
***16th European Interparliamentary Space Conference (EISC)***

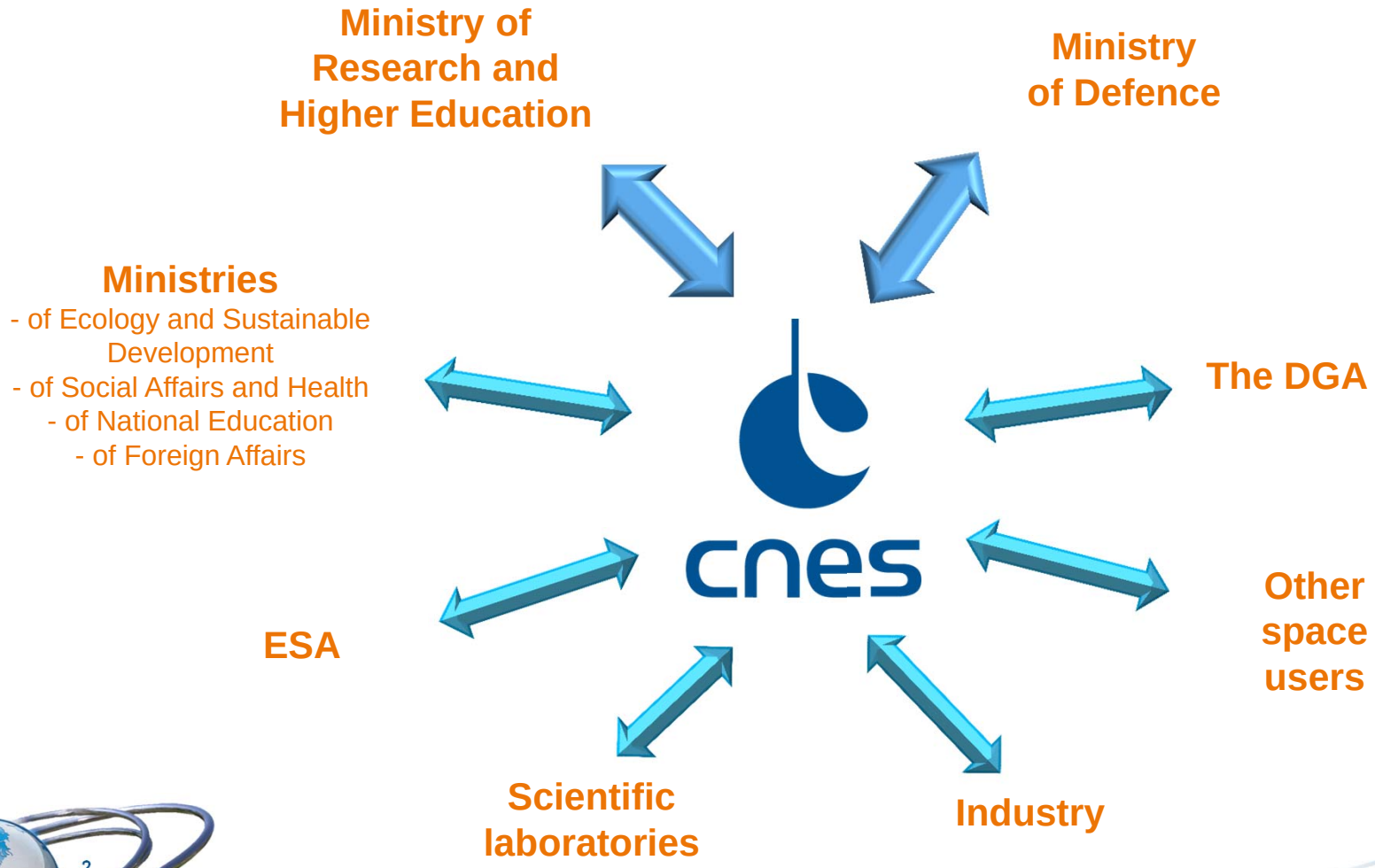
**Visit to CNES**

**April 15th, 2014**

# CNES

## *Its partners in France*

### An ambitious French space policy

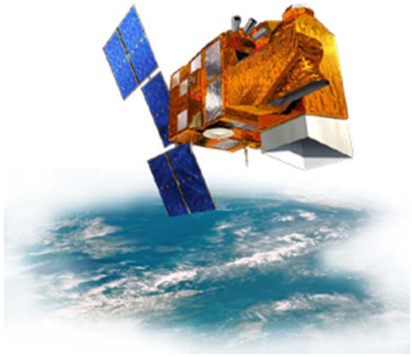


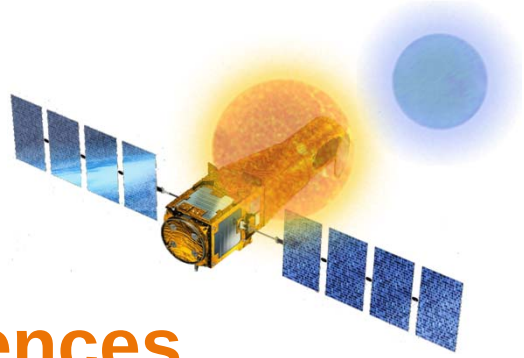
# CNES

## *Five programme themes*

## Defence

***Observation of the Earth, Telecommunications, Electronic tapping***





## Telecommunications

***Telecommunications, data collection, Navigation/Positioning***

## Sciences

***Astronomy/Astrophysics, Solar system, Fundamental physics, weightlessness experiments, ionosphere/magnetosphere***

## Ariane

***Ariane 5, Soyouz in Guiana, Vega***

## Observation

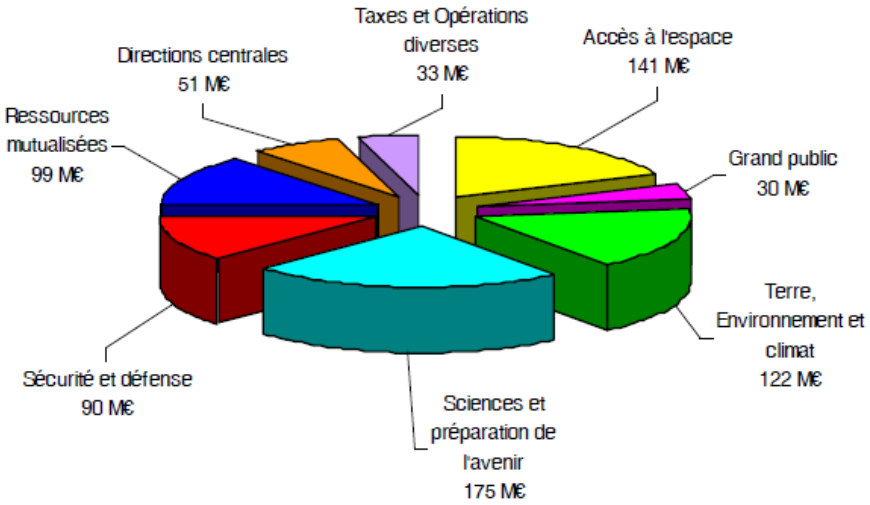
***Atmosphere, landmasses, Solid land/geomagnetism, oceans, meteorology, space and major disasters***

# CNES

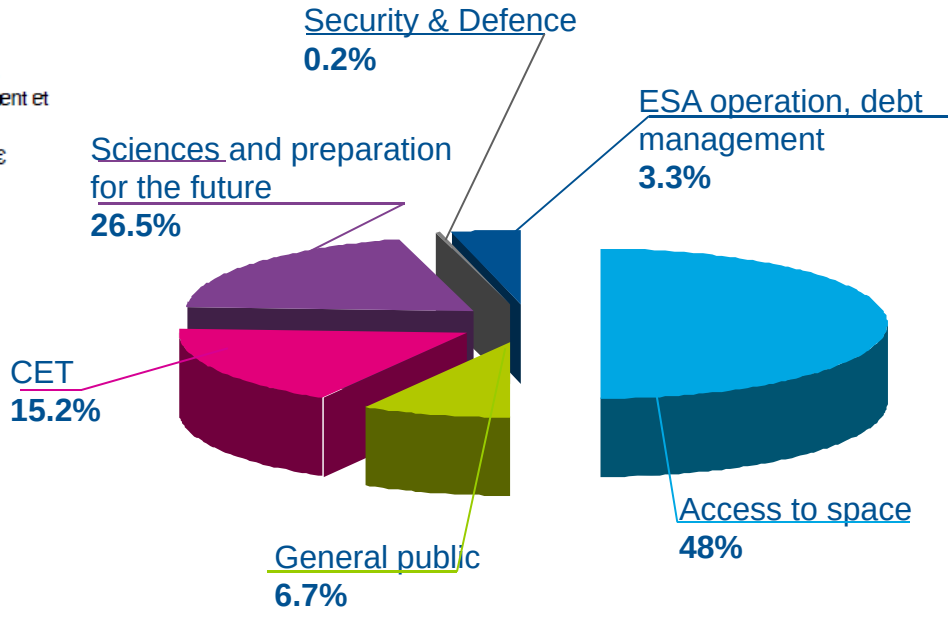
## *A budget*

## Comparative distribution of funding excluding PIA (investment for the future plan) (year 2013)

### Multilateral MTP (€ 743 M)




### ESA MTP (€799M)



# CNES

## *Four additional support centres*

**2,461 employees on 31/12/2012, including 1,958 engineers**

**Headquarters**
Incorporates functional structures. Prepares the CNES strategy and manages international relations




**French Guiana Space Centre**
Implements launch means from the site


**Toulouse Space Centre**
Designs, develops and operates orbital systems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# Satellite in our daily life

***The Visible***

**Meteo**

**Geo Positioning**

**Satellite TV**

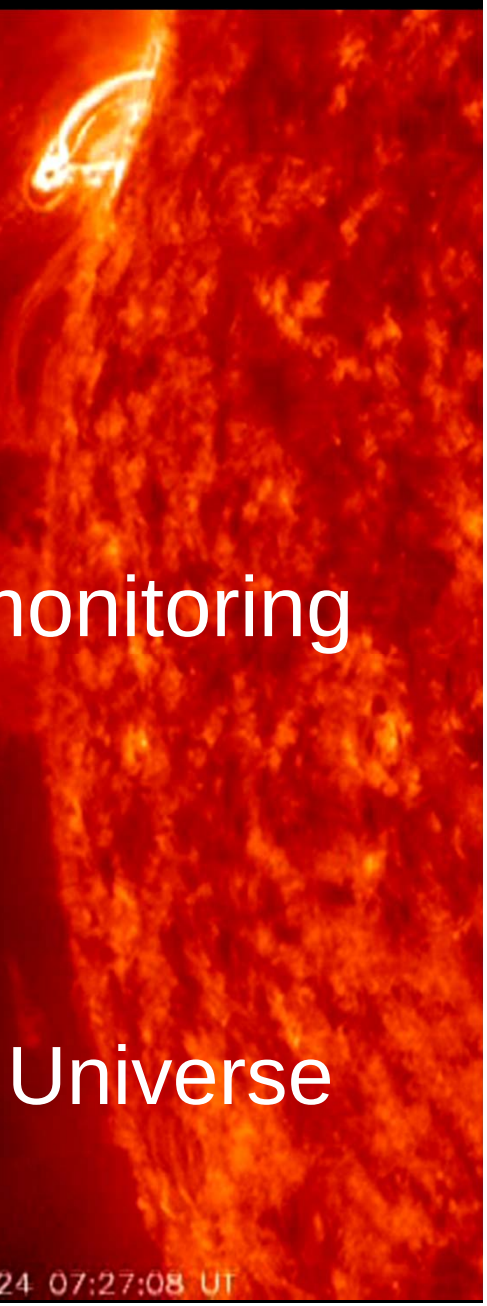
***And the hidden face***

Knowledge and monitoring of the Earth

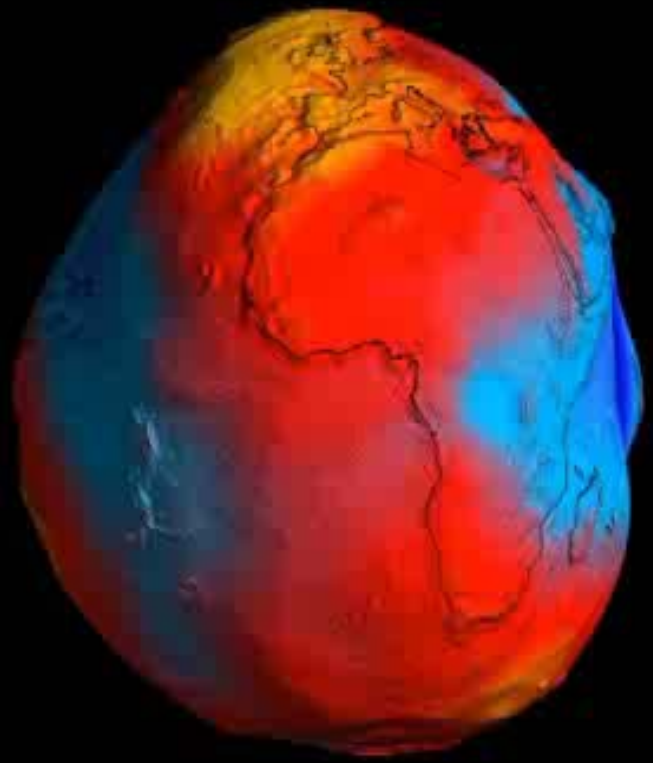
Data transfer

Time reference

Knowledge of the Universe



# Geoid measured by GOCE



# The space environment

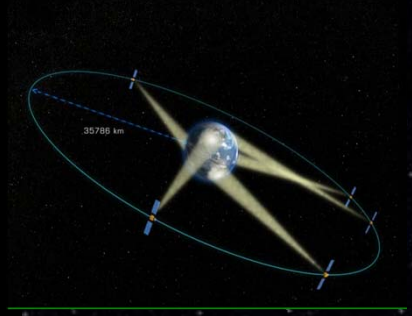
***Space, a unique point of view***

## ➔A global and constant vision of our planet

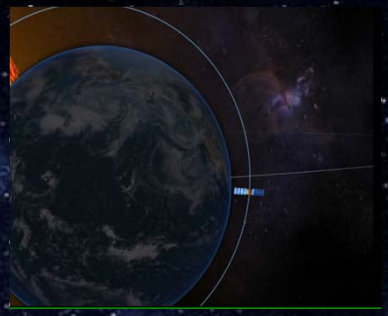
>Understand Earth and how it functions

>Monitor its development

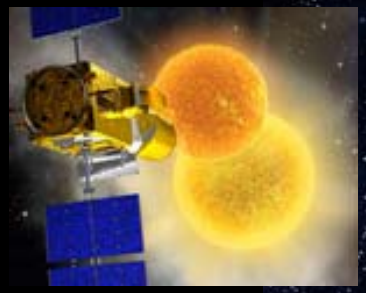
>Forecast natural and violent disasters




Remain permanently above the same point of the globe due to geostationary orbit



See all of Earth every day or over several days due to heliosynchronous orbit



## ➔ An observation location unrestricted by the atmospheric barrier and gravity

>Examine the Universe, explore the solar system

>Use the space environment as a location for experiments (weightlessness, radiation environment, etc.)

# The space environment

***Space, a hostile environment***

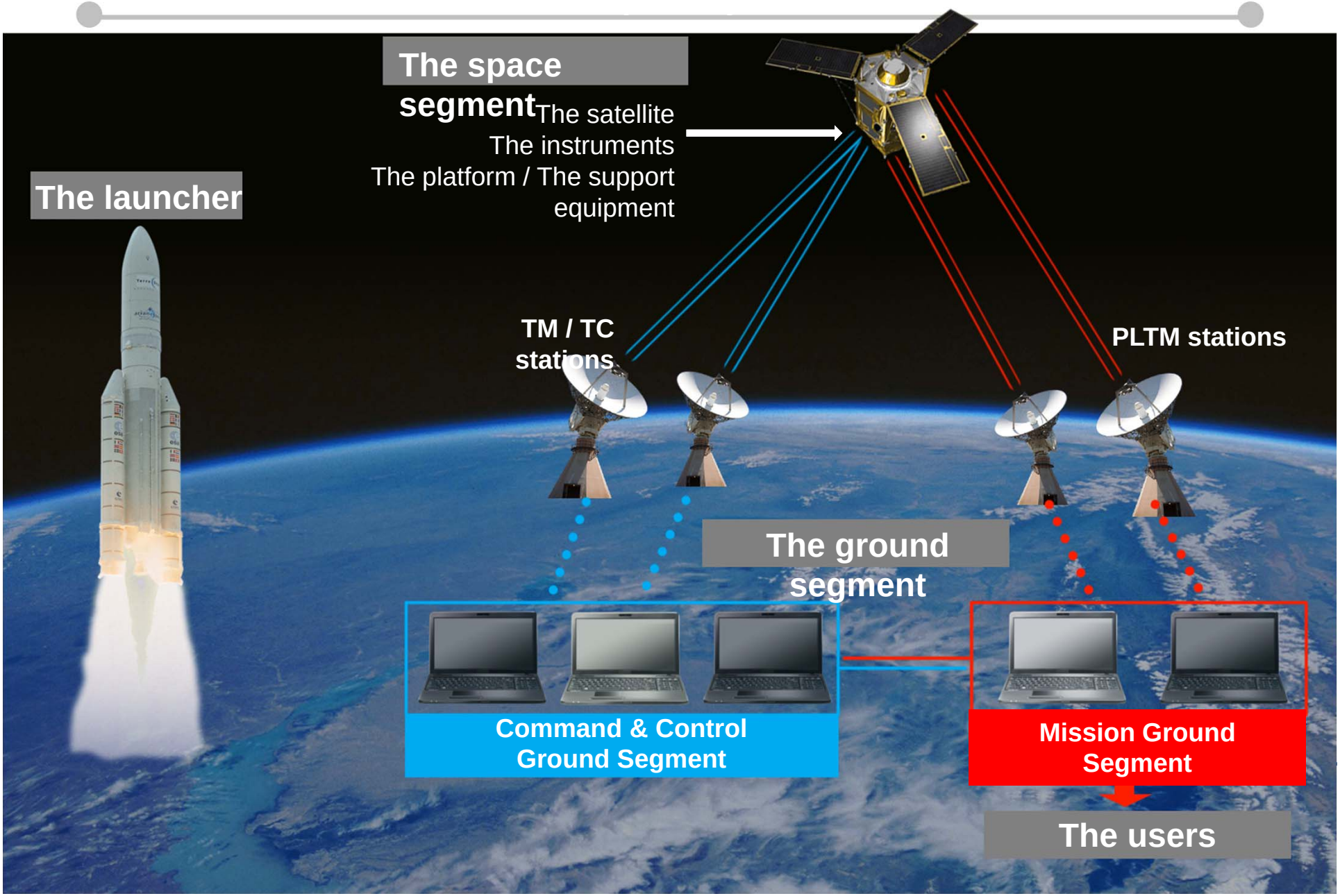
➔ **Major technical constraints**

> Impossible to intervene on site : no hardware maintenance possible ➔ software maintenance

> Instruments need to be remotely controlled and calibrated throughout the mission

> Aggressive environment : radiation, heat, vacuum, etc.

➔ **A place of ongoing technological innovation**


The space segment
The satellite
The instruments
The platform / The support equipment
The launcher
TM / TC stations
PLTM stations
The ground segment
Command & Control Ground Segment
Mission Ground Segment
The users

# DCT
## *Missions*

- ➔ **Prepare future orbital systems**
- ➔ **Raise skills and technologies needed to futur orbital systems**
- ➔ **Manage orbital system projects : satellites, on-board payloads, ground segments, balloons**
- ➔ **Exploit the space segment of orbital systems and data acquired**
- ➔ **Monitor space and check the compliance of orbital systems with space law**

# CNES

## *More than 30* operating projects with 20 countries worldwide

### Observation

➔Champ-Grace, Cryosat, Doris HY2A, Goce, Iasi Exploitation, Megha-Tropiques, Jason 1 and 2, Polder-Parasol-Calipso, Smos, Spot 4 and 5, etc.

### Sciences

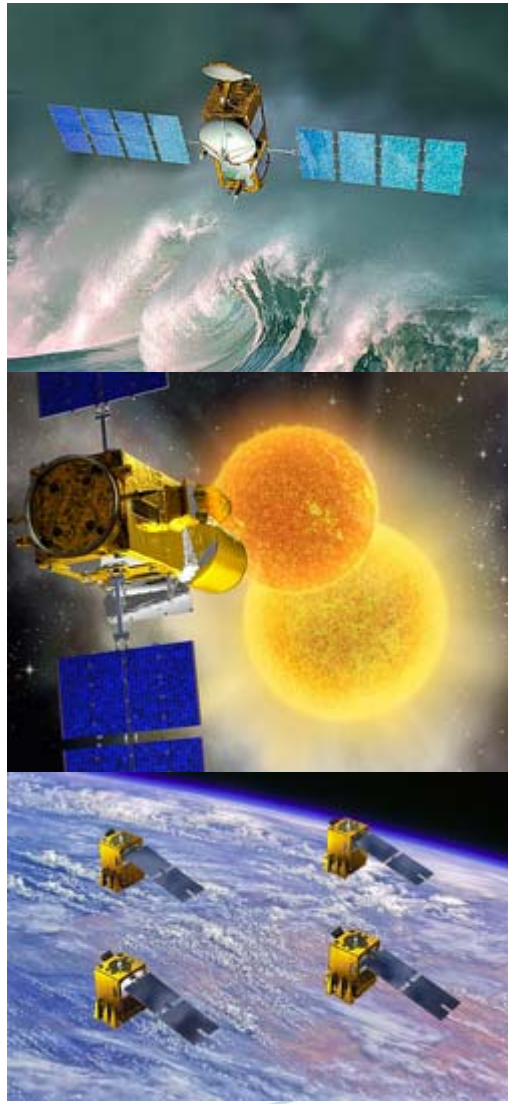
➔Cardiolab, Cassini-Huygens, Cluster, Corot, Declic, Intégral, Herschel, Mars Express, ChemCam on Curiosity, Picard, Planck, Rosetta croisière, Soho, T2L2, Venus Express, Parabolic flights, etc.

### Telecommunications

➔Argos 3, Cospas-Sarsat, etc.

### Defence

➔Elisa, Hélios 2A and 2B, Pléiades 1A and 1B, Soro, etc.





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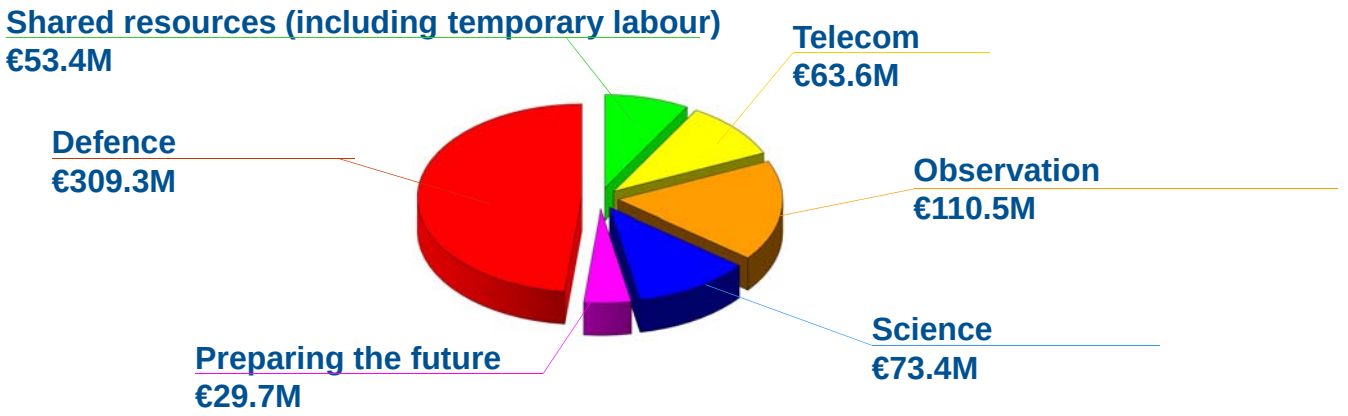
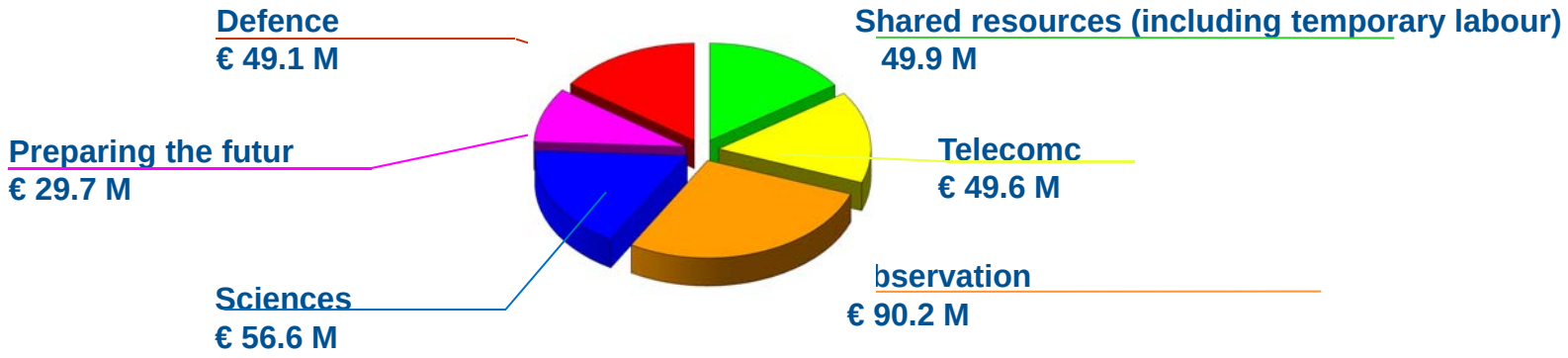
# DCT

## *2013 Budget (including PIA) – Distribution by theme*

### Distribution of expenses (640,00 M€)




### Distribution of subsidies (325,2 M€)

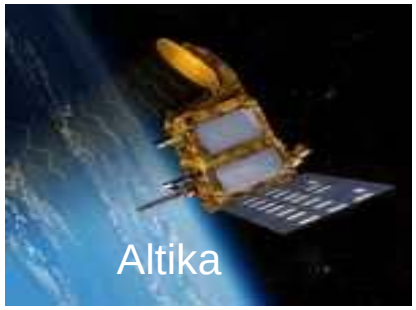


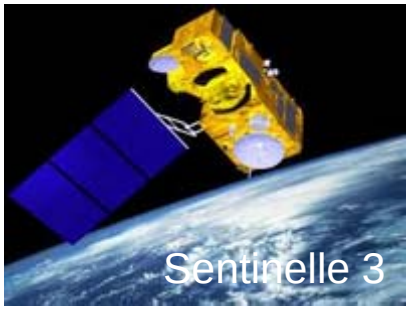
# DCT

## *Over 50 projects in the development phase*

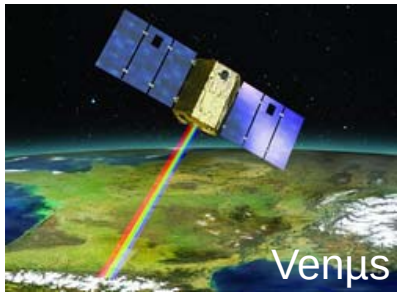
### Observation

2013



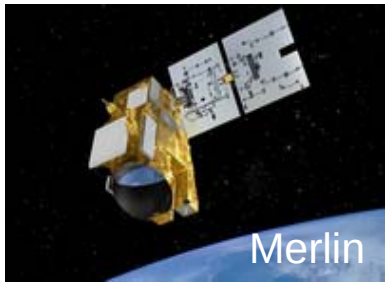


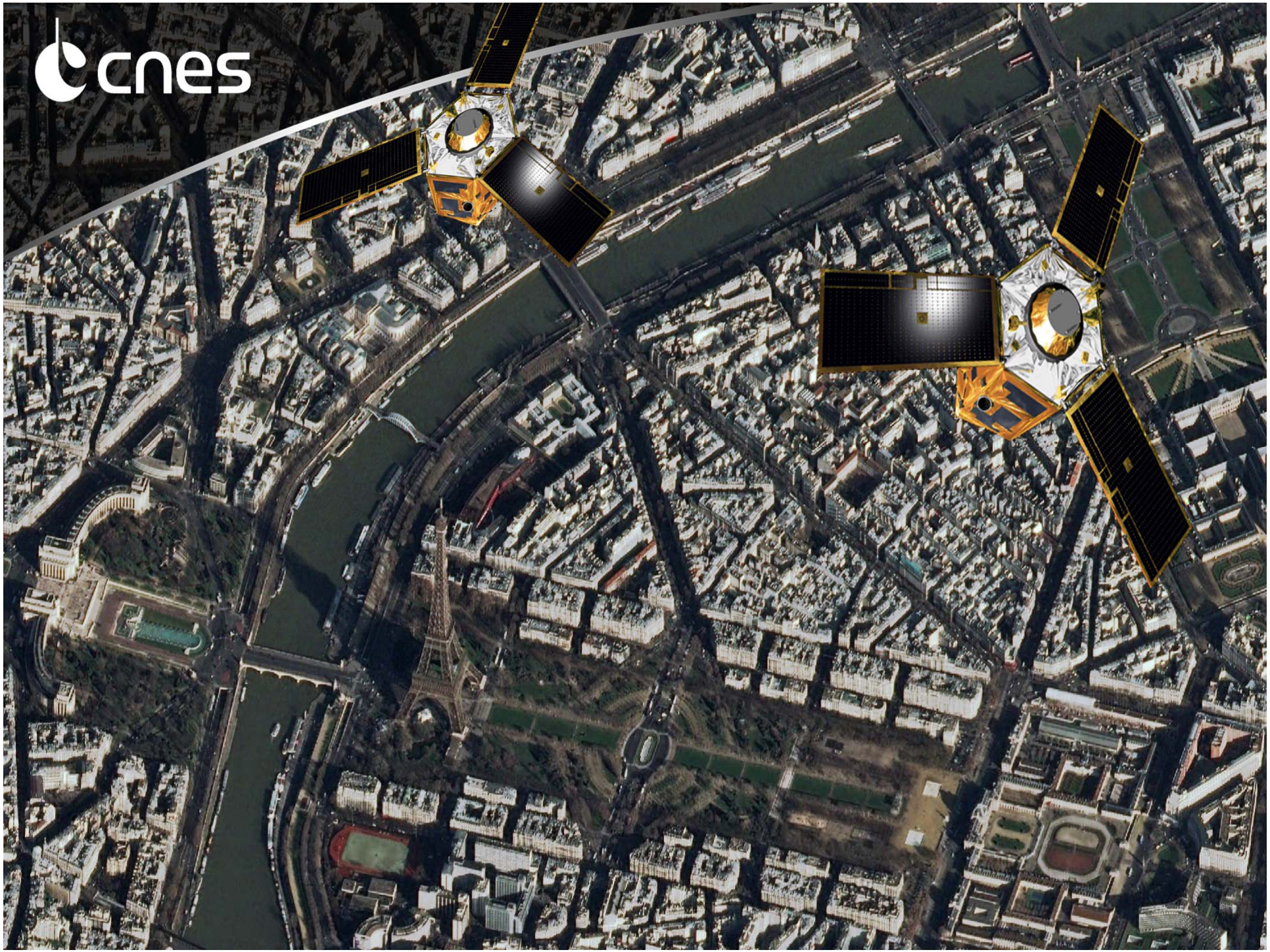






2020

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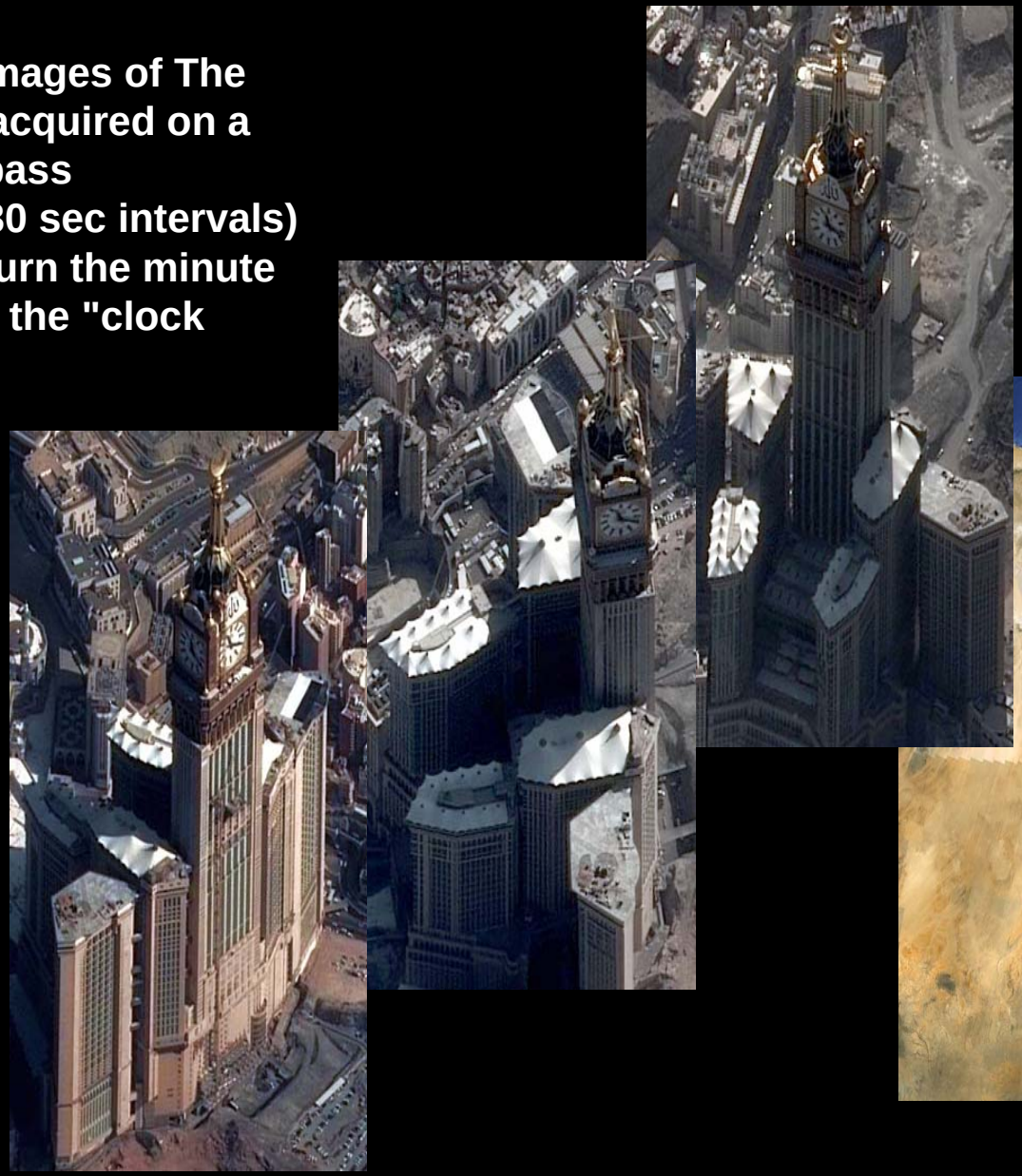
# An example of agility

- Three images of The Mecca acquired on a single pass (1 min 30 sec intervals) to see turn the minute hand of the "clock tower"!

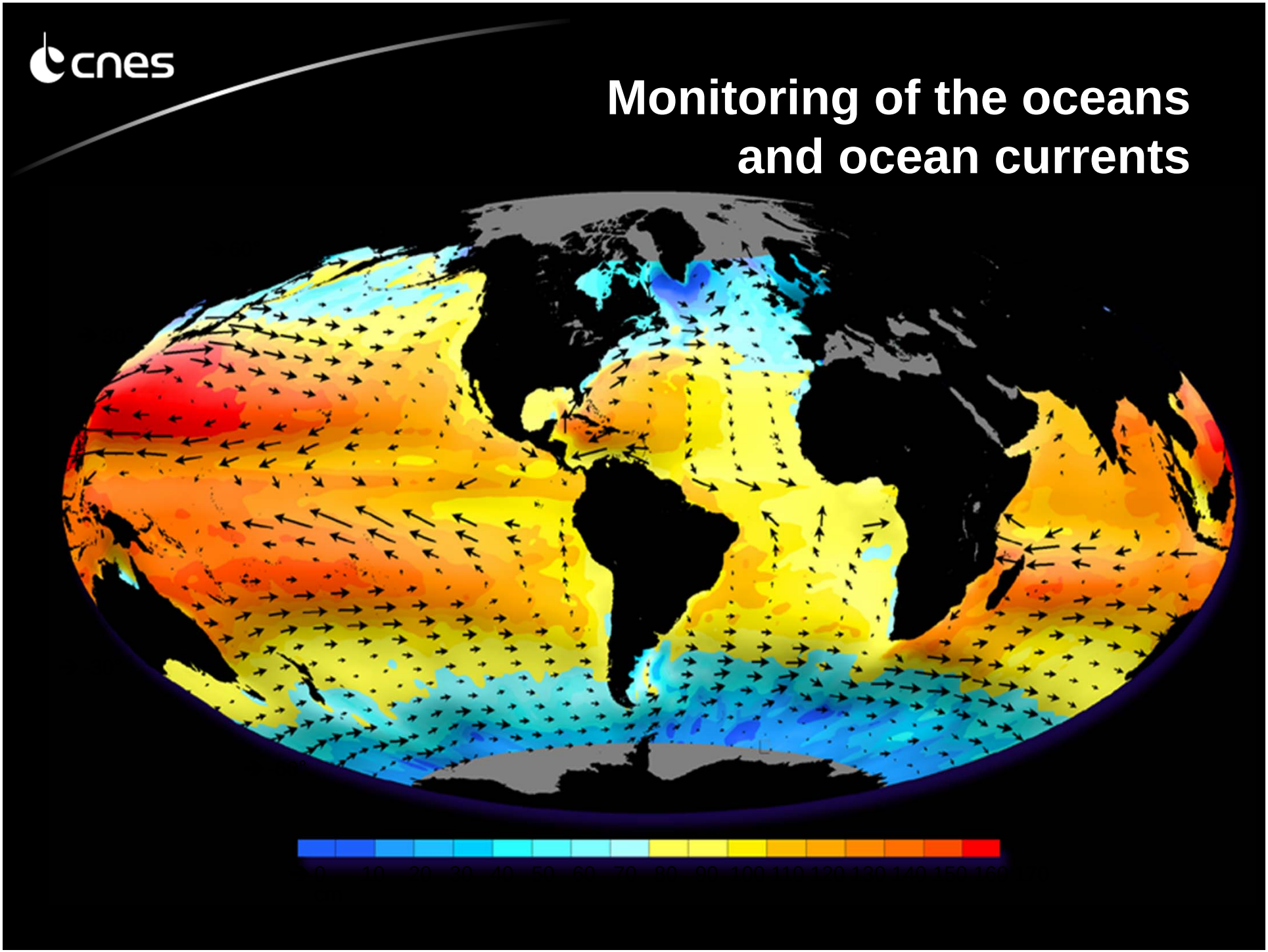


IASI CO data

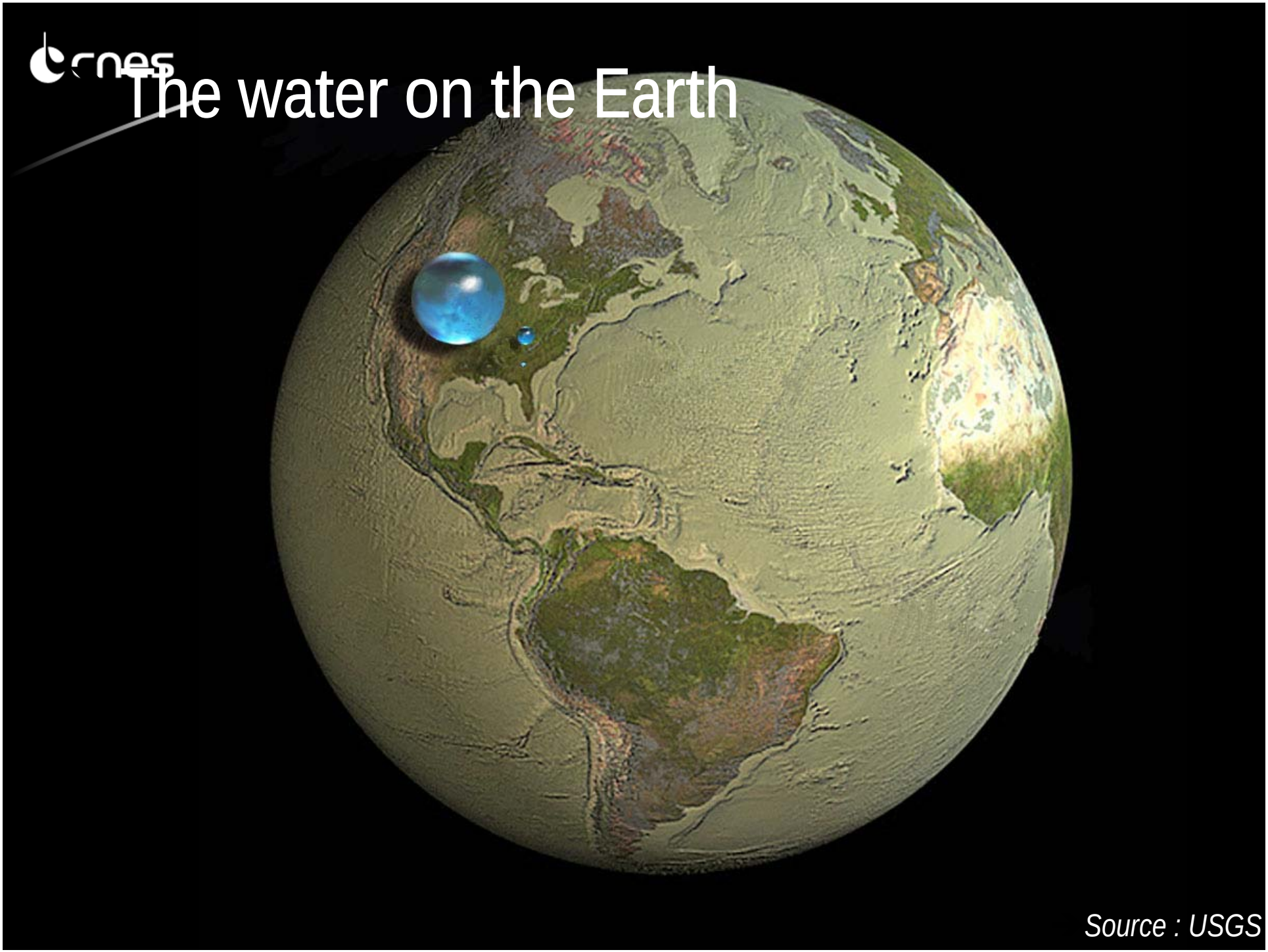
LATMOS-IPSL / ULB

CO total column measurements derived from the IASI/MetOp observations from July 22 to August 22, 2010. These data are averaged over 3 days on a 0.5°x0.5° grid and only daytime concentrations above 2.2 x 18 molecules/cm$^2$ are shown.

# Monitoring of the oceans and ocean currents



# The water on the Earth



*Source : USGS*

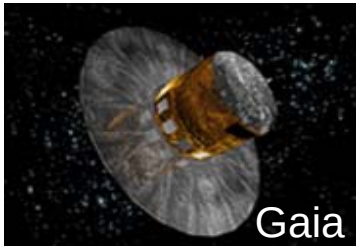
# DCT

## *Over 50 projects in the development phase*

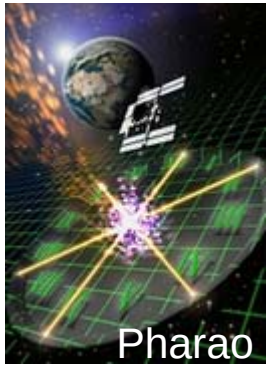
### Sciences

2013



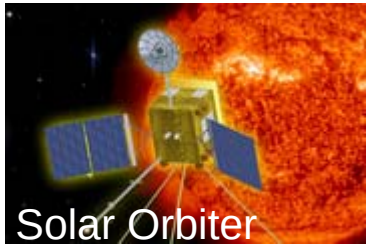


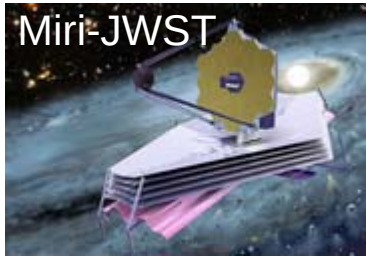






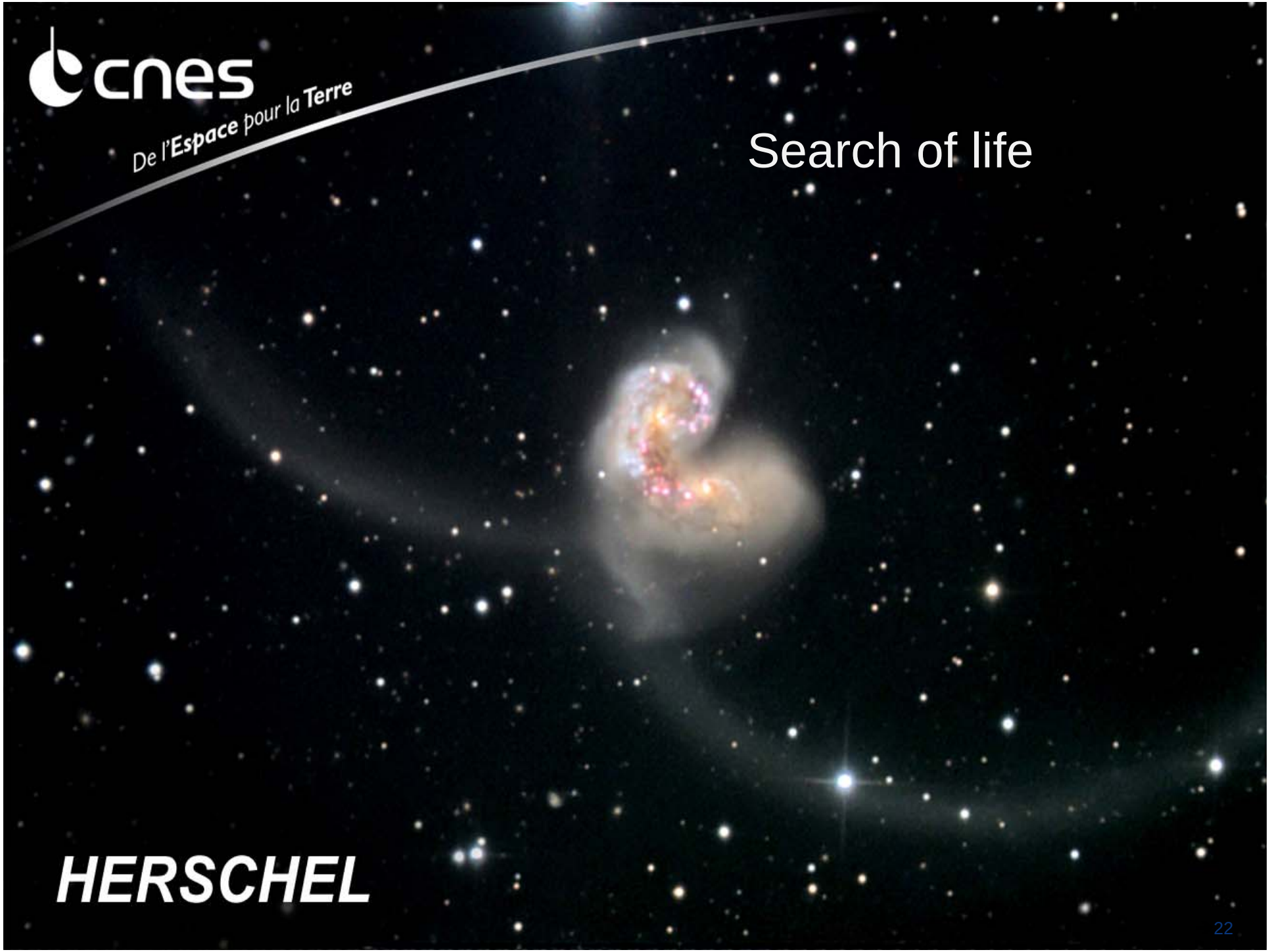





2020

**Euso Balloon – MTB – Juice – Cardiospace**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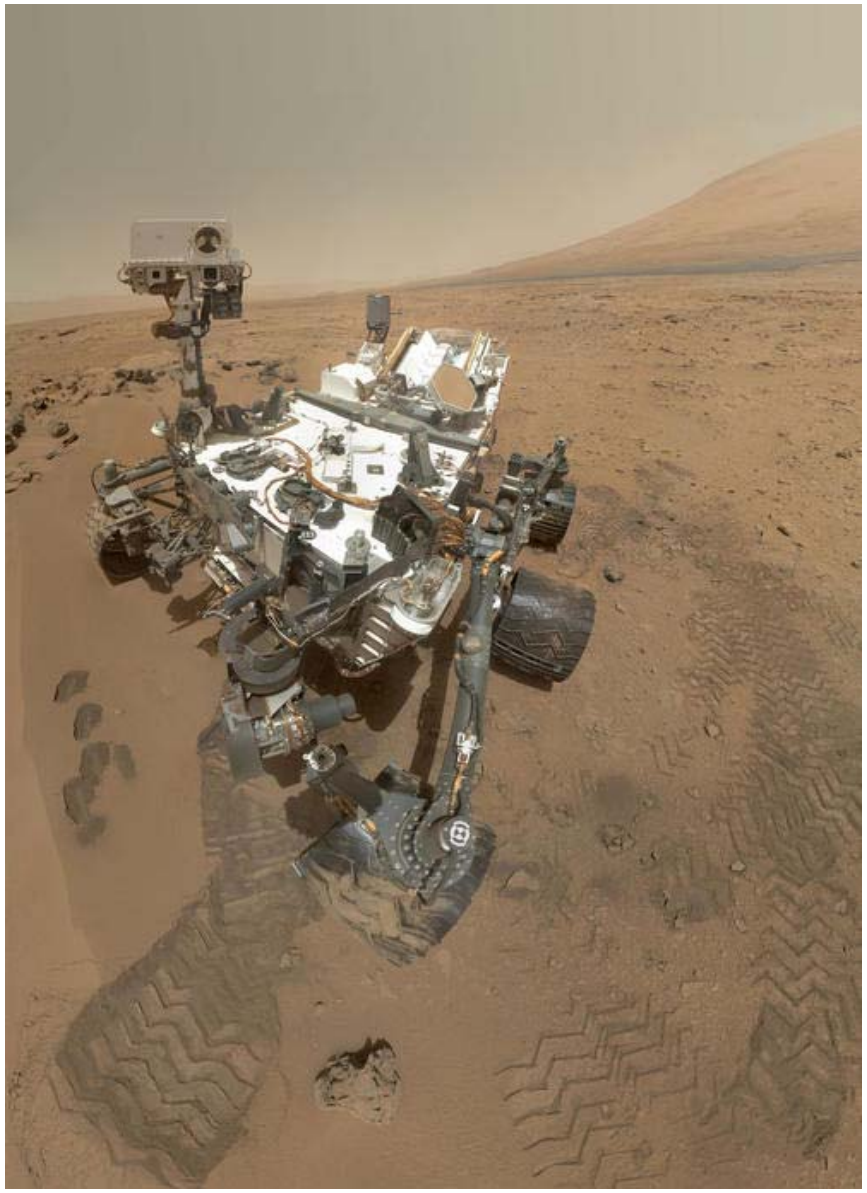
De l'Espace pour la Terre
Search of life
HERSCHEL

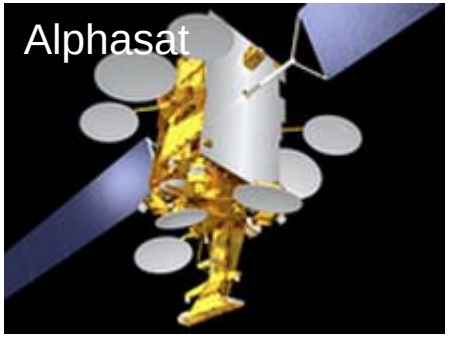
# Mars pictures



# DCT

*Over 50 projects in the development phase*

## Telecommunications








**Flip - PFNG – Smile - THD – TCS 21**

# DCT

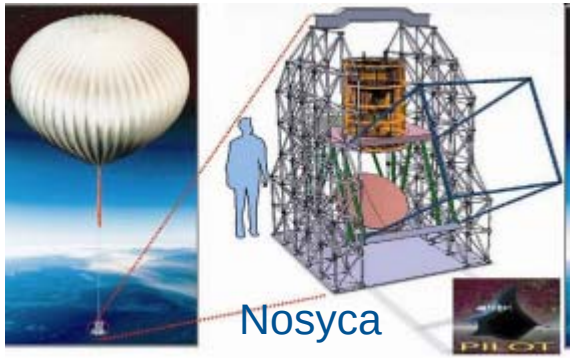
***Over 50 projects in the development phase***

## Defence




**CXCI – Grand IR - HYPXIM**

## Cross-functional activities





**Cormoran**

# DCT

## *Using orbital systems: the space segment*

### Positioning and station-keeping satellites

- ➔Manage operations performed from separation between the satellite and the launcher up to reaching operational orbit
- ➔Allow the satellite to perform its mission and to maintain its orbit throughout its service life
- ➔Over 80 positioning and station-keeping operations on-going
- ➔More than 10 satellites operating simultaneously

### Anchor the ATV to the ISS

- ➔Prepare and manage ATV operations and control centre exploitation in liaison with those of Moscow and Houston, on behalf of the ESA
- ➔ATV1, 2 and 3 anchored and deorbited, ATV4 and ATV 5 programmed for 2013 and 2014

# CNES

## *Survey space*

## A reality

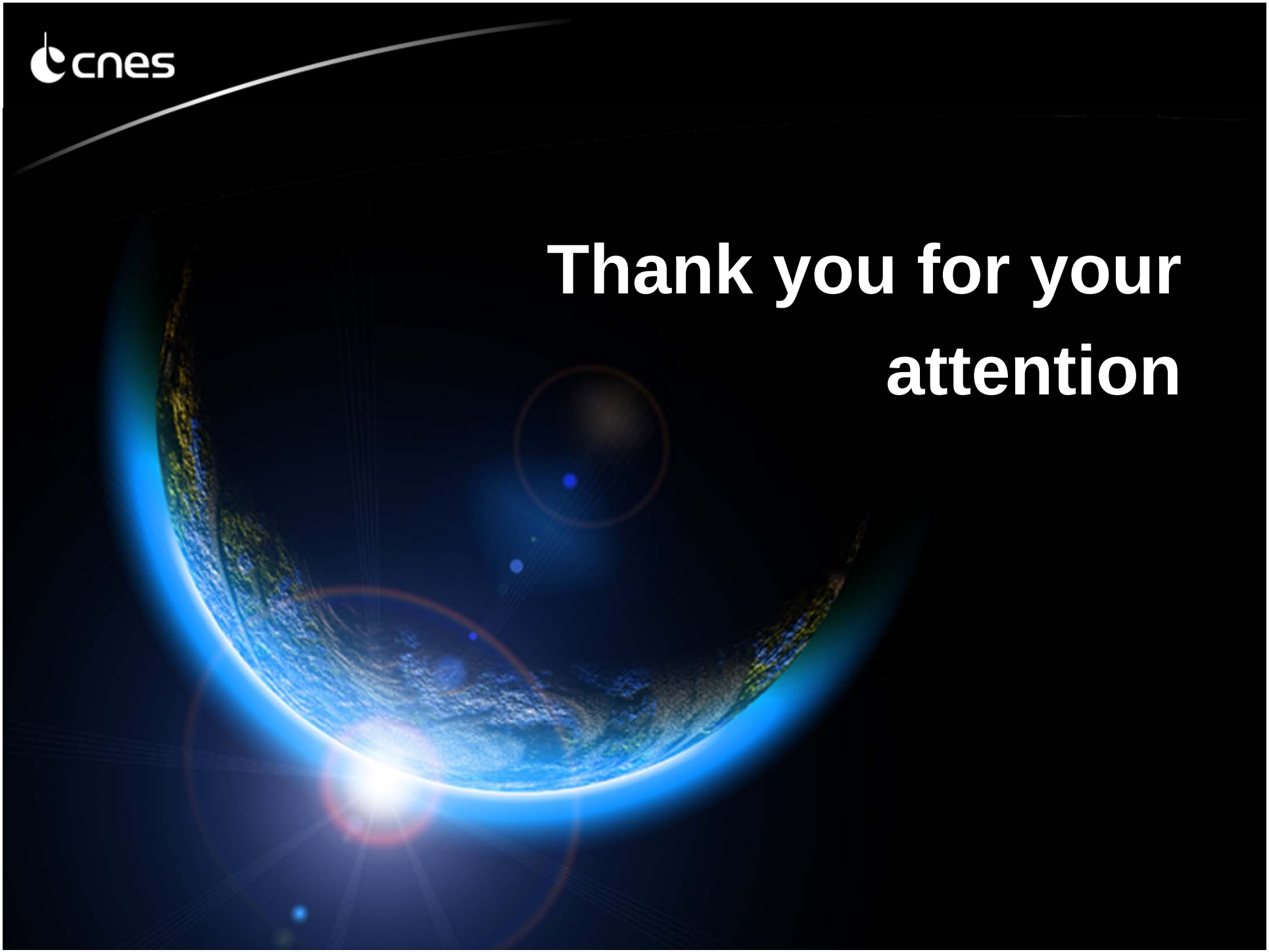
- 900 satellites launched in the last 10 years, and as many scheduled for the next 10 years
- 20,000 objects larger than 10 cm in orbit around the Earth (15.000 catalogued)
- 500,000 objects between 1 and 10 cm (not catalogued)
- Ten of millions of objects less than 1 cm (not catalogued)

## Issues

- To limit the nomber of debris produced
  - Protection of low orbits (25-year rule)
  - Protection of geostationary orbit (graveyard orbit)
  - Passivation of satellites and launchers at end of life
- To prevent collisions between working satellites and this debris
- To limit the risks in the event of fallback to Earth
- Understand and follow the evolution of the debris population

## Role of CNES

- Space monitoring Defence Partner  (collisions, re-entries), design and application of prevention measures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Thank you for your attention