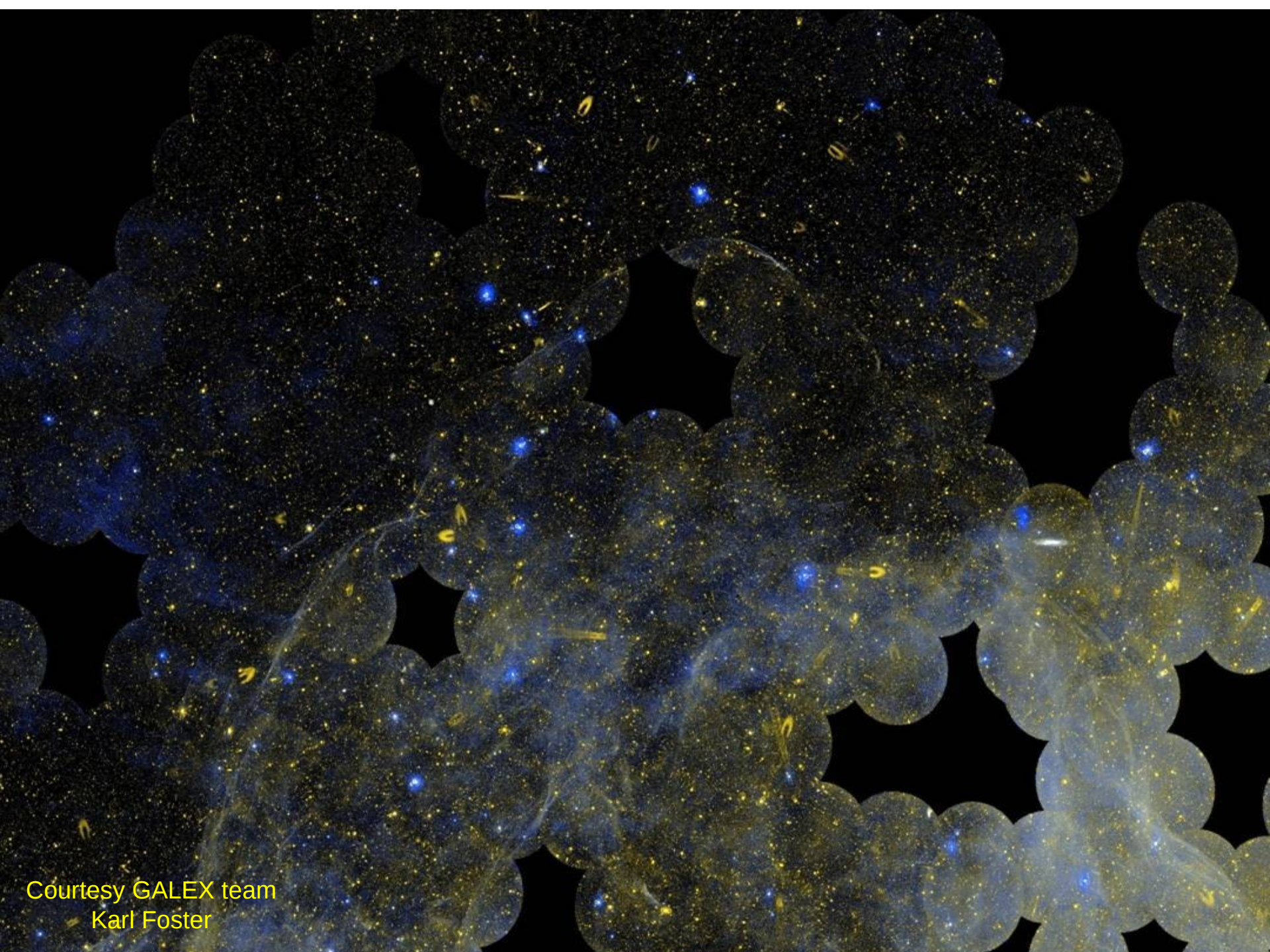


# The Space Telescope: World Space Observatory- Ultraviolet

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 Nestor Sánchez Doreste, Paola Sestito, Javier Yañez  
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Courtesy GALEX team  
Karl Foster



# WSO-UV, the next UV mission



**OAO-3**  
(1972-1981)

**IUE**  
(1978-1996)

**HST**  
(1986-...)

**FUSE**  
(1999-2007)

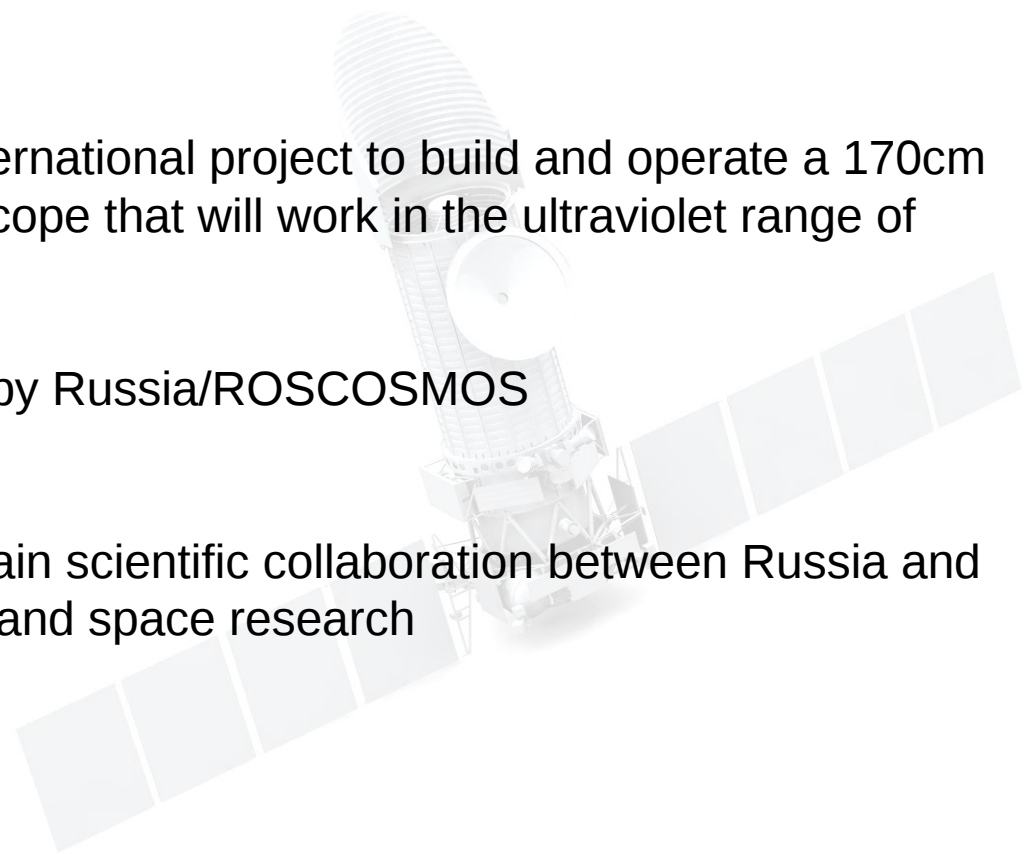
**GALEX**  
(2003-...)

**WSO-UV**  
(2015-...)

➤ WSO-UV is an international project to build and operate a 170cm primary space telescope that will work in the ultraviolet range of spectrum

➤ The project is led by Russia/ROSCOSMOS

➤ WSO-UV is the main scientific collaboration between Russia and Spain in astronomy and space research





WSO-UV was born in Sevilla in 1997, at the end of the IUE mission.

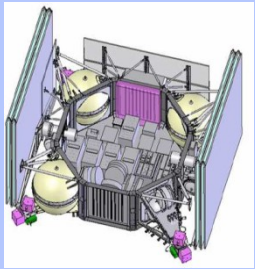
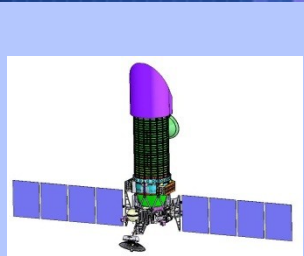
WSO-UV was presented to United Nations (1999).

(A/AC.105/723)

*“The world space observatory embodies a twofold goal:*

- To create opportunities for participation at the frontiers of science, on a sustainable basis and at the national level, by all countries in the world without the need for excessive investment. In so doing, the observatory will make an important contribution to the development of an academically mature and competitive cadre in many developing countries within 5 to 10 years after inception of the project by offering equal opportunities to astronomers all over the world*
- To support worldwide collaboration and to ensure that the study of the mysteries of the universe from space can be maintained in a sustainable way by scientists from all countries. This will then not only maintain the curiosity-driven spirit of discovery that is an integral part of sustainable development, but also make a reality in the scientific world of the visionary principle that space is the province of all mankind.”*





**Telescope:** T-170M, 170 cm diameter primary

**Spectral range:** 110 - 320 nm,

**Platform:** “Navigator”, Russia

**Orbit:** geosynchronous one,  $i=51.8^\circ$

**Launcher:** “ZENIT SB” (PROTON under evaluation)

**Launch:** End 2015, 2016

**Ground Segment:** Russia, Spain –

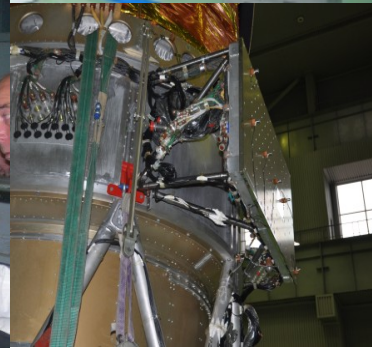
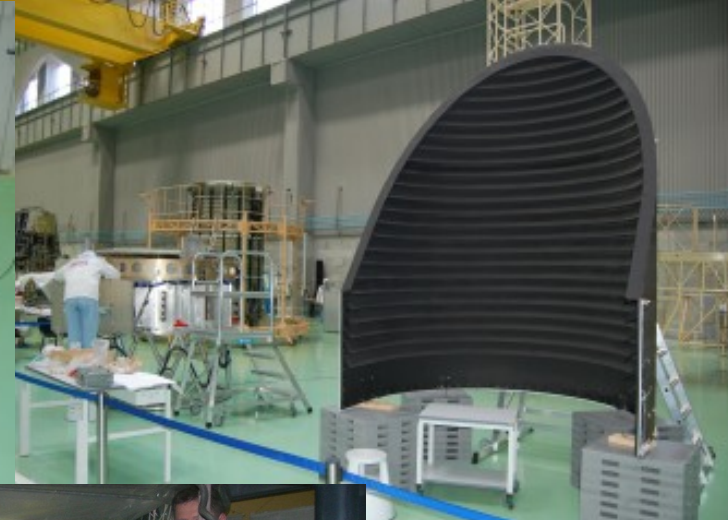
shared mission and science operations (50%-50%)



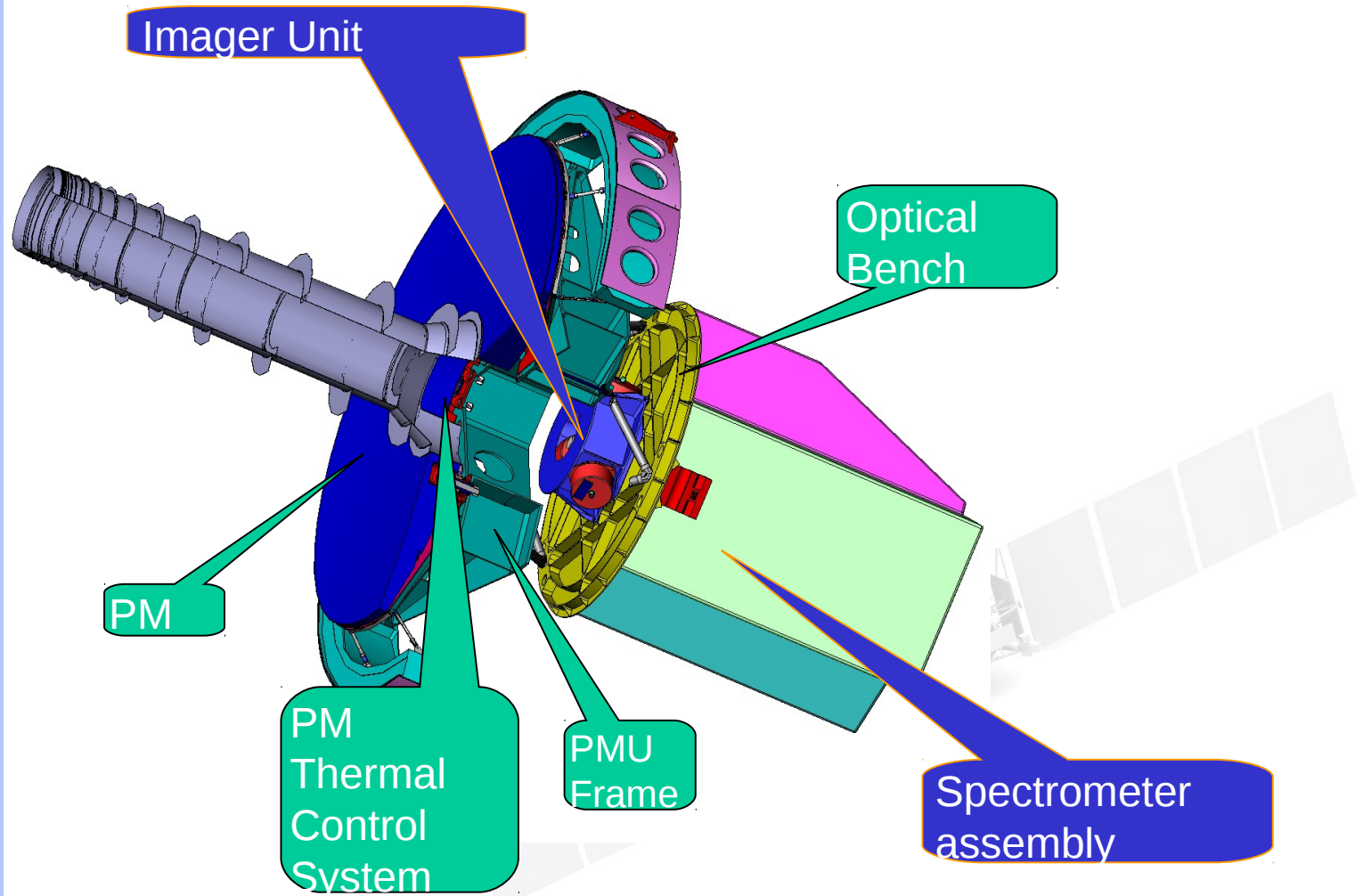
**RUSSIA:**  
 Telescope  
 Platform  
 Launcher  
 Launch  
 Operations  
 Instrumentation  
 (FGS, WUVES)

**SPAIN:**  
 Ground Segment  
 Operations  
 Instrumentation  
 (ISSIS)

**GERMANY:**  
 FUV Detectors



Lavochkin  
 Lytkarino





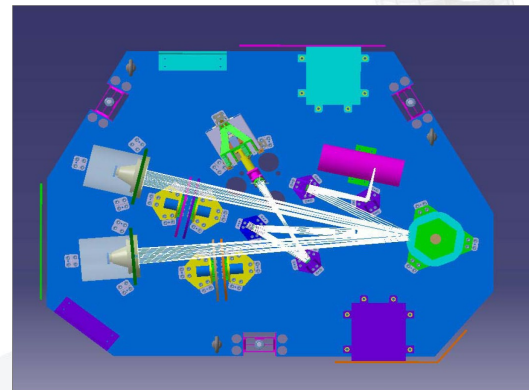
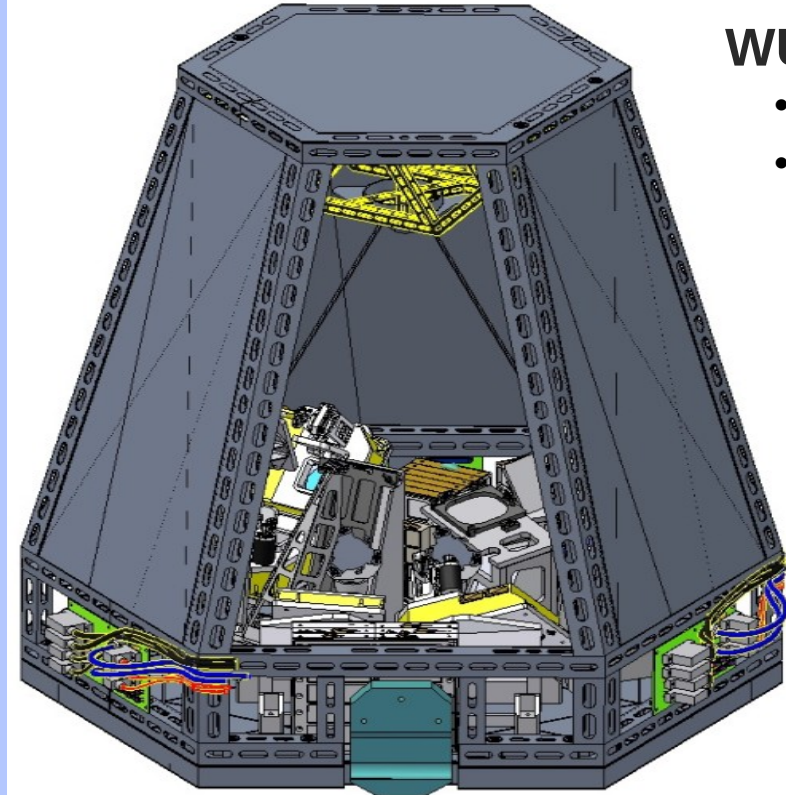


# INSTRUMENTATION

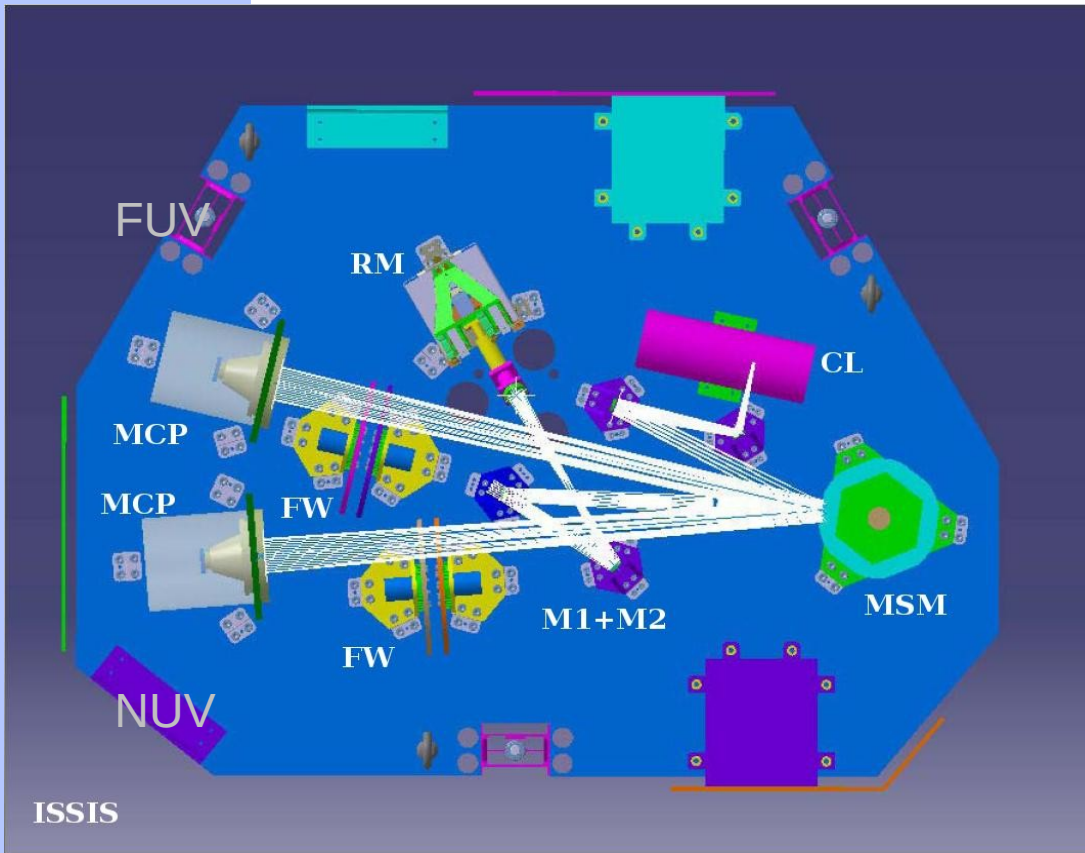


## WUVES: WSO-UV UV SPECTROGRAPHS

- HIRDES: UVES, VUVES,  $R \approx 55,000$
- LSS,  $R \approx 2500$



## ISSIS: IMAGING AND SLITLESS SPECTROSCOPY INSTRUMENT FOR SURVEYS (PSF < 0.1arcsec ; fov>2arcmin, R=500)



## Canal FUV

Field of view: > 1.2 arcmin

Resolution: <0.1 arcsec

Spectral Range: 1150-1750 Å

Detector : MCP

## Canal NUV

Field of view: > 1.2 arcmin

Resolution: <0.1 arcsec

Spectral range: 1850-3200 Å

Detector : MCP

## SLITLESS SPECTROSCOPY

R=500

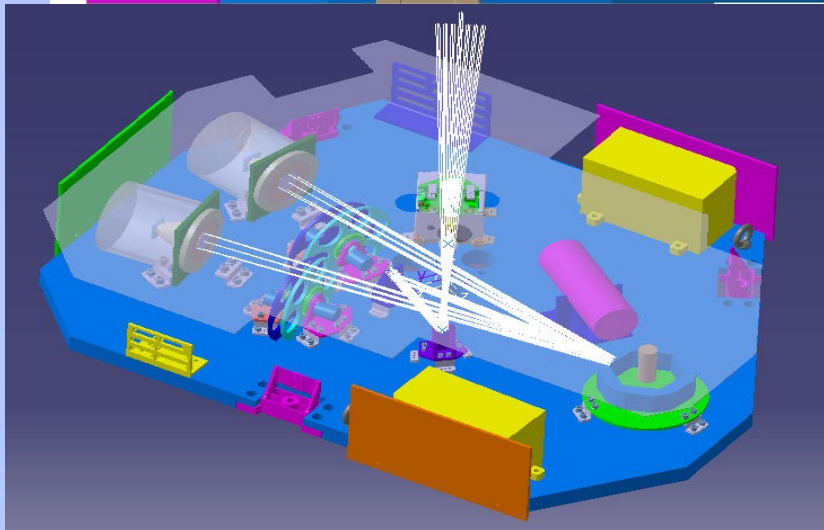
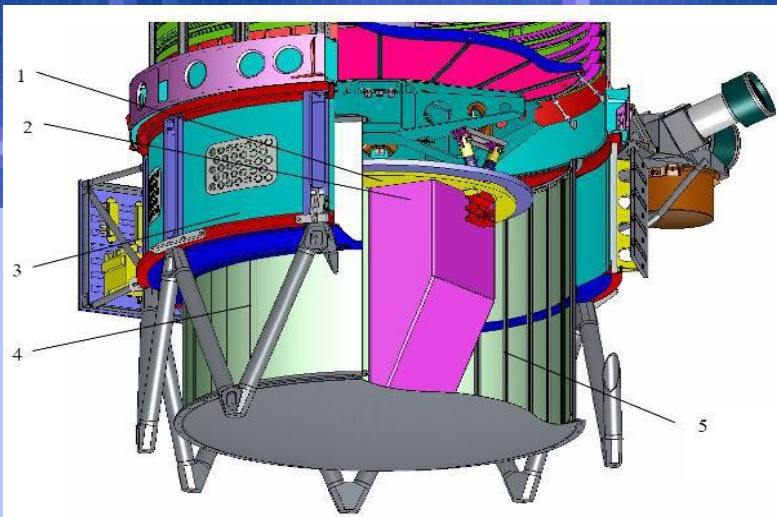
(BOTH CHANNELS)



# ISSIS OPTICAL DESIGN



	<b>FUV channel</b>	<b>NUV channel</b>
Spectral range	1150 – 1750 Å	1850 – 3200 Å
Field of view: imaging	70 arcsec x 75 arcsec	70 arcsec x 75 arcsec
Field of view: spectroscopy	36 arcsec x 65 arcsec	31 arcsec x 61 arcsec
Pixel scale	0.036 arcsec	0.036 arcsec
Scale ratio	< 7%	< 7%
Distortion	< 1%	< 1%
Number of reflections	4	4
Temporal resolution	40 ms	40 ms
Detector type	CsI MCP	CsTe MCP
Detector diameter	40 mm	40 mm
Peak throughput (imaging)	~1300 Å	~2500 Å
Slitless spectroscopy resolution	R = 500	R = 500

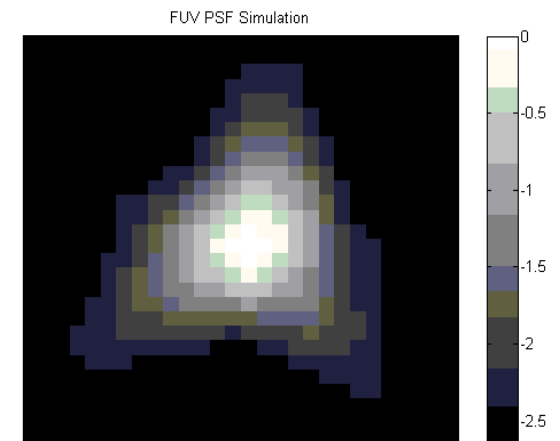
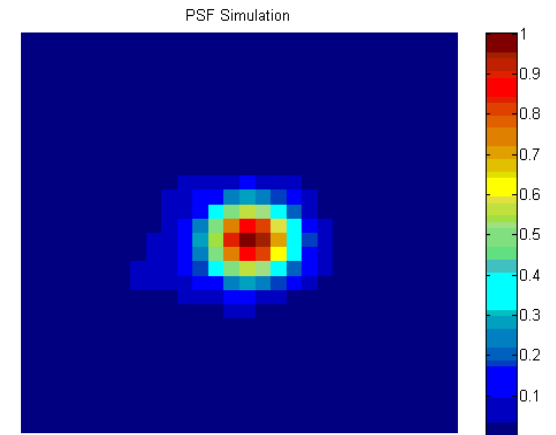


140cm Diameter  
17.3cm height  
61.5 kg on optical bench  
75 kg full mass

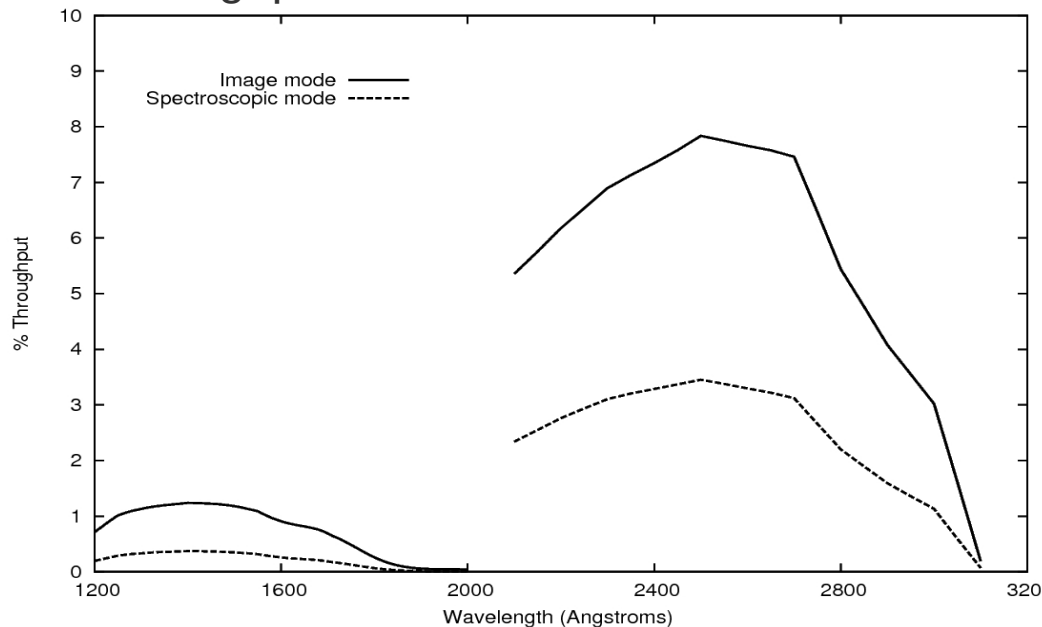


# SIMULATIONS OF ISSIS PSF in the far ultraviolet (FUV) channel (1150-1750Å spectral range).

Pixel-equivalent  $\sim 0.''04$

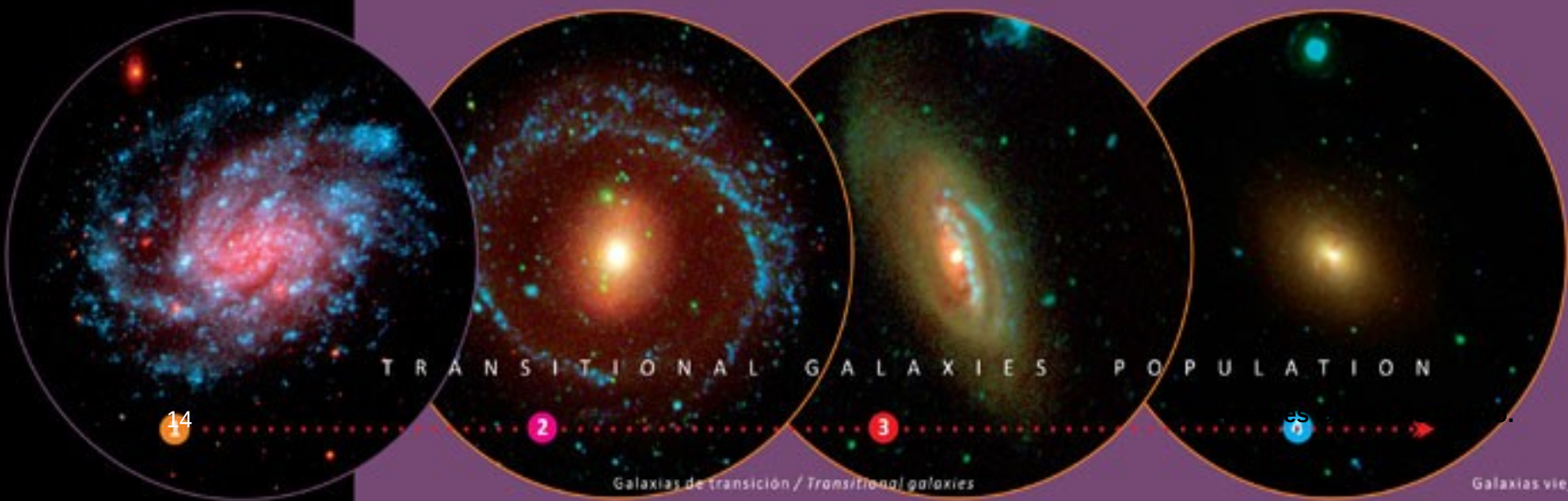
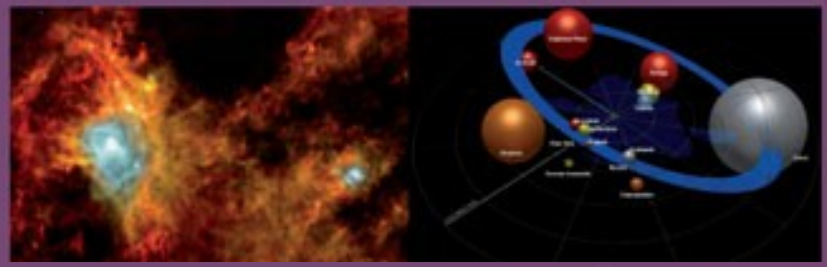


## Throughput





Cinturón de Gould - Gould's belt



14

2

3

4

- N
- M
- N
- N



.ISSIS key programs are:

- High resolution mapping of weak and nebulous sources such as microjets, star forming galaxies or gravitational lenses.
- The mapping of UV emission lines in extended emission nebulae (H II regions, supernovae remnants, planetary nebulae) and jets (from protostars or from compact objects).
- Efficient spectroscopy of weak sources: from transiting planets to Active Galactic Nuclei and star forming galaxies at moderate redshifts ( $0.5 < z < 1.5$ ).



- Resolution of  $R \sim 500$  to study the absorption of the stellar radiation by transiting planets or to determine the terminal velocity of the radiatively driven winds of O stars in Local Group galaxies.
- Enhancement of the dynamic range with coronagraphs or masks to map faint emission close to bright sources on sub-arcsec scales: from disks to jets or binary components
- Time resolution as short as 40 milliseconds to track the evolution of instabilities in disks around compact sources.

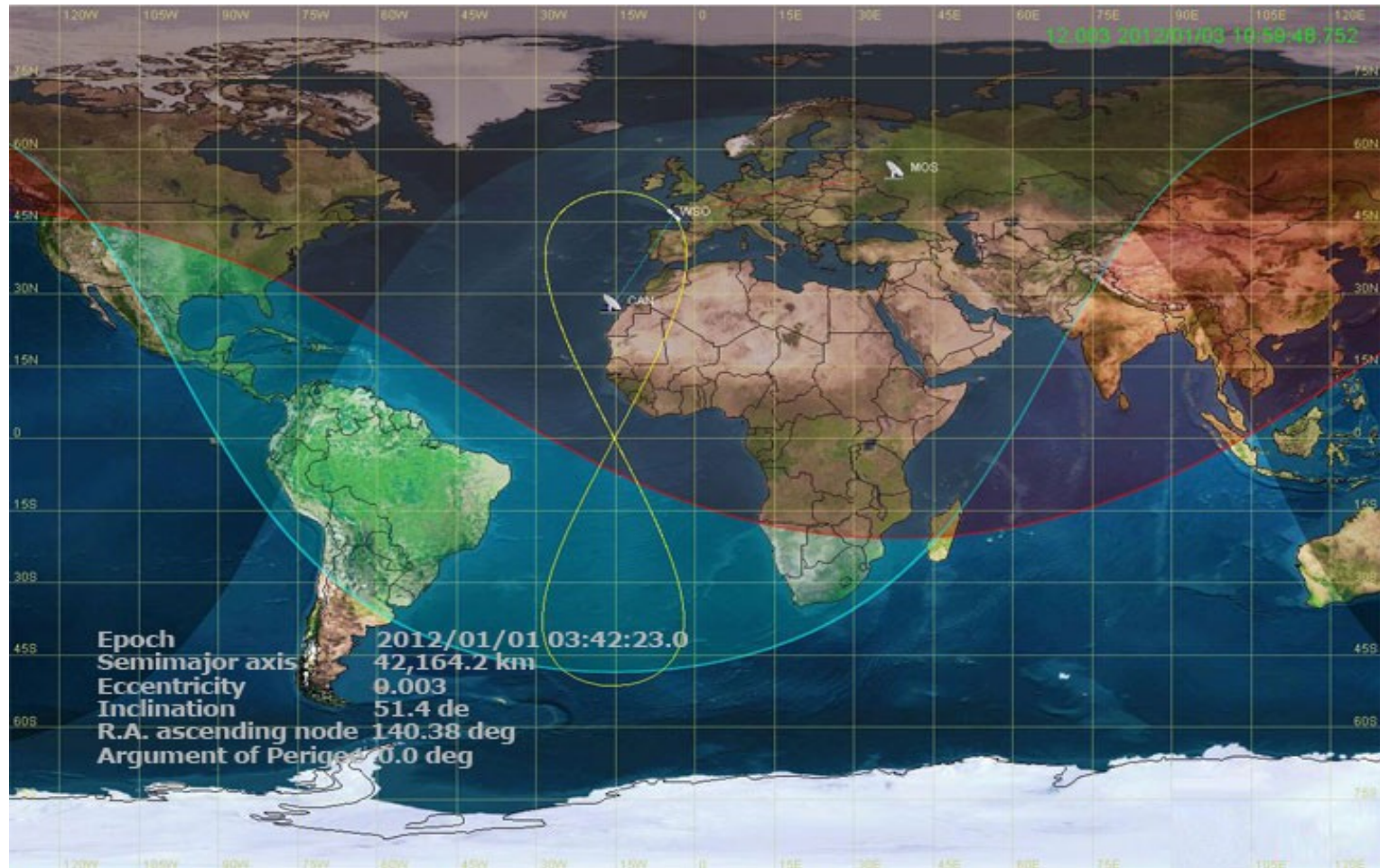




# WSO-UV orbit

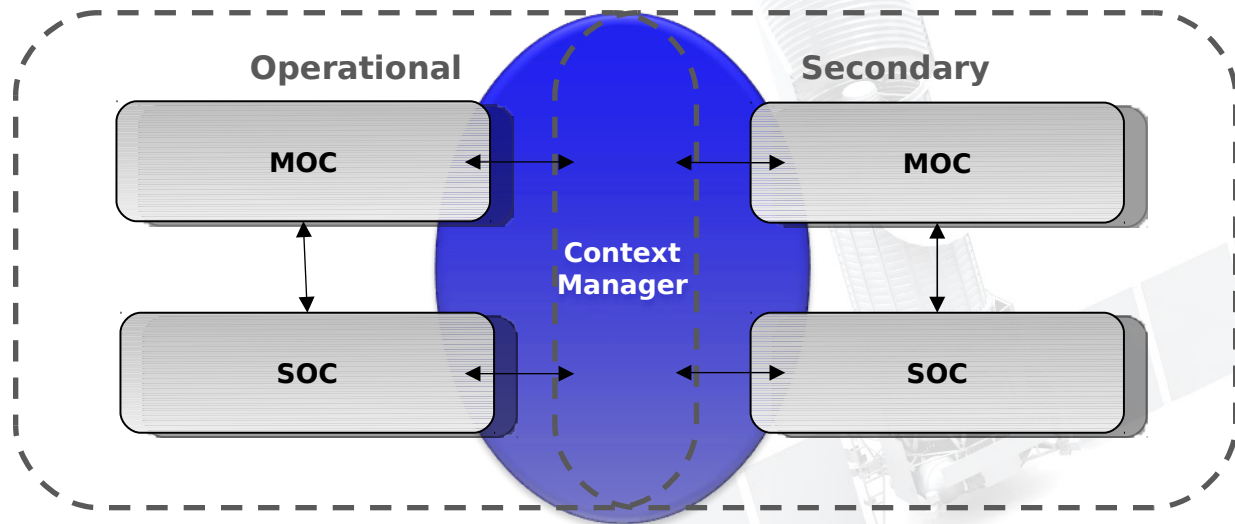


## RUSSIA-SPAIN SHARED OPERATIONS



**Operations Centers:**

**Russia:**  
Moscow  
**Spain:**  
Madrid





# Scientific Program

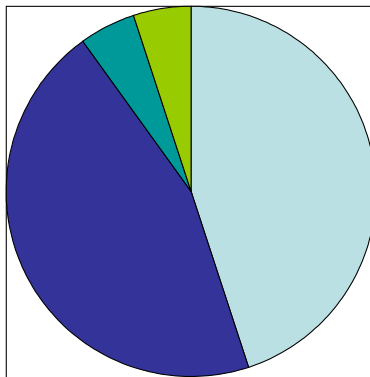


**Core Program (CP):** Fundamental science to be carried by the project team (ends in year 4)

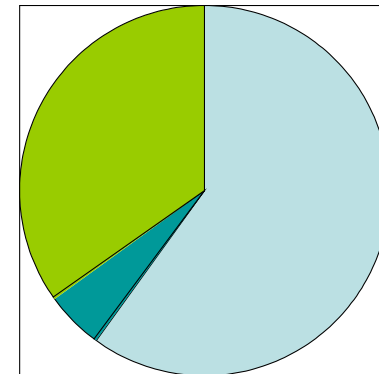
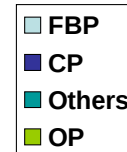
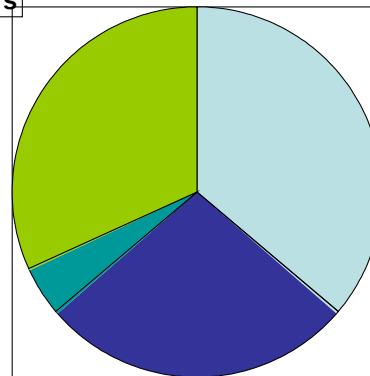
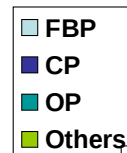
**Funding Bodies Program (FBP):** Guaranteed Time to the countries funding the project

**Open Program (OP):** Open program to the world wide scientific community

Año 1



Año 2





**WSO-UV**  
Mission management

**WSO-UV GS**  
Operation Management

**WSO-UV**  
Science Management

**Mission**  
Operation  
Manager

**Science**  
Operation  
Manager

**MCS**  
Coordination

**SW**  
Support

**SCS Uplink**  
Coordination

**FDS**  
Coordination

**SCS downlink**  
Coordination

**SCS Uplink**  
Coordination

Science Program  
Instruments Teams  
Scientific Community  
Science Archive  
Analysis System

**Communication**  
Coordination

**MOC**

**SCS downlink**  
Coordination

**User Science**  
Support


**User Science**  
Support



# WSO-UV PLANNING (12072012)



TESTS S.T.M.	NoV 2012
TESTS R.P.S.	Nov 2012
CDR	Dec 2012
EQM	Mar 2013
AO – Core Programme	May 2013
Evaluation Core Programme	Dec 2013
ISSIS delivery	June 2014
Launch	Nov 2015

A faint, grayscale illustration of a satellite with a cylindrical body and a long boom with solar panels, positioned diagonally across the right side of the slide.



# Thank you!



[www.WSO-UV.es](http://www.WSO-UV.es)  
[wso.inasan.ru](http://wso.inasan.ru)