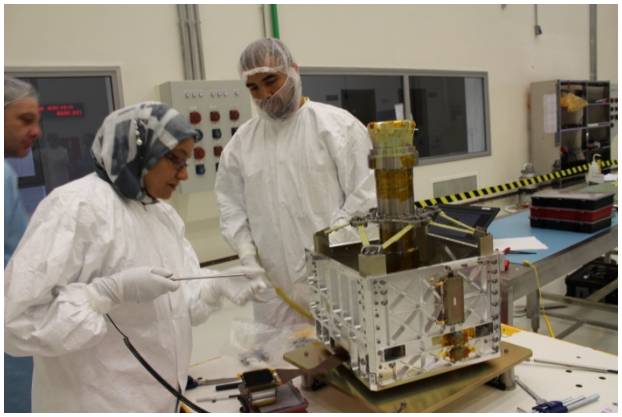
- Nominal AIT set up deployment by ASAL engineers preparing the AIT phase at CDS-ASAL

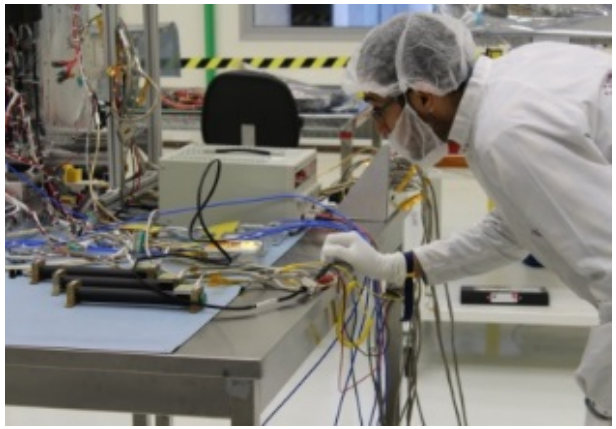




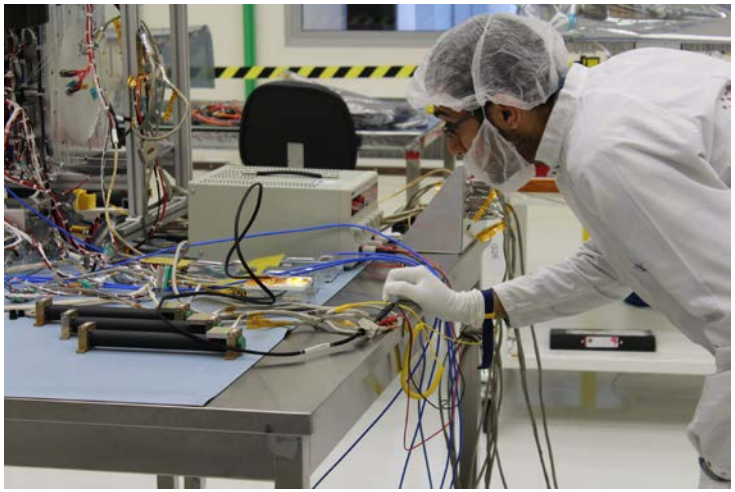
Alsat-1B integration at ASAL-CDS (Oran)

- Within KHTT frame work integration and testing activities led-algerian activities at CDS from September 2015 to February 2016



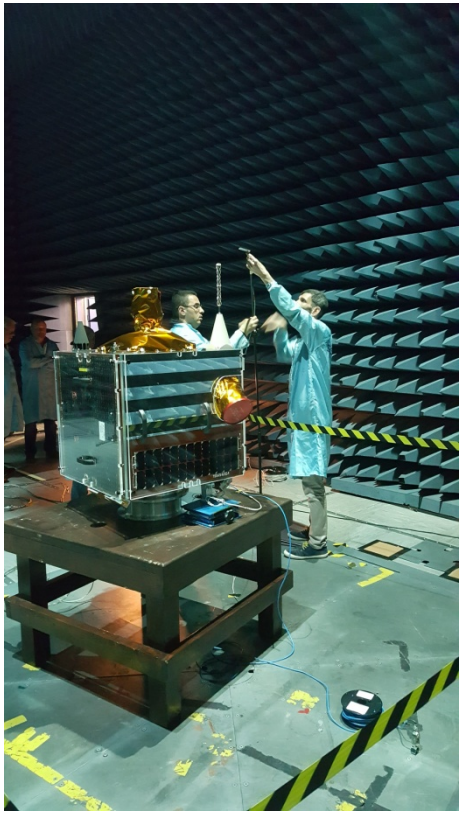


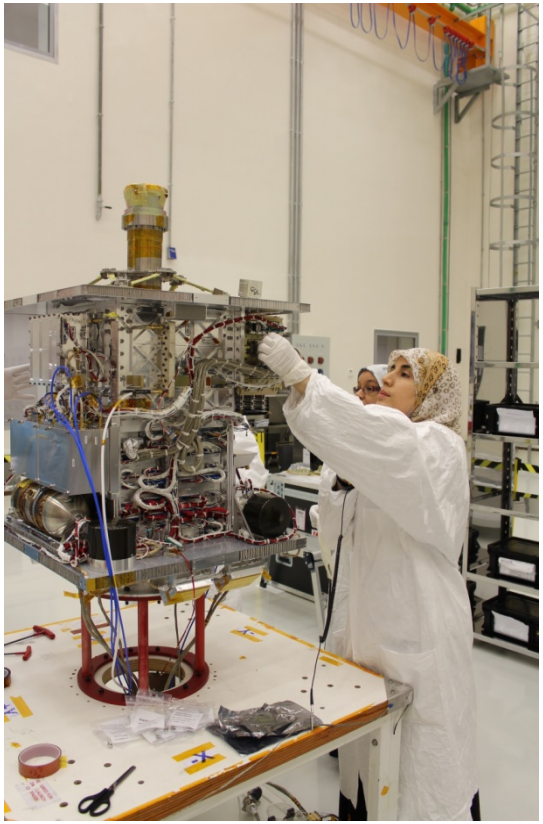
Alsat-1B integration at ASAL-CDS (Oran)

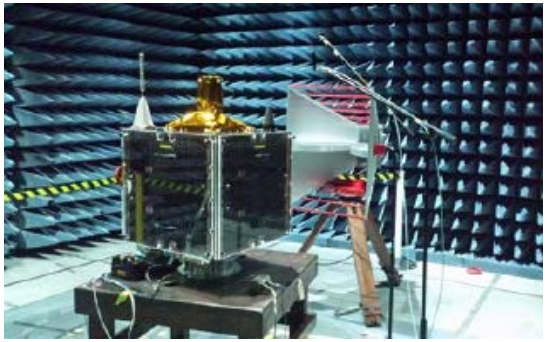


ALSAT-1B EVT Testing with ASAL staff

- Effective ASAL engineers involvment in spacecraft environnmen testing

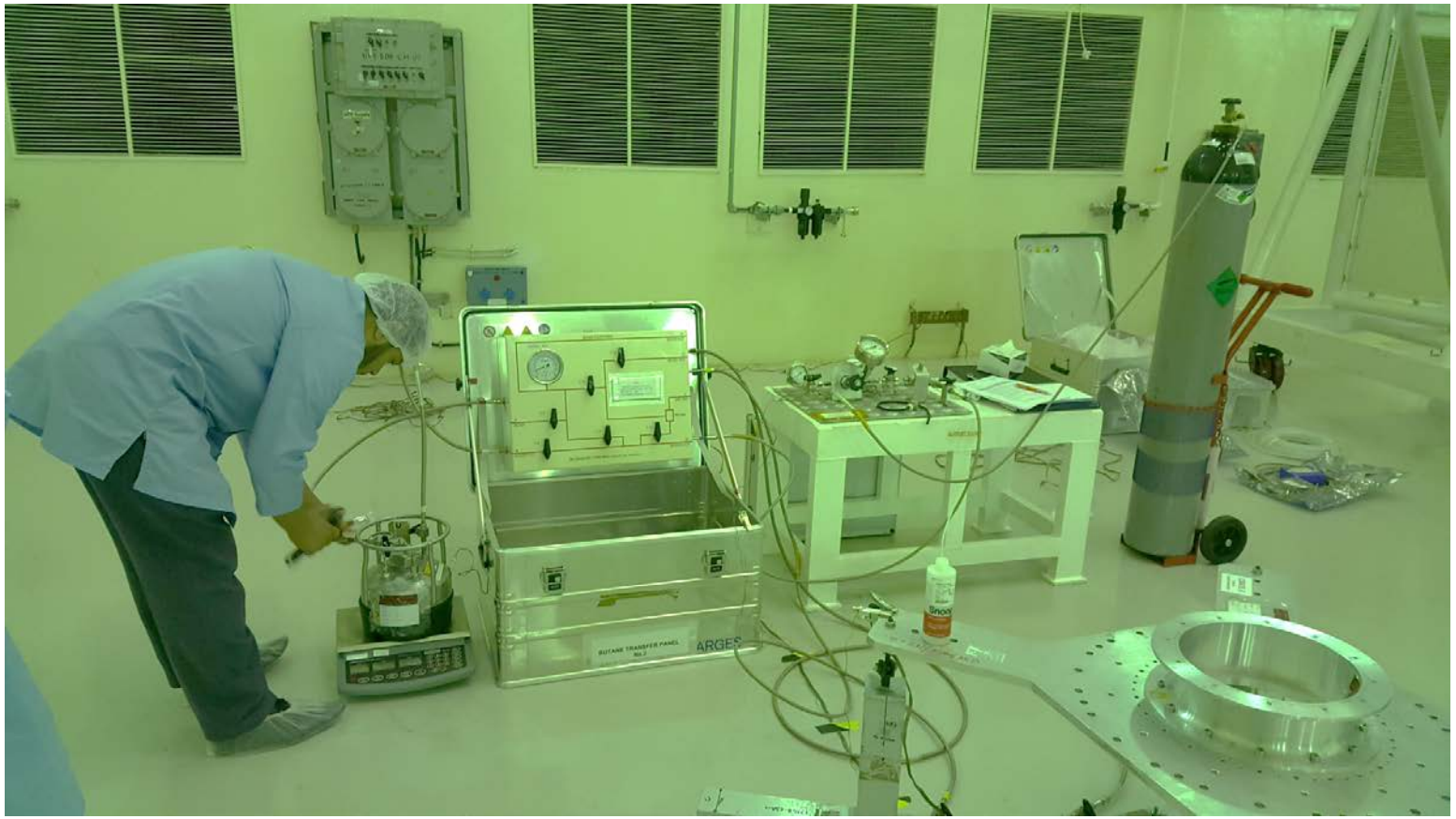






Alsat-1B Launch site activities

- Tank fuelling activities at launch site

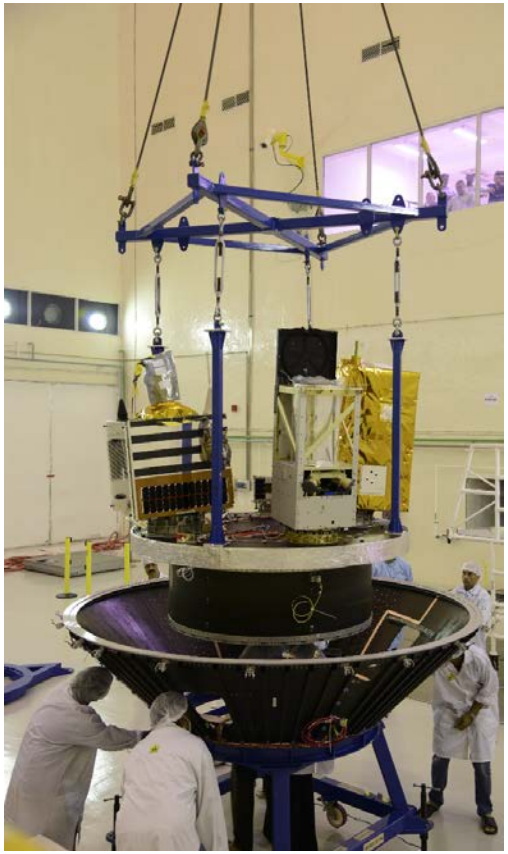


Alsat-1B Launch site activities

- Satellite integrated to Multi-Satellite Adaptor at launch site

Alsat-1B Launch site activities

- Launch vehicle fairing closure preparation at launch site



Alsat-1B Project Main Phases

Mission conception & Definition

Sub systems manufacturing

Assembly & Integration

System End to End Testing

EVT testing

Launch

LEOP & routine operation

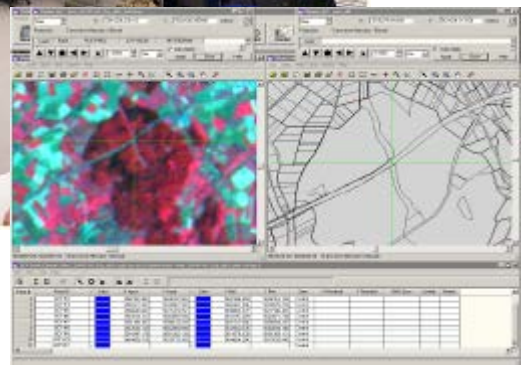
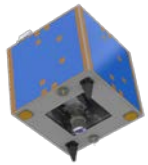


Image Product available to end user



Alsat-1B Ground Segment Facilities at CDS

First Alsat-1B images

- Bradenton / Florida (USA) and its surroundings

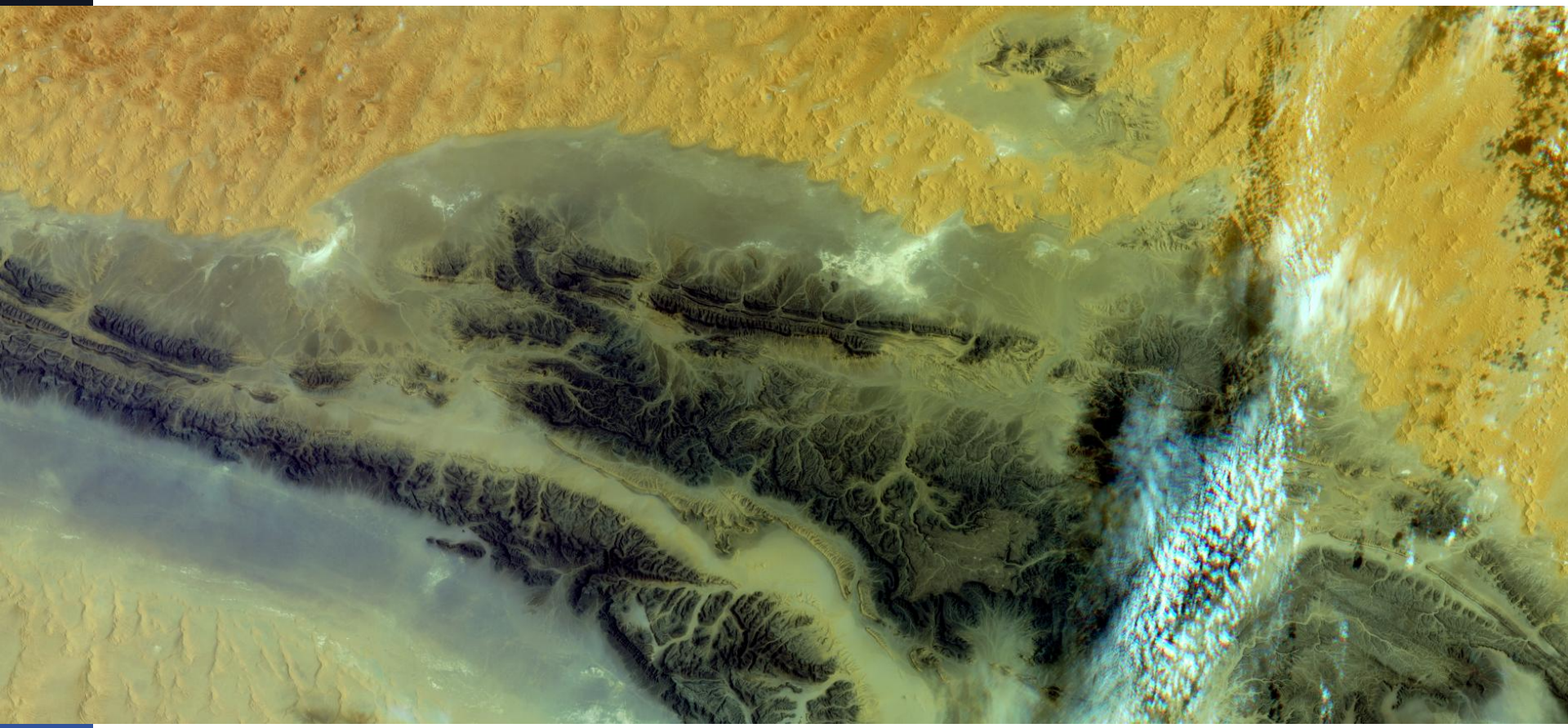
First Alsat-1B images

- Sarasota bay / Florida (USA) and its surroundings

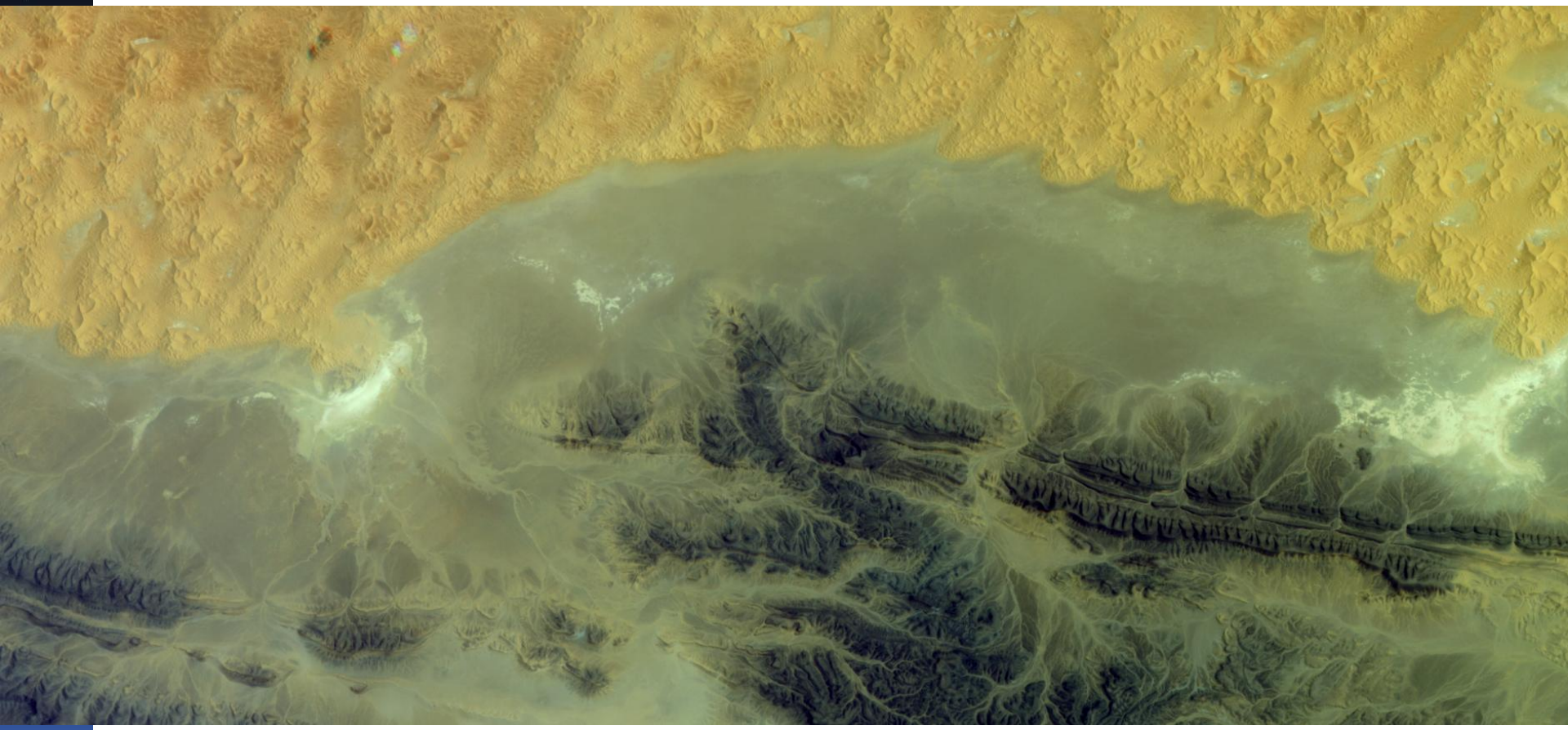
First Alsat-1B images

- Tampa / Florida (USA) and its surroundings

Monts de l’Ougarta « Bechar » (12- 05- 2017)

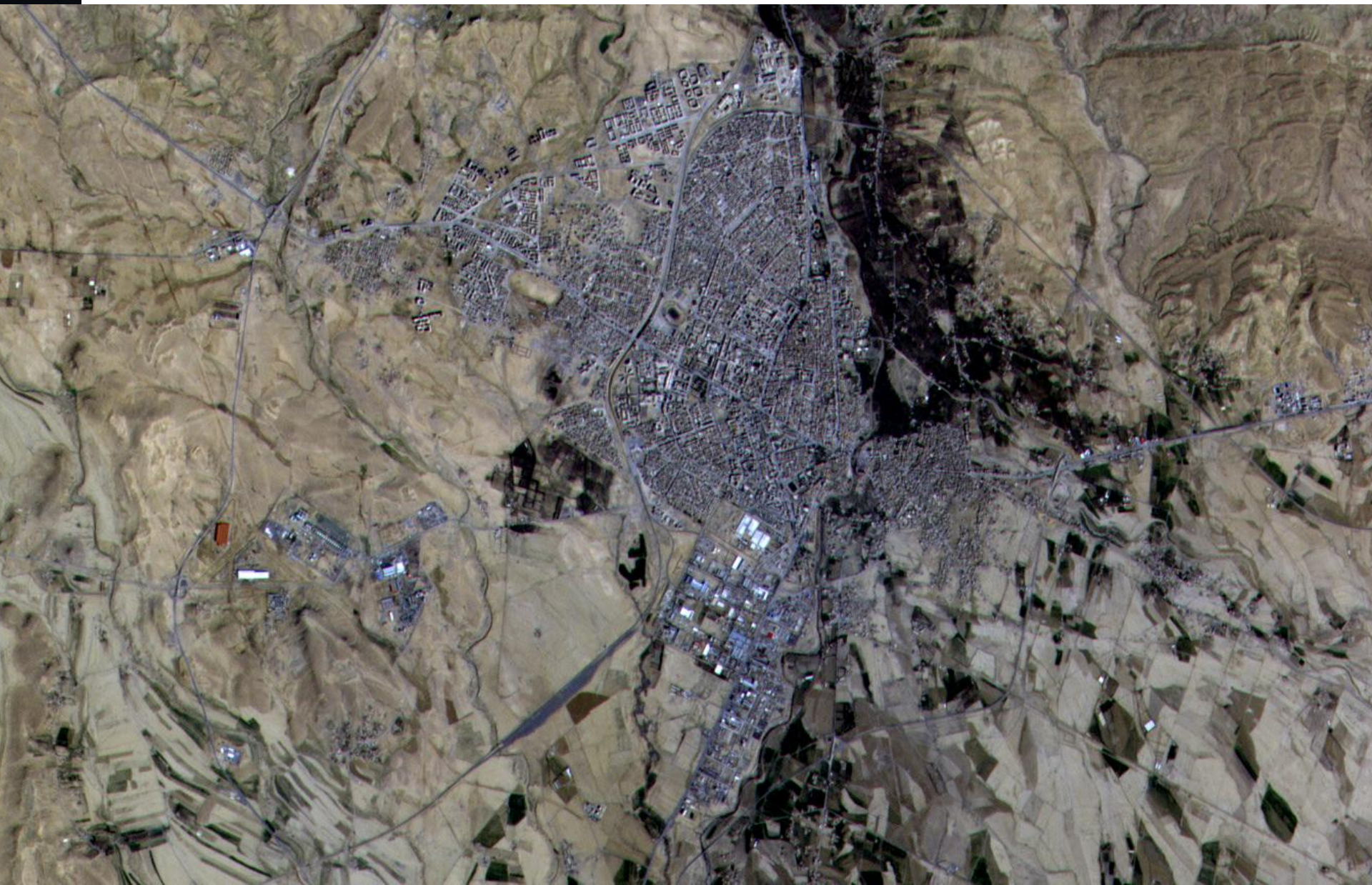


Monts de l’Ougarta « Bechar » (12- 05- 2017)



Barrage du Ksob (Wilaya de M’Sila) (02- 02- 2017)

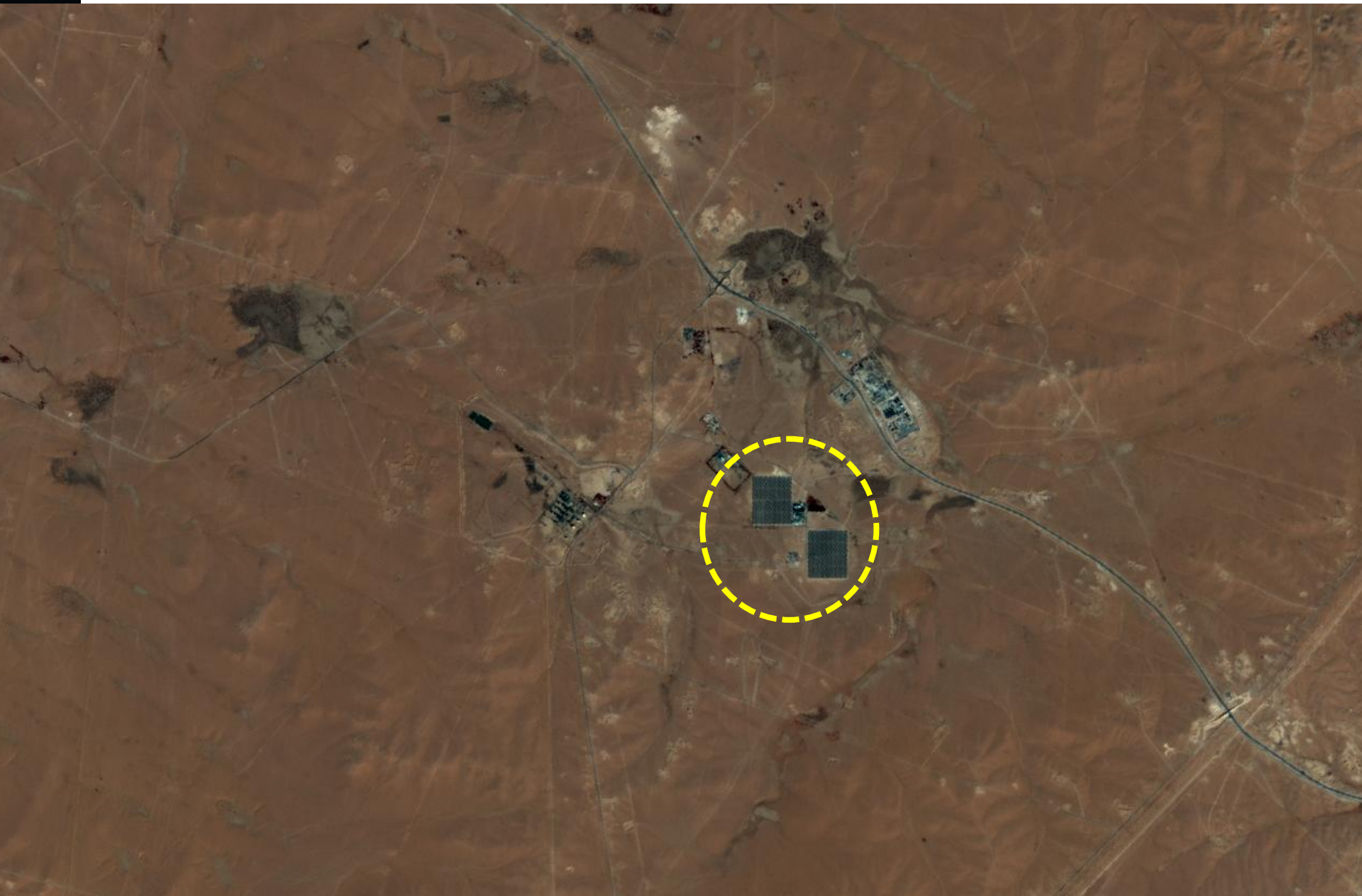
Ville de M’Sila (02- 02- 2017)



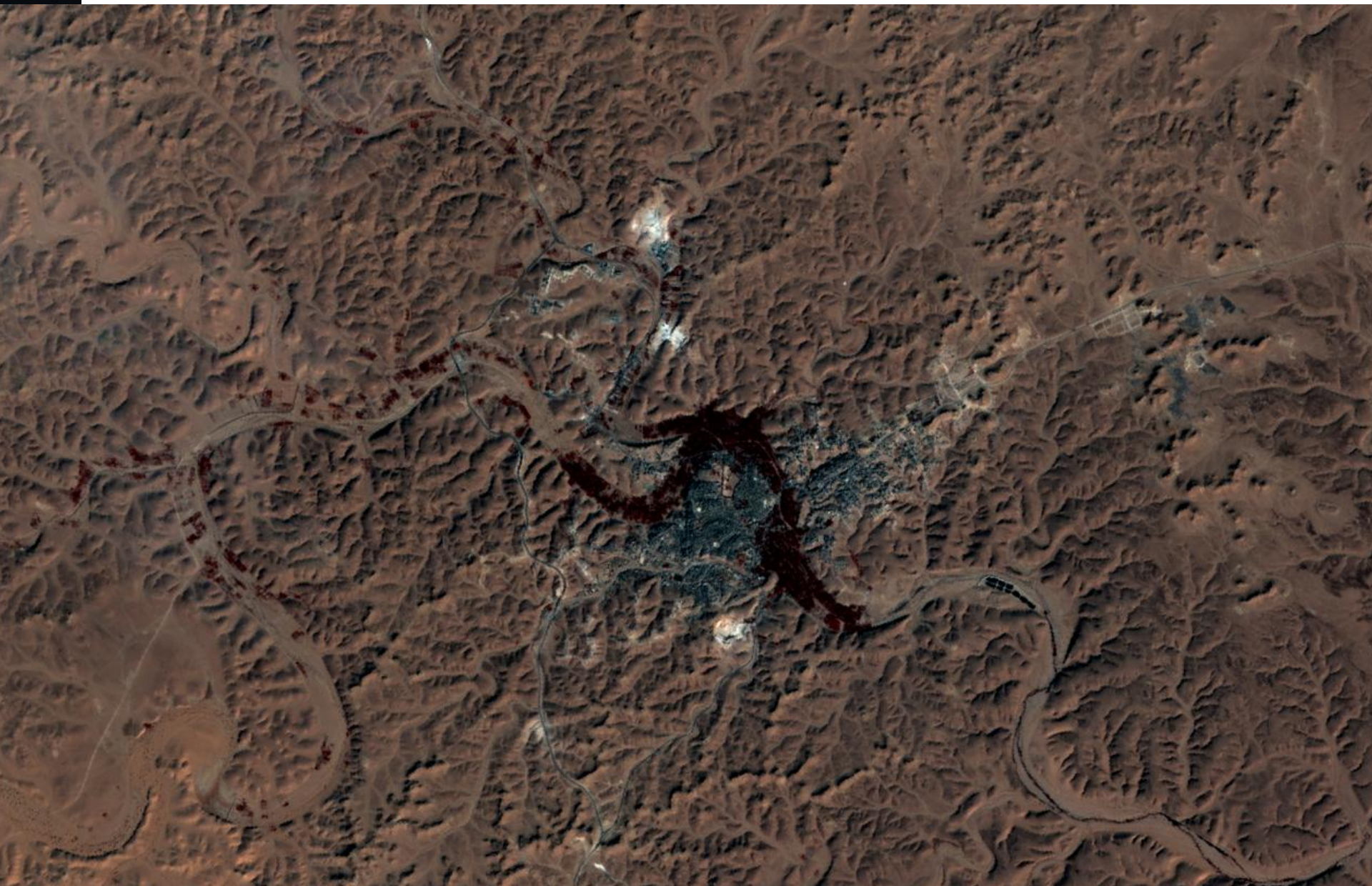
Ville de Bousaada (02- 02- 2017)

Hassi R’mel (02- 02- 2017)

Centrale solaire électrique mixte de Hassi R’mel (02- 02- 2017)



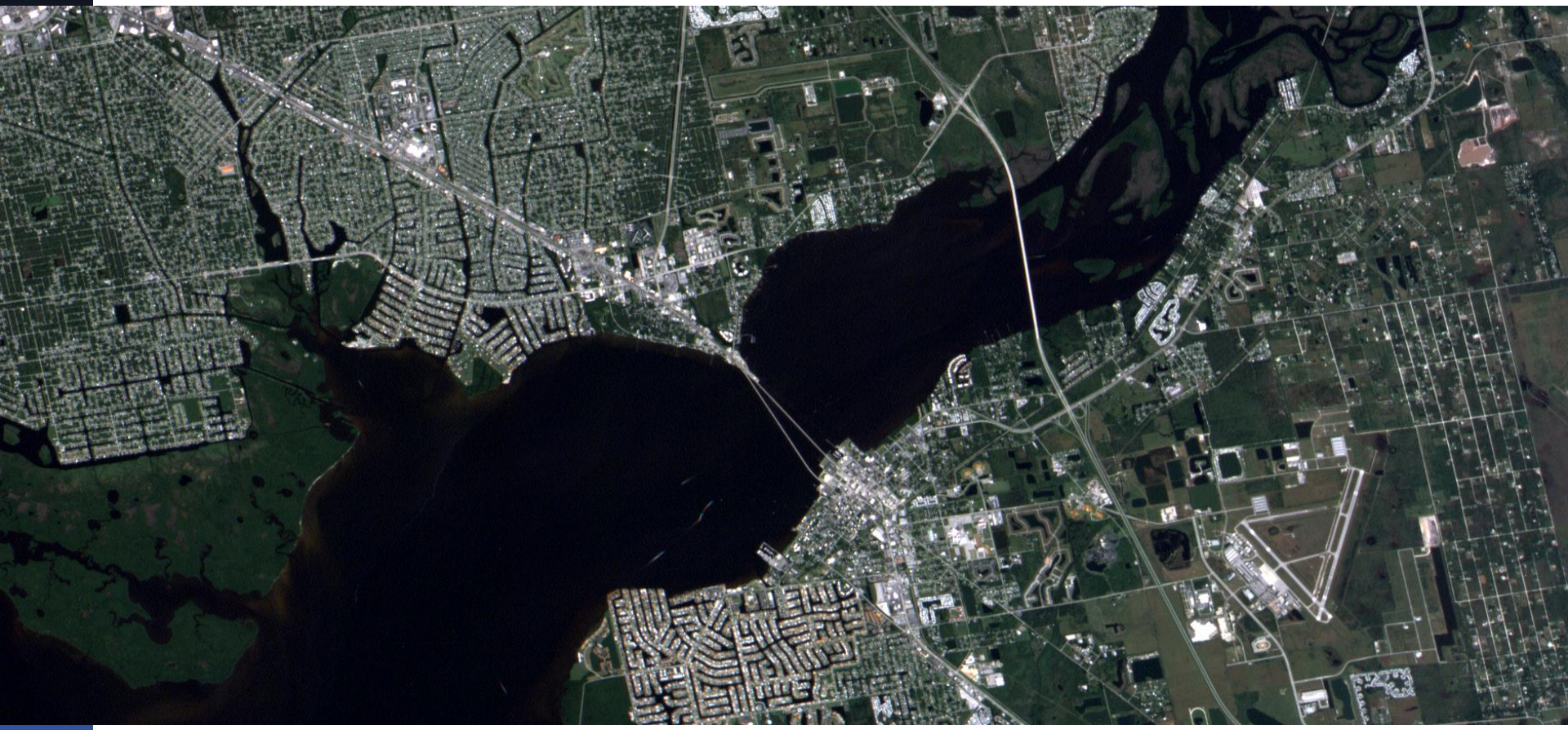
Berriane (02- 02- 2017)



Dubai (EAU) (17- 04-2017)

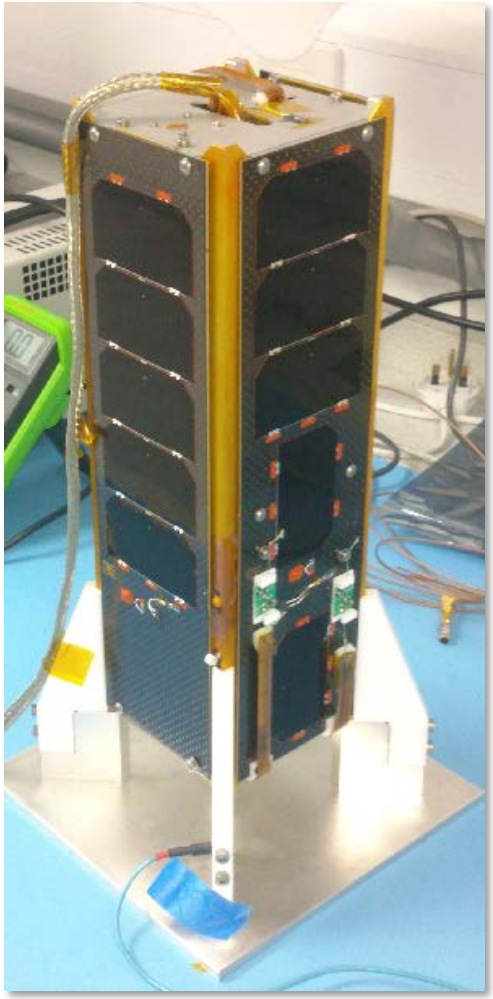
Dubai (EAU) (17- 04-2017)

Port Charlotte (Cleveland / Floride –USA) Octobre 2016



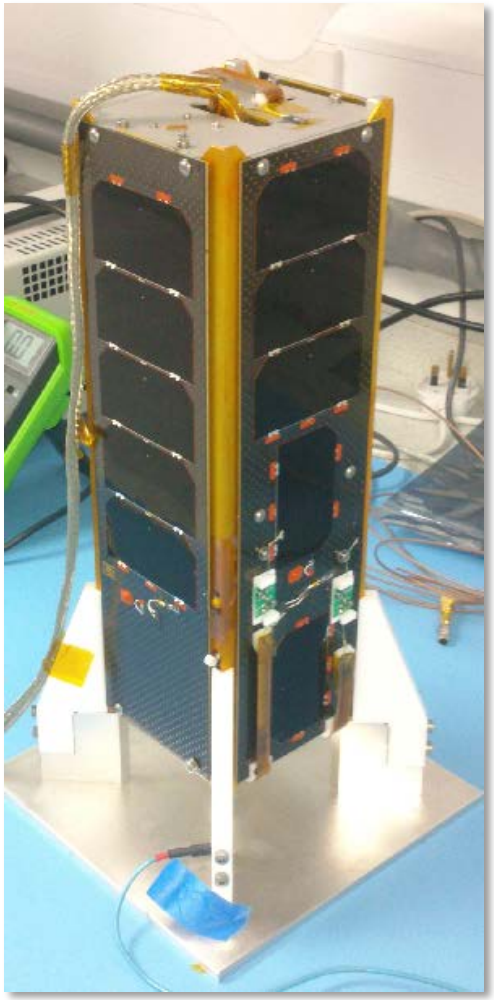
Delta de l’Ebre « Espagne » (Octobre - 2016)

ALSAT-1N



ALSAT Nano Program - ALSAT-1N nano-satellite

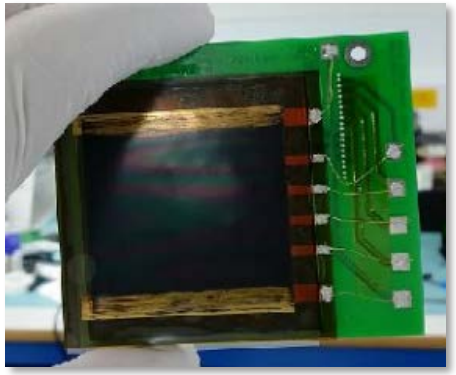
- Joint Cubesat Mission development in cooperation with UK Sapce Agency (UKSA) and Surrey Space Centre (SSC) University of Surrey,
- Involving the training of 3 PhDs et 2 MSc's from ASAL engineers.



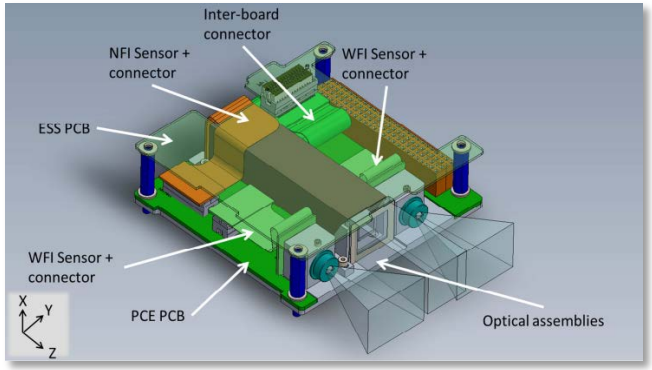
ALSAT-1N Specifications

- Form factor : Cubesat 3U,
- Dimensions : 100x100x340 mm,
- Mass : 3,470 kg,
- Orbit : Sun-synchronous,
- Altitude : ~670 Km,
- Inclination : 98,16°
- Communication : VHF uplink / UHF downlink,
- Attitude control : 3 axis magnetorquer and 1 reaction wheel (Y-Thomson).

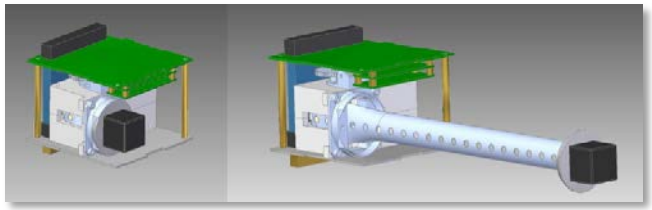
- 3 scientific and technology demonstration payloads :
  - Thin Film Solar Cells (TFSC): 4 solar cells
  - Compact CMOS Camera Demonstrator 2G (C3D2): including 3 cameras , 2 wide field imagers and 1 Narrow Field Imager.
  - Astrpotube Boom™ : Deployable and retractable boom incorporating a RADFTET and a magnetometer.



TFSC

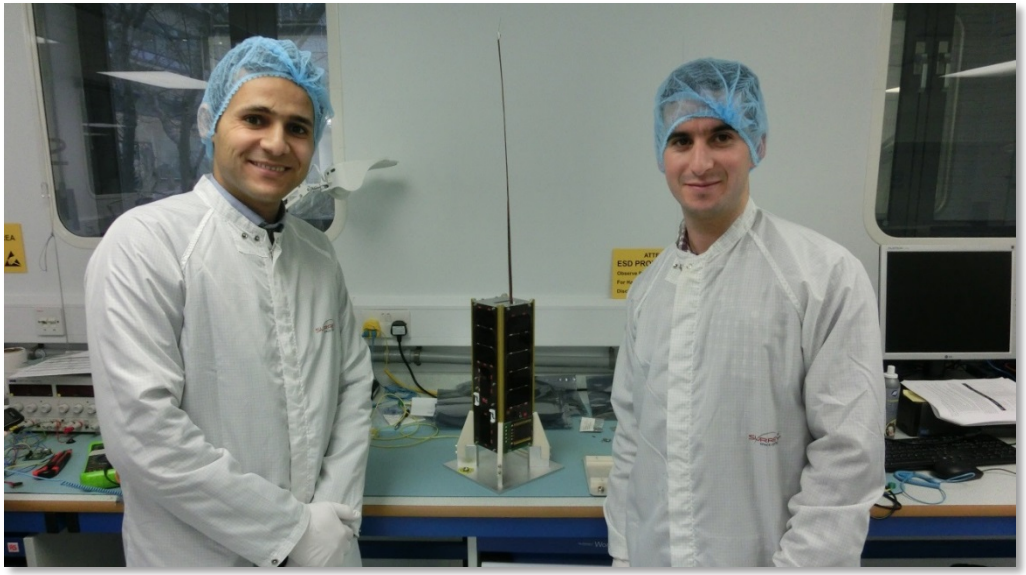


C3D2

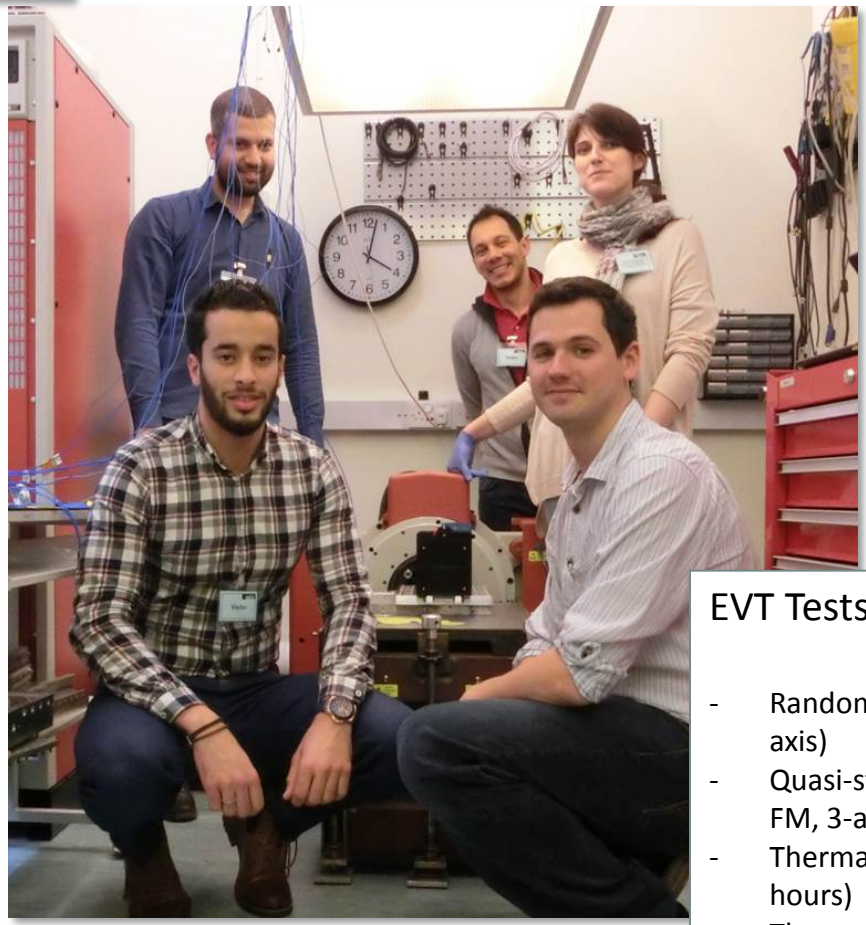


AstroTube ™ Boom

Alsat 1N – Assembly Integration and Tests

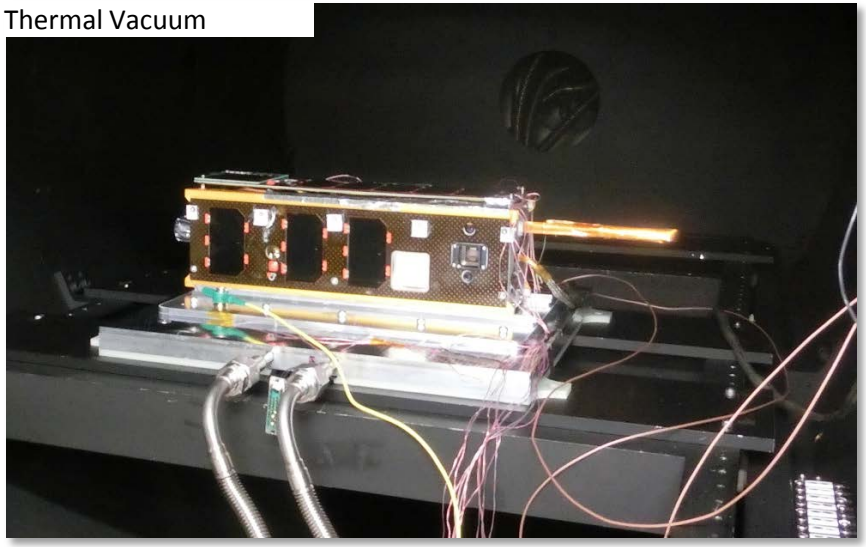


Alsat-1N: Environnemental Tests



Environment Tests Team

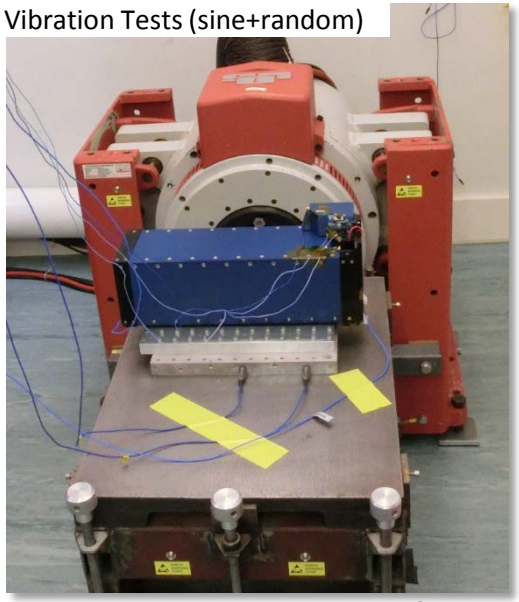
Thermal Vacuum



EVT Tests Summary

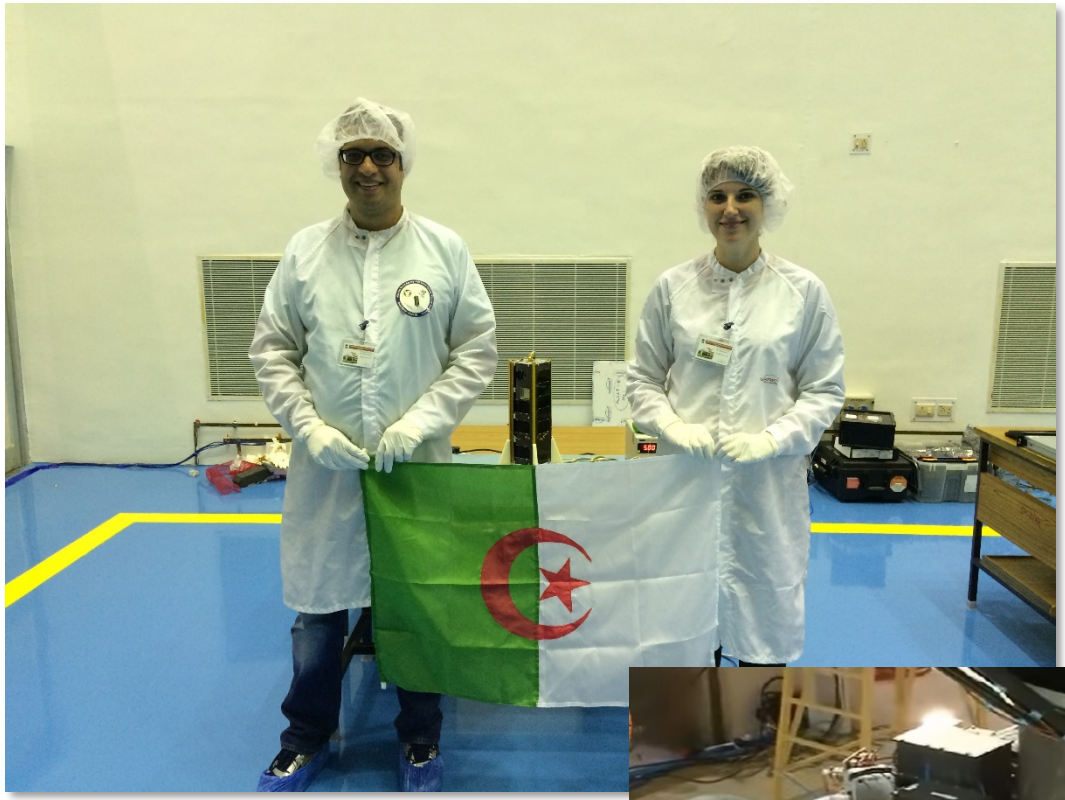
- Random vibe (PFM + FM, 3-axis)
- Quasi-static/Sine vibe (PFM + FM, 3-axis)
- Thermal bake out (+50° C, 24 hours)
- Thermal Vacuum (-20° C to +50° C, 2 cycles)
- Ambient Thermal (0° C to +45° C, 10 cycles)
- Shock testing (SQM, 70g 2ms, 2x 3-axis)

Vibration Tests (sine+random)

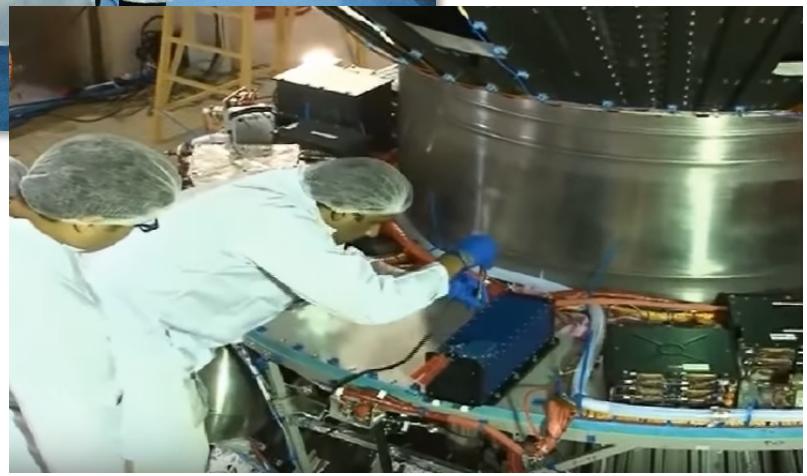


Launch Campaign

- FRR
- Visual check
- Power-up & Functional Tests
- Stow/ Deploy Test
- Startup Test
- Battery Charging
- Stowing
- LRR
- Launcher Coupling

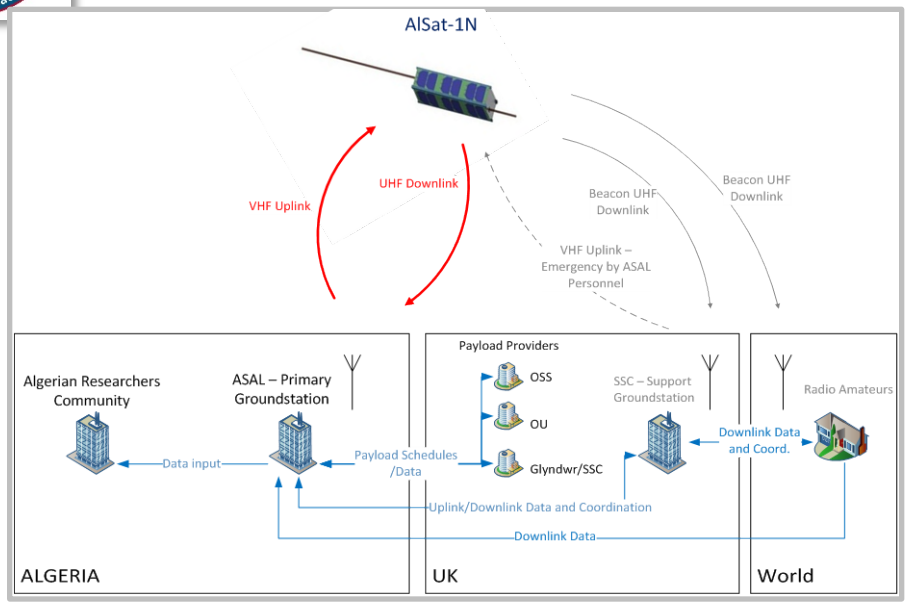


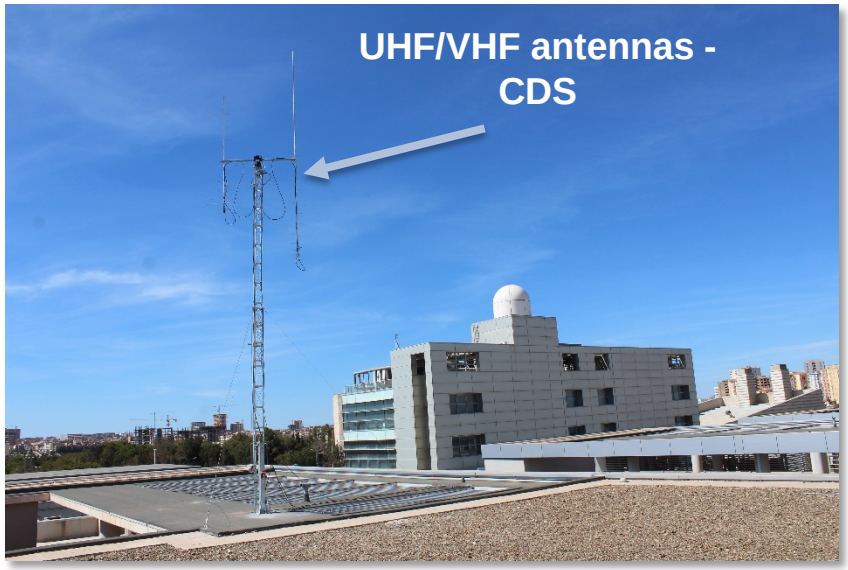
Alsat 1N, Ready for Launch

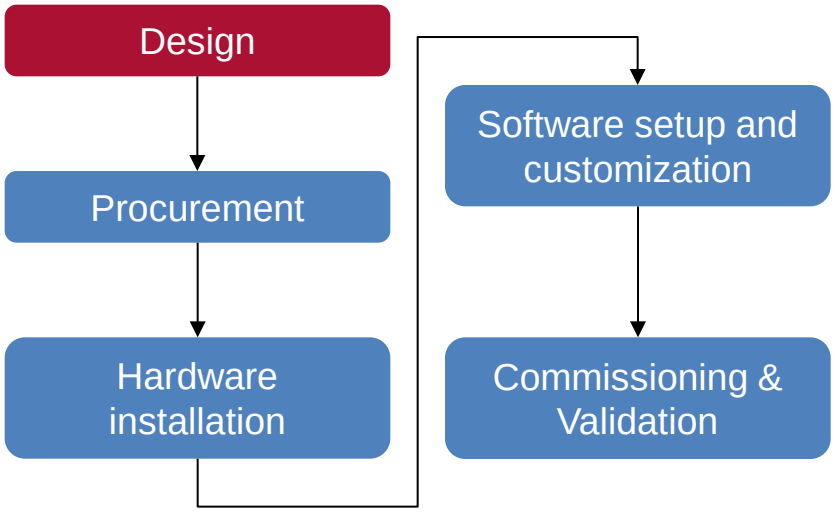


Alsat 1N fitting on launcher

Alsat 1N Ground Segment and Satellite Control Operations

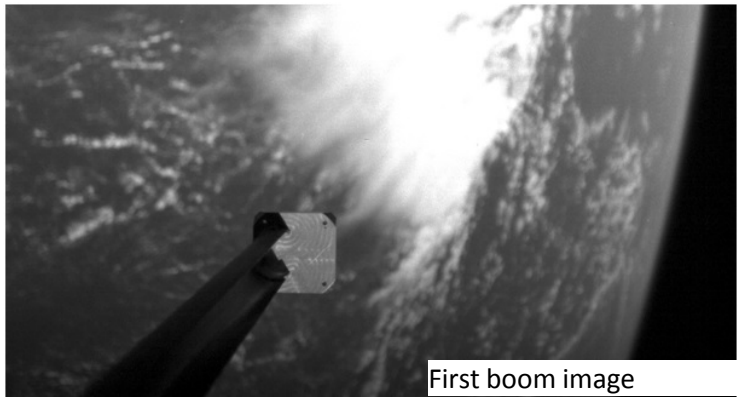






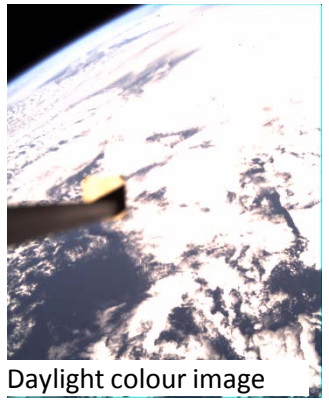
Ground Segment Development Process

Alsat 1N - Images



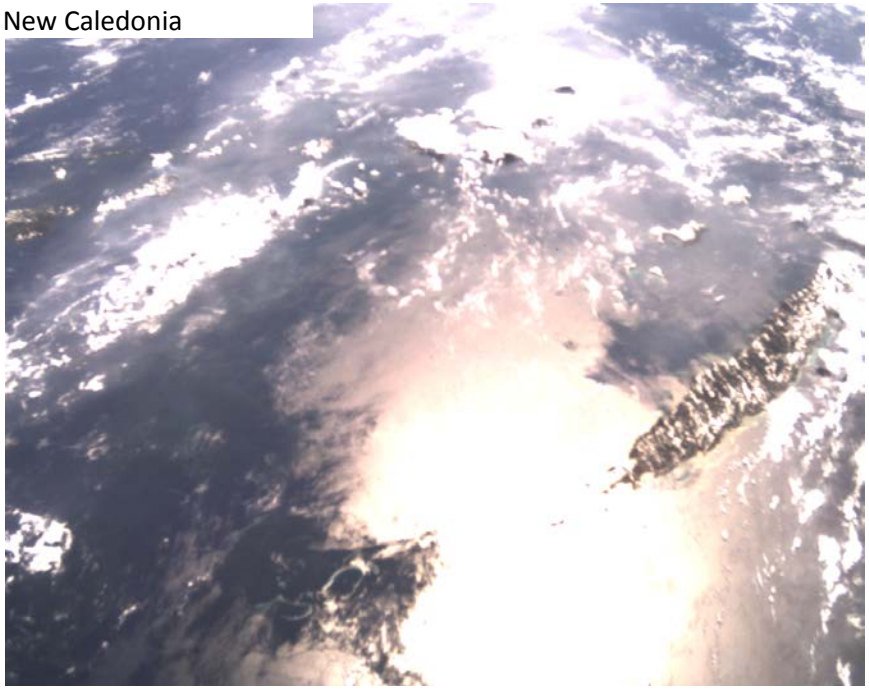
First boom image

First colour image - sunset

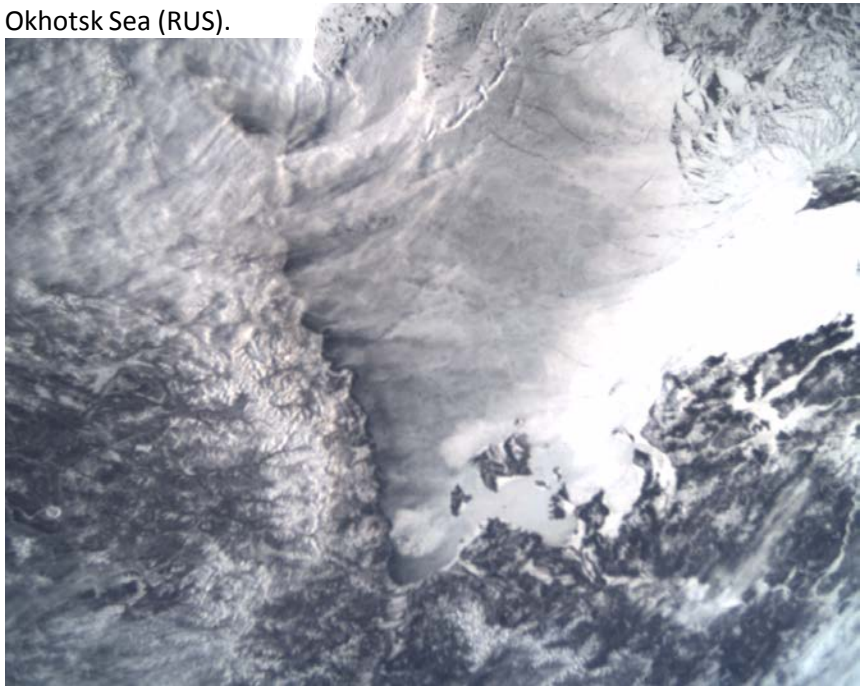


Daylight colour image

New Caledonia

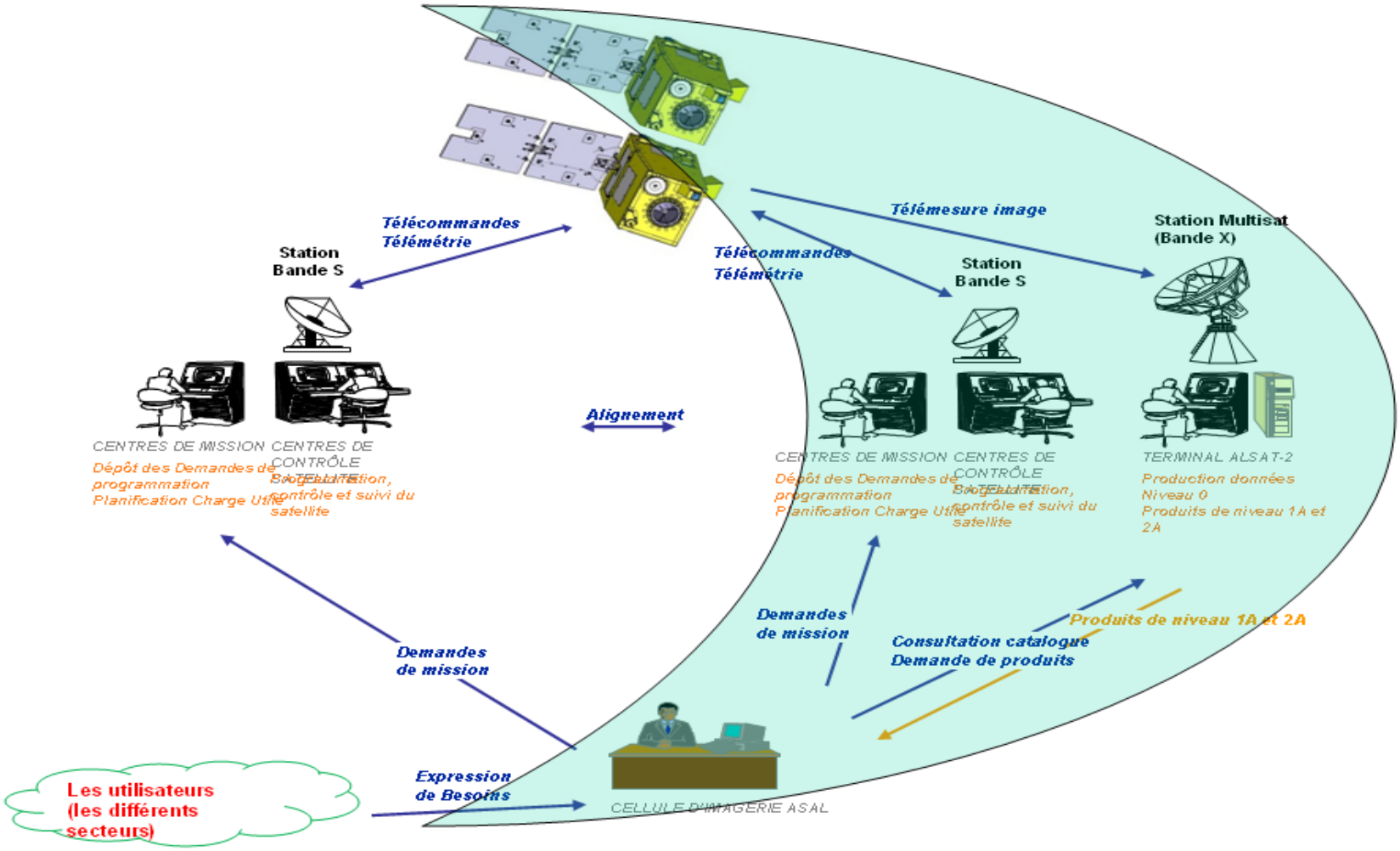


Okhotsk Sea (RUS).



ALSAT-2B
High Resolution Earth Observation Mission

System Description



Grounds Segments Description


Salle de contrôle,

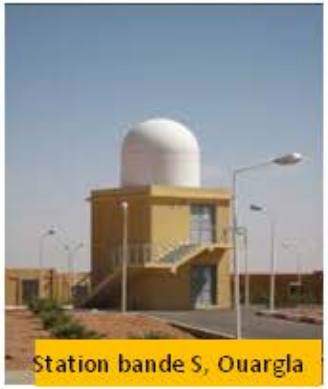

Salle des baies CGS, Oran


Station 1 bande X, CREIS


Centre de contrôle et de commande, Ouargla


Salle du simulateur satellite BVS

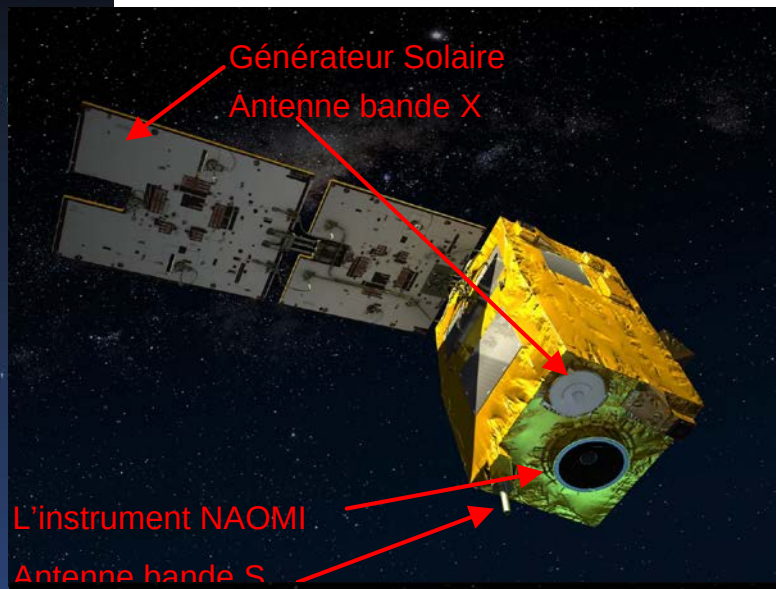

Station 2 bande X, CREIS

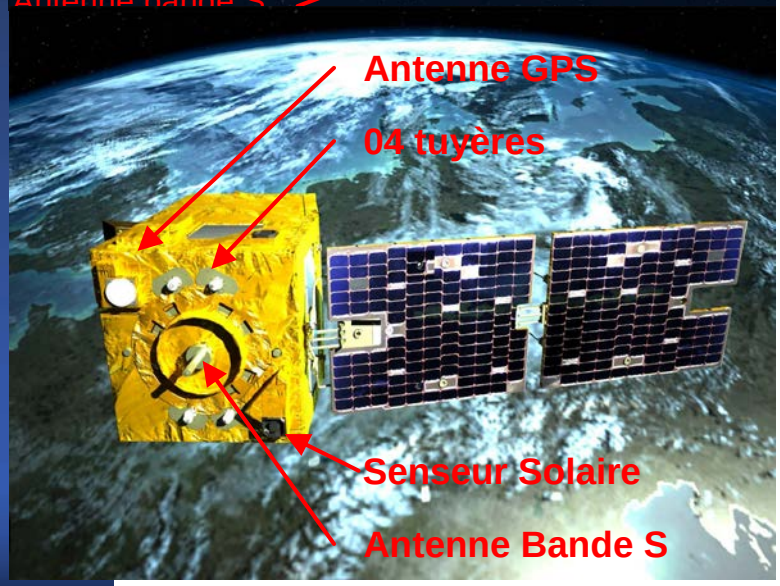

Station bande S, Ouargla


Station bande S, Oran


Antenne ALSAT-1N, Oran

Space Segment Description

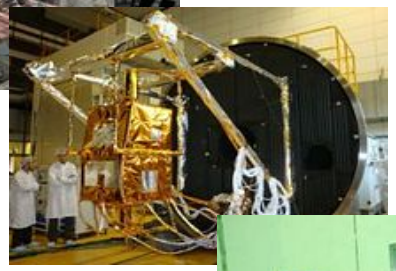




- Alsat-2 spacecraft is composed of high resolution optical payload including SiC Korsch telescope with high performance CCD detector incorporated inside a Front End Electronic.
- Payload services: Mass memory, High rate telemetry module TMHD and GPS function.
- Service module based on the Myriade platform architecture contains ADCS module for fine pointing and targeting, and standard spacecraft modules (power, thermal and communication)

Alsat-2 Development steps

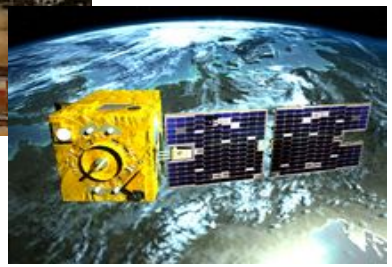
Assembly Integration & Tests



Environnemental tests

Launch campaign

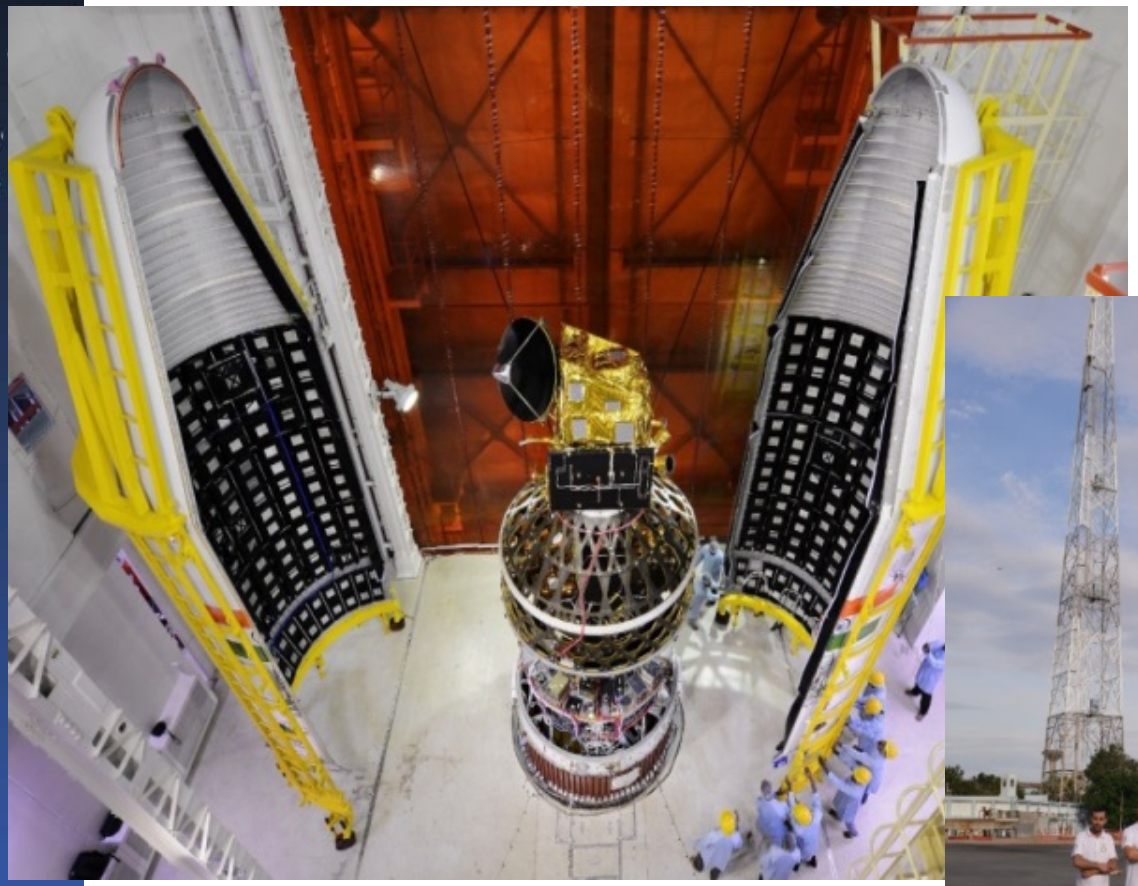
Launch LEOP & IOT



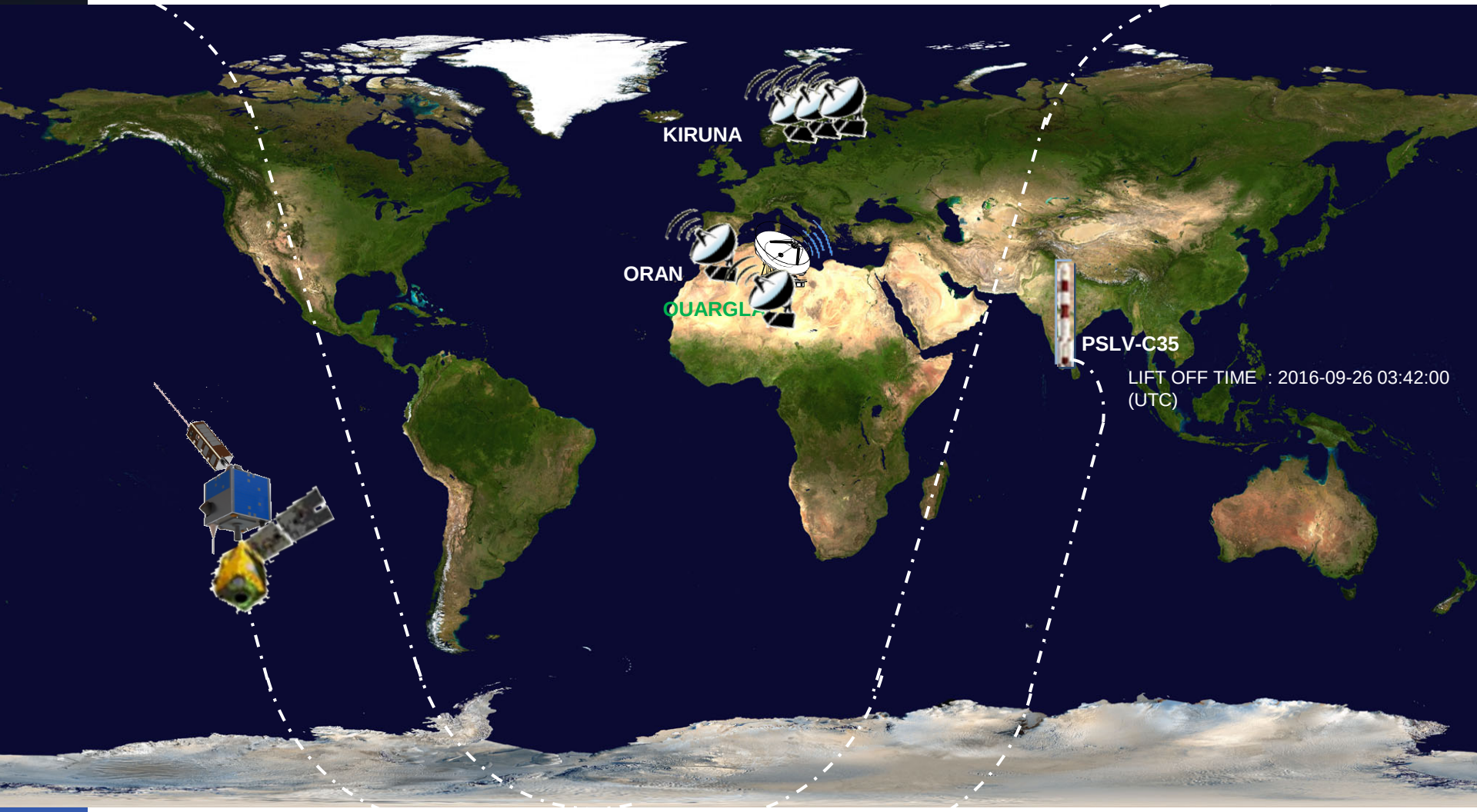
Orbit life

Alsat-2B launch campaign team (SP2-B building)

The three Alsat Spacecraft and team at the launch pad



Launch phase and first acquisition



Alsat-2 LEOP and IOT team at Oran Ground Segment

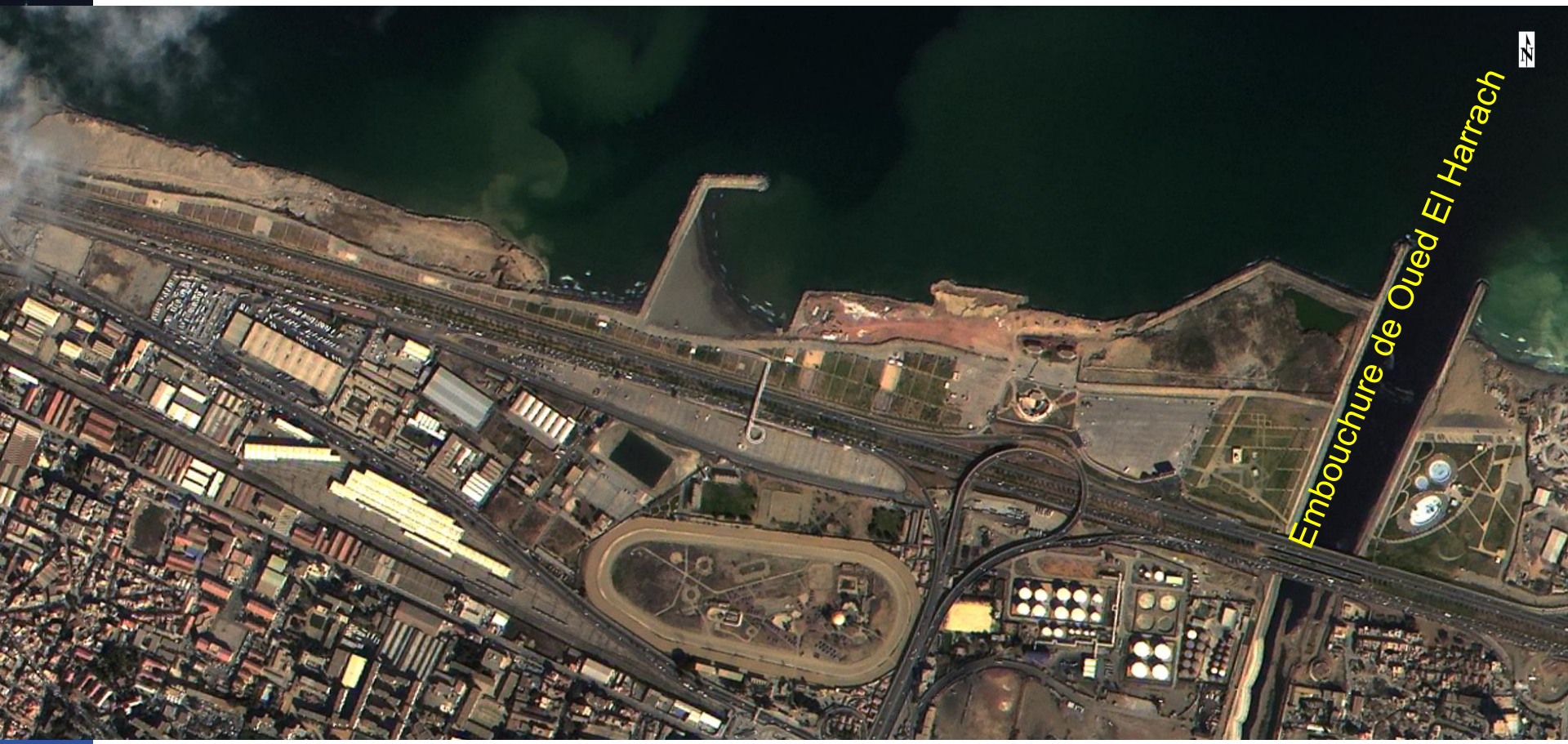
Image Alsat-2A in 2010

Image Alsat-2B in 2016

Vue générale de la partie centrale de la Baie, couverte par Alsat-2B La grande Mosquée d’Alger en cours de réalisation

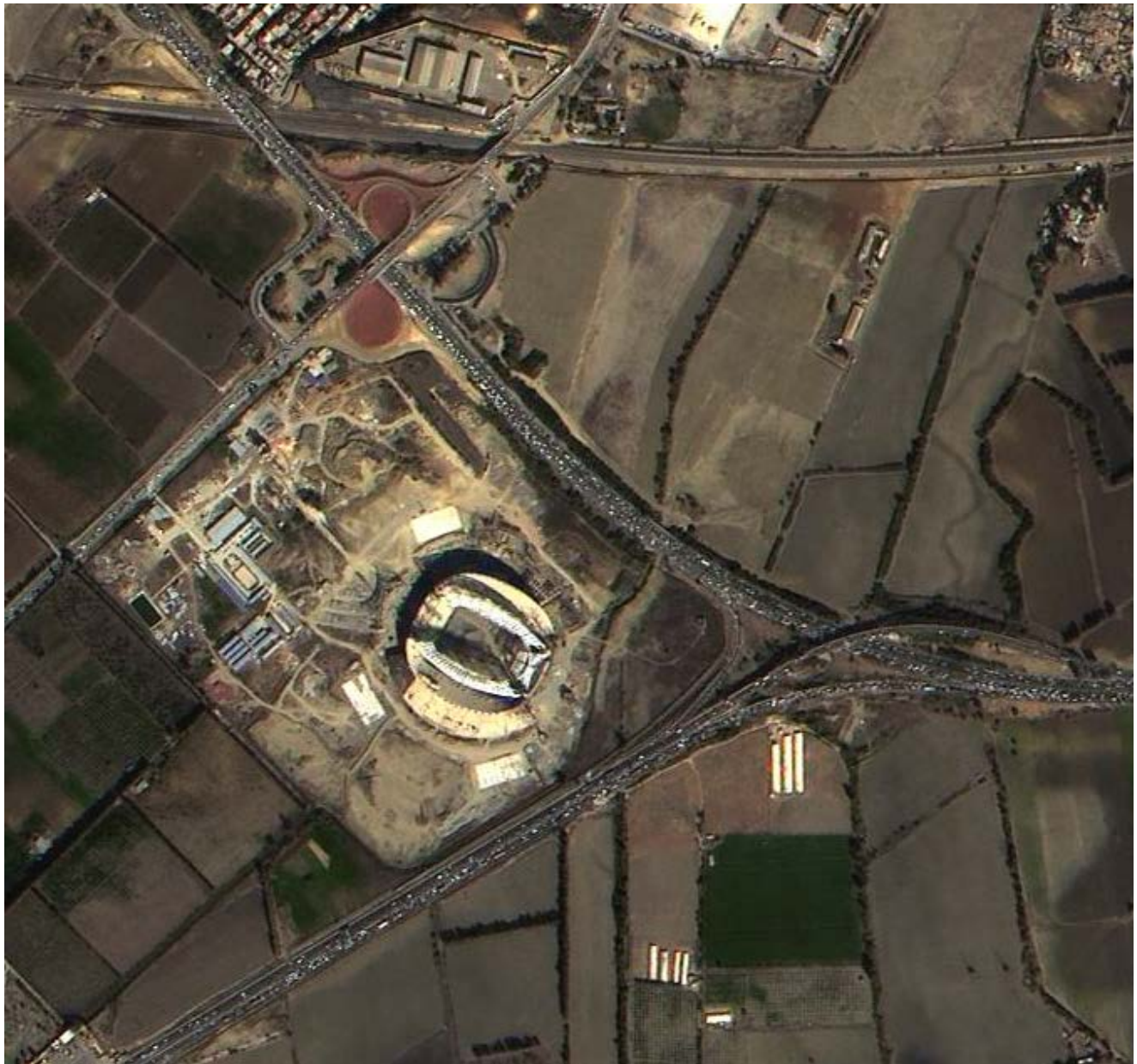
Zoom sur le chantier de la grande Mosquée d’Alger, en cours de réalisation

Vue générale de la partie centrale de la Baie, couverte par Alsat-2B : « Les Sablettes » avec les aires de loisirs en cours d'aménagement



Vue générale de la partie Sud de wilaya d'Alger, couverte par Alsat-2B :
Aïn Naadja « Gué de Constantine » et le grand stade de Baraki en cours de réalisation

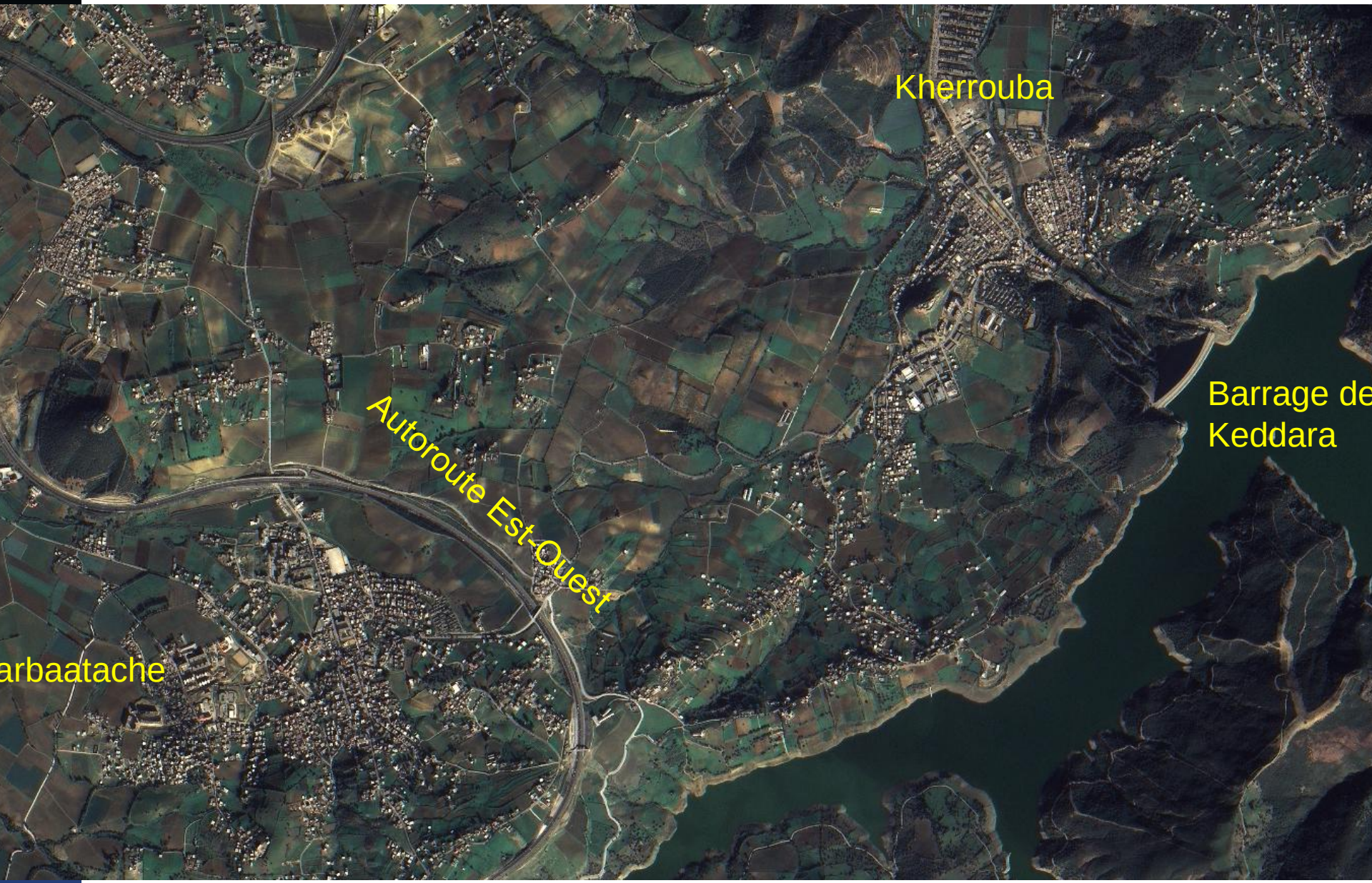
Zoom sur le Stade de Baraki
En cours de réalisation



Béjaia et son port (24-01-2017)

Khemis El Khechna (Est d'Alger) (Janvier 2017)

Larbaatache / Est d’Alger (Janvier 2017)



Constantine et ses ponts suspendus (Mai 2015)

Image Alsat-2B centrée autour du Royal Nairobi Golf Club / Kenya (Janvier 2015)

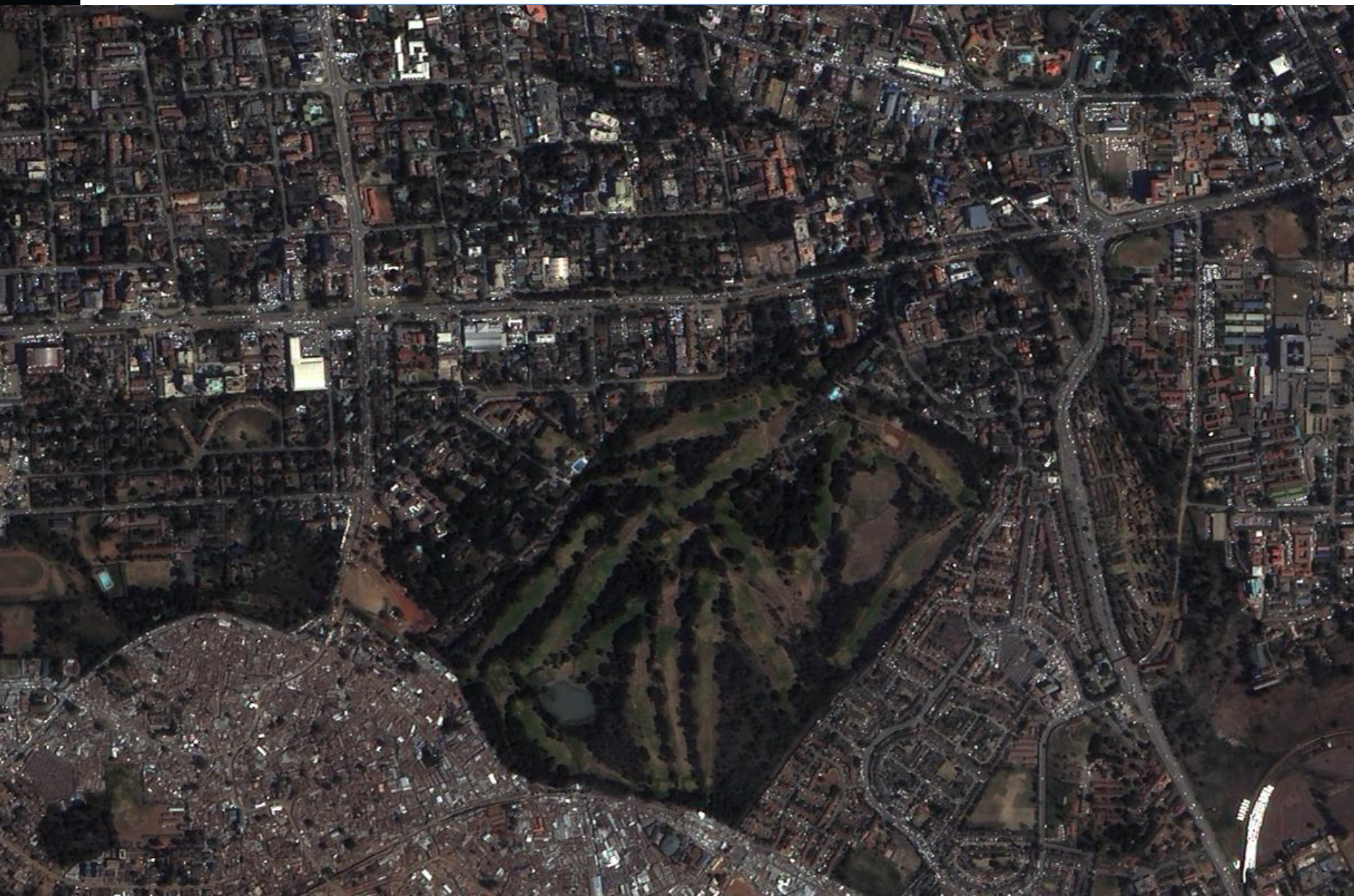


Image Alsat-2 centrée autour de la Cité Interdite
et de la place Tiannmen : Pekin / China (Aout 2016)

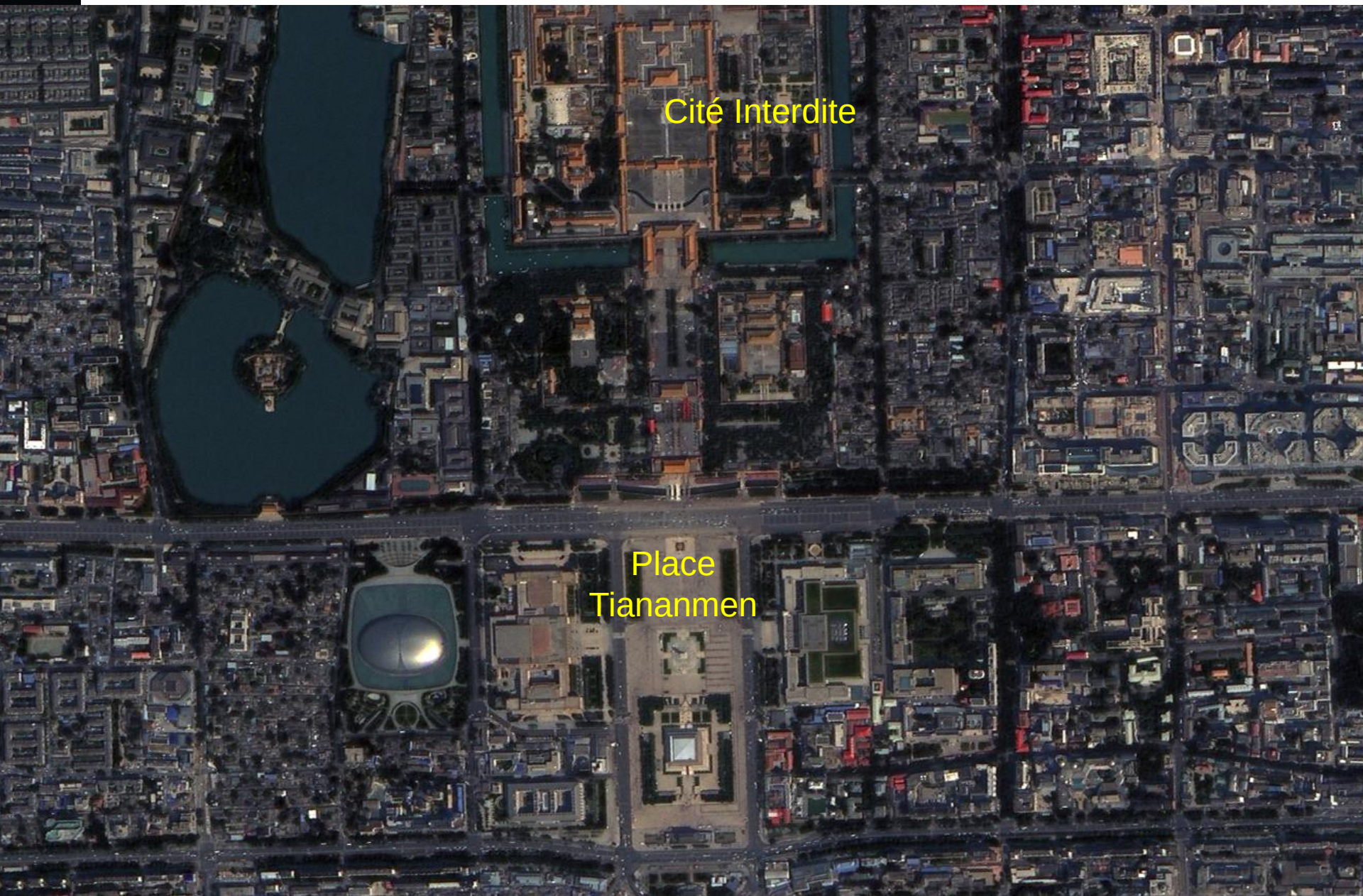
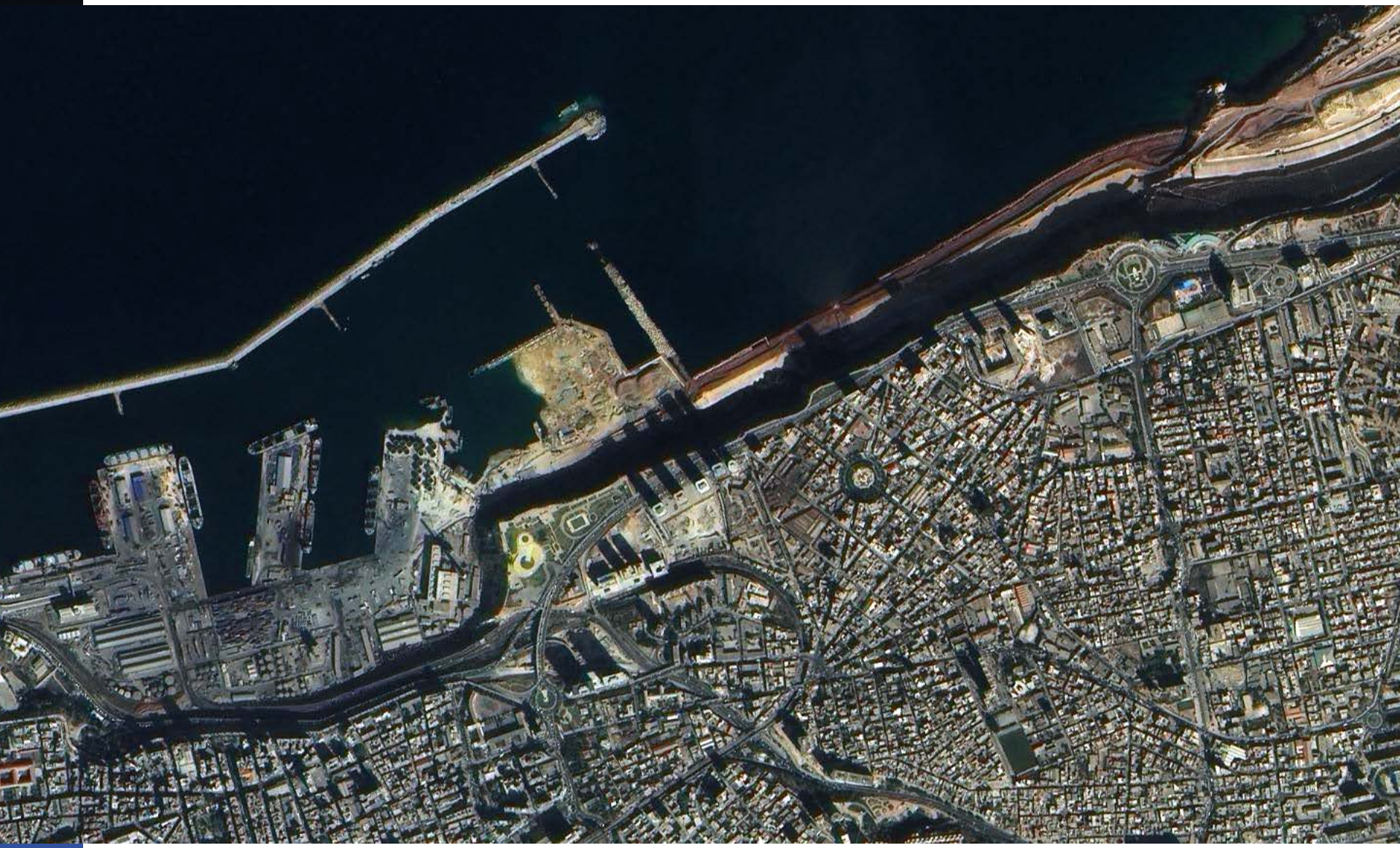


Image Alsat-2B sur Dubai (EAU)

Oran (Octobre 2016)



Annaba (septembre 2016)

Paris (Octobre 2016)

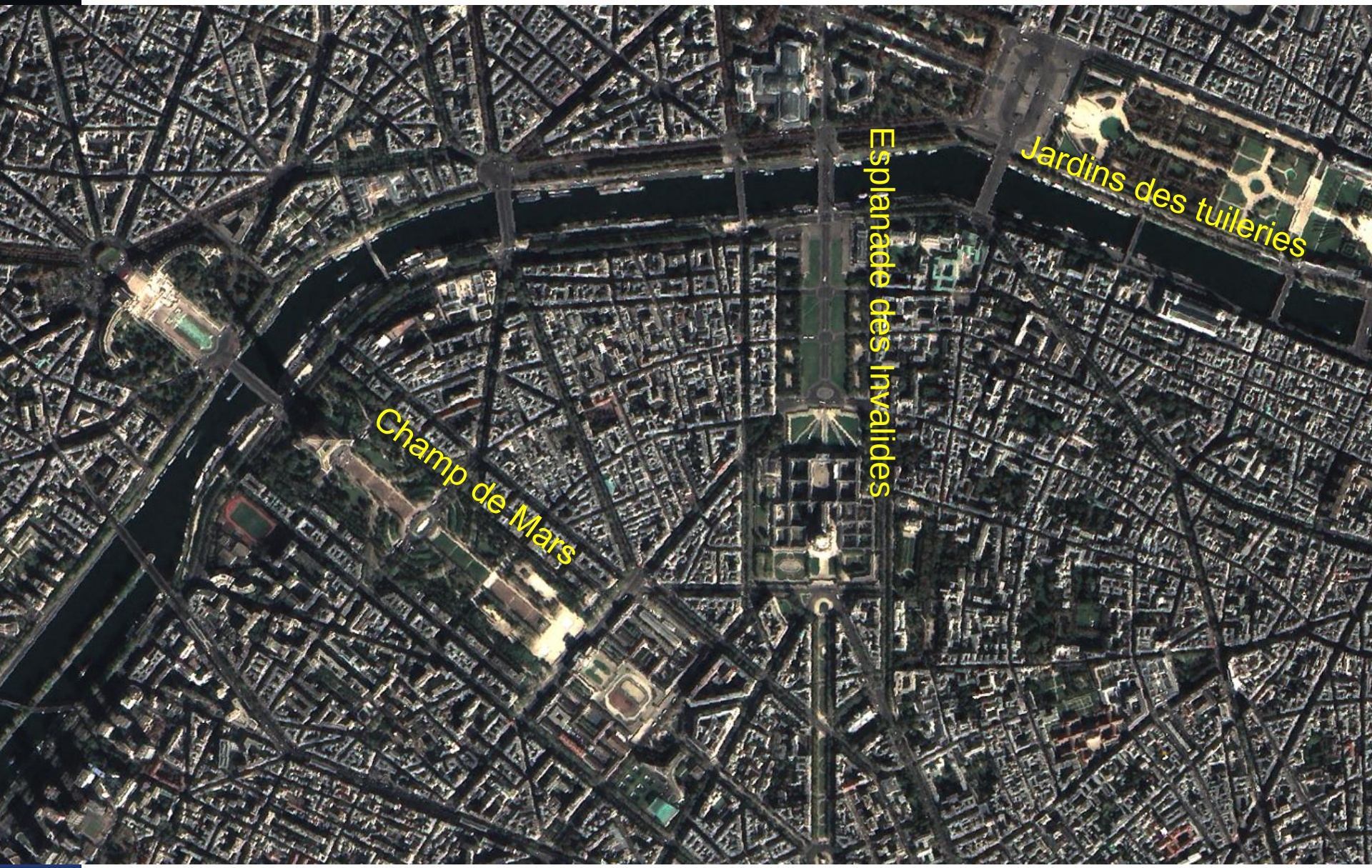


Image Alsat-2B sur Purmerend (Près d’Amsterdam) / Hollande

Image Alsat-2B du Vendredi 28/10/2016 Couvrant la Mecque et ses environs

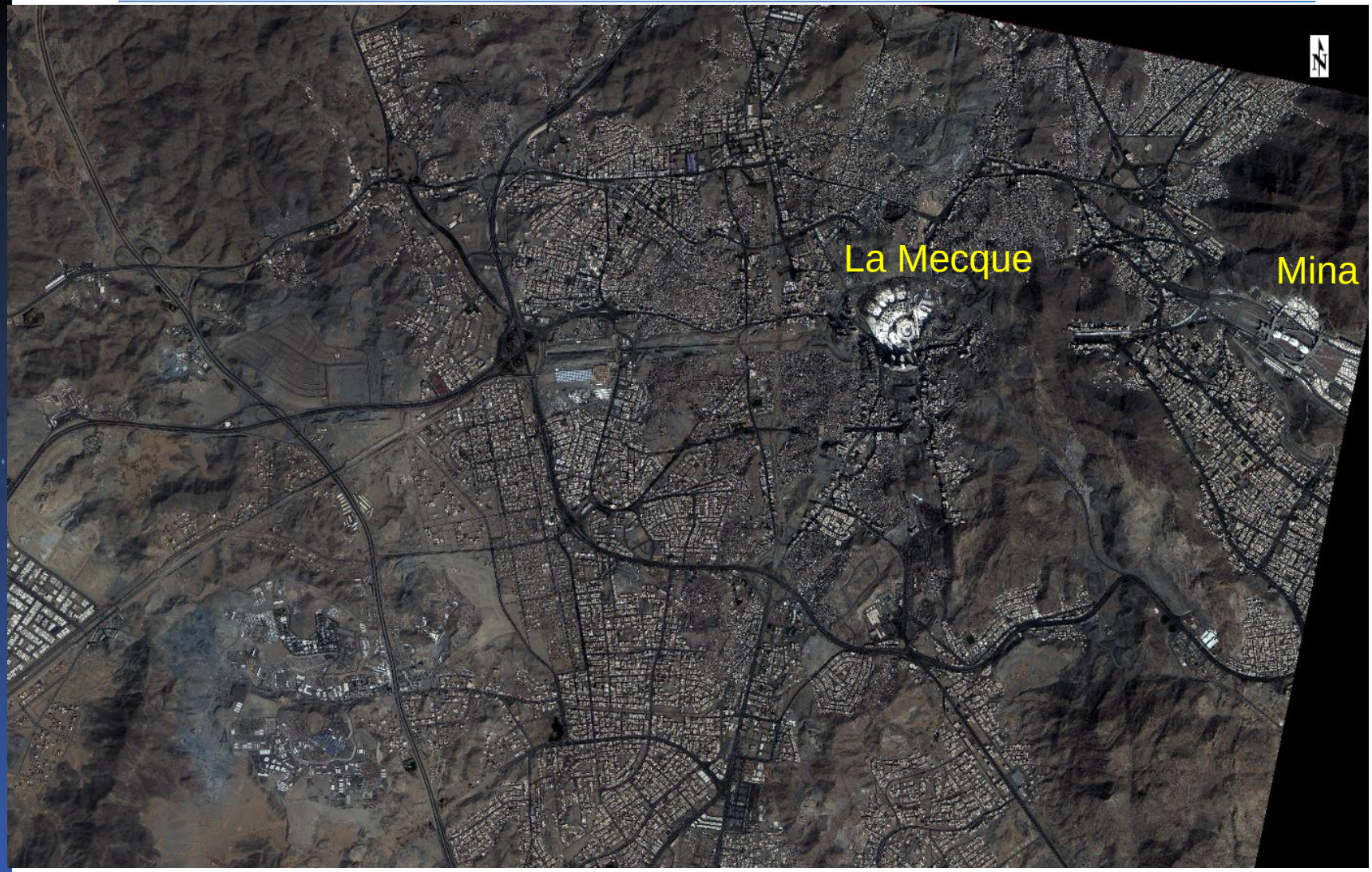
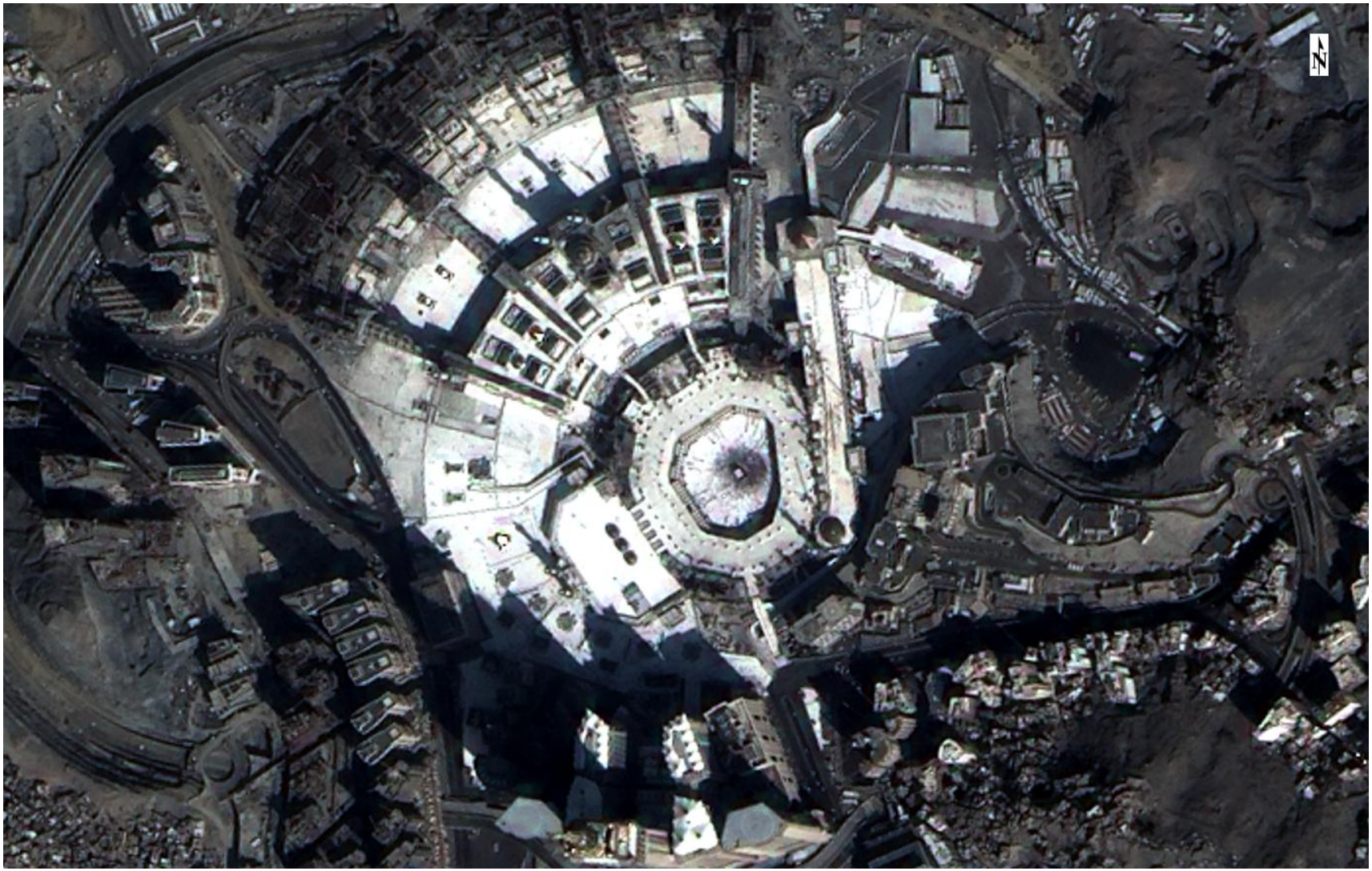


Image Alsat-2B du Vendredi 28/10/2016, Couvrant la Mecque et ses environs

Zoom de l’Image Alsat-2B du Vendredi 28/10/2016 à 09h58 (UTC+3), sur la Mosquée Sacrée (Mesjid El Harâm)



Mina (la Mecque) / Arabie Saoudite