

smile
LAUNCH KIT



ABOUT SMILE




Smile will give humankind its first complete look at how Earth reacts to streams of particles and bursts of radiation from the Sun.

By scrutinising Earth's response to the solar wind, Smile will improve our understanding of solar storms, geomagnetic storms and the science of space weather.

Smile stands for Solar wind Magnetosphere Ionosphere Link Explorer. It is a joint mission between the European Space Agency (ESA) and the Chinese Academy of Sciences (CAS).

DISCOVER SMILE
through this series of
INFOGRAPHICS

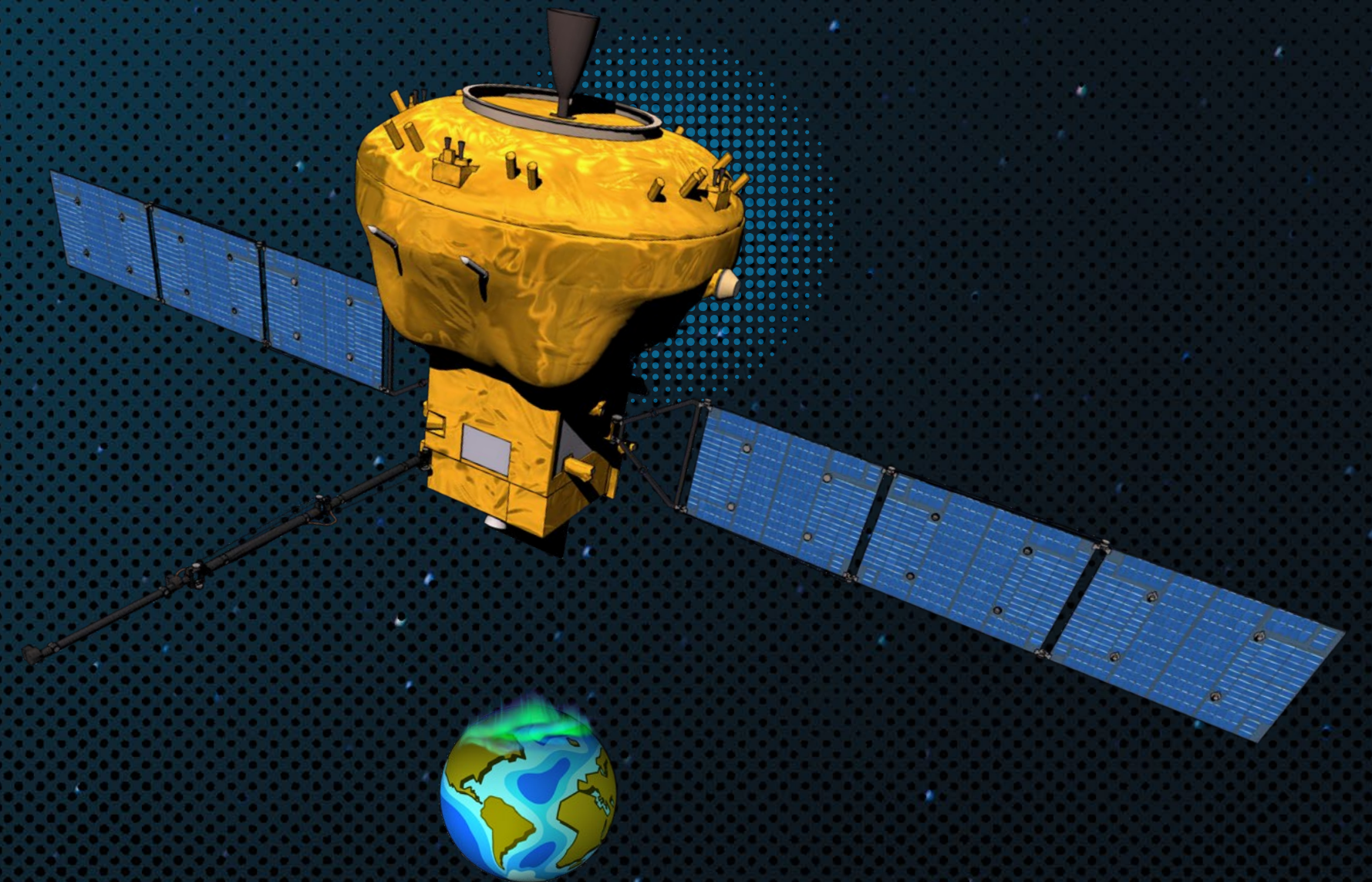
ABOUT THIS MEDIA KIT

This **interactive media kit** is designed especially for media covering the Smile mission. Navigate between pages from the contents page or with the arrows    at the bottom of each page.

Click on the symbol  to directly access the **infographic** download page.

Click on the symbol  to **find out more**.

Links to recommended images, videos and animations are provided towards the end of this media kit.



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SMILE IN NUMBERS



121 000 km
above the north pole



45
continuous hours of observing the
northern lights per two-day orbit



14

European countries involved in developing
Smile's payload module and X-ray camera



>250

European and Chinese
scientists

THE 1ST SPACECRAFT TO:

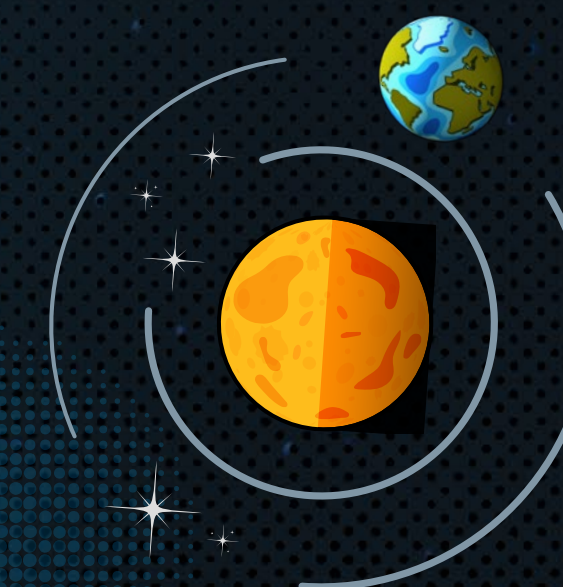
- Make detailed and long-running X-ray observations of Earth's magnetic field
- Watch the northern lights non-stop for 45 hours at a time
- Be jointly selected, designed, implemented, launched and operated by ESA and China

130 million
euros invested by ESA

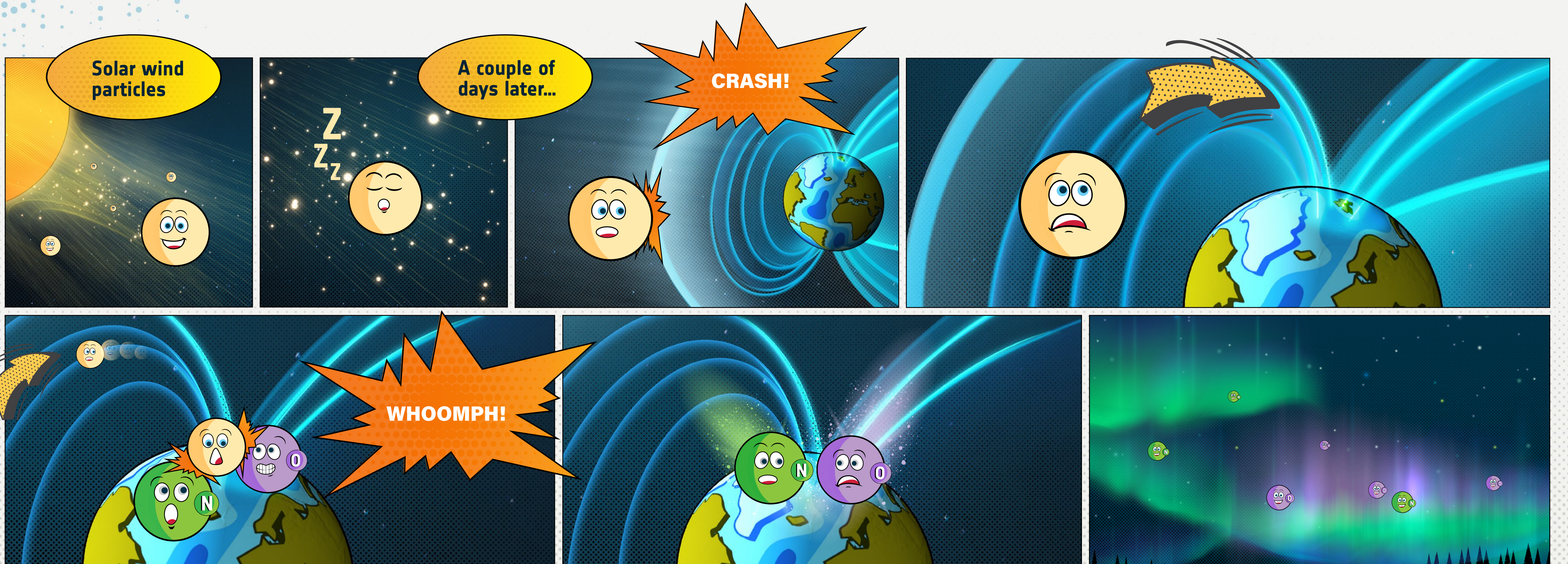


4
instruments

3
years of science
(planned mission lifetime)



THE SUN'S THREAT TO EARTH



TOP THREE MYSTERIES SMILE WILL SOLVE



1



What happens where the solar wind meets Earth's magnetic shield?

2



How can we predict the most dangerous magnetic storms earlier?

3

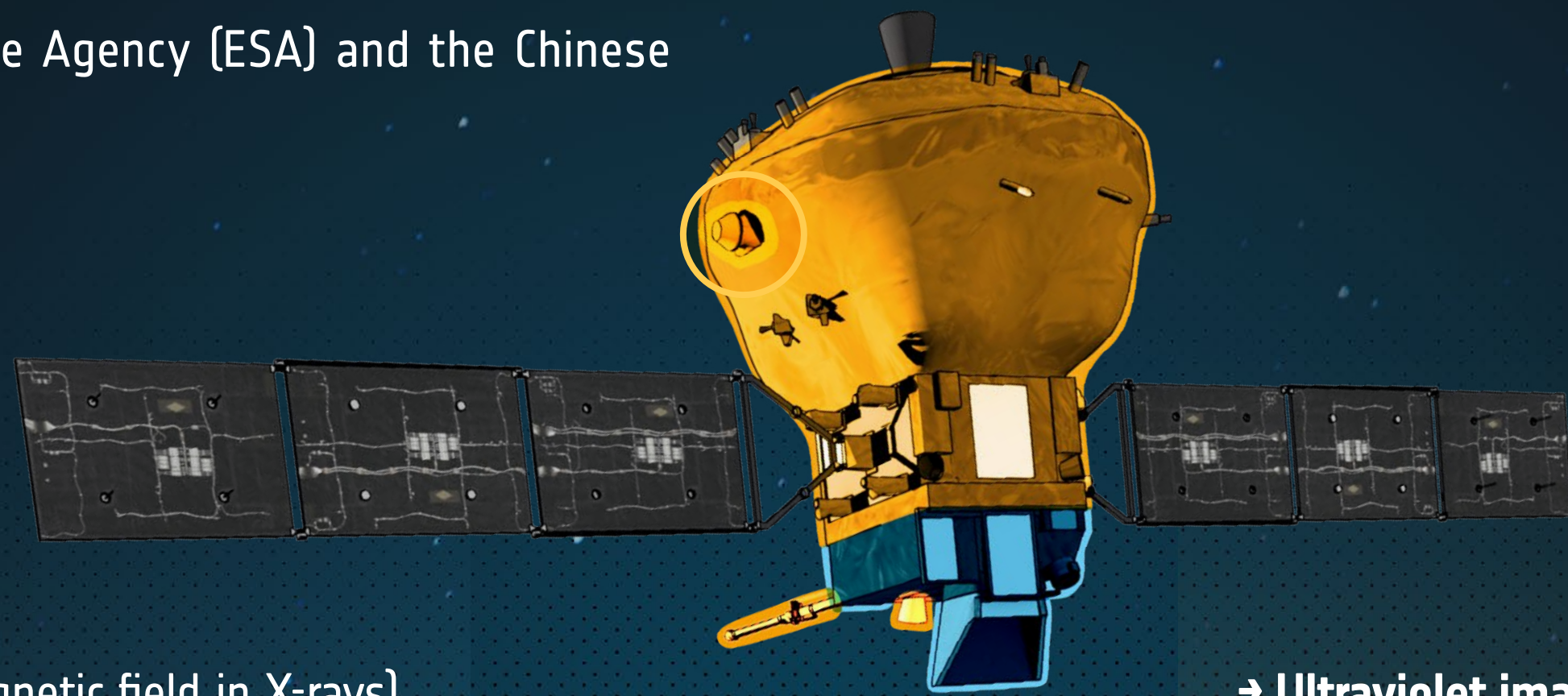


What causes magnetic glitches on the dark side of Earth?



A GLOBAL ANSWER TO A GLOBAL QUESTION

Smile is a joint mission between the European Space Agency (ESA) and the Chinese Academy of Sciences (CAS).

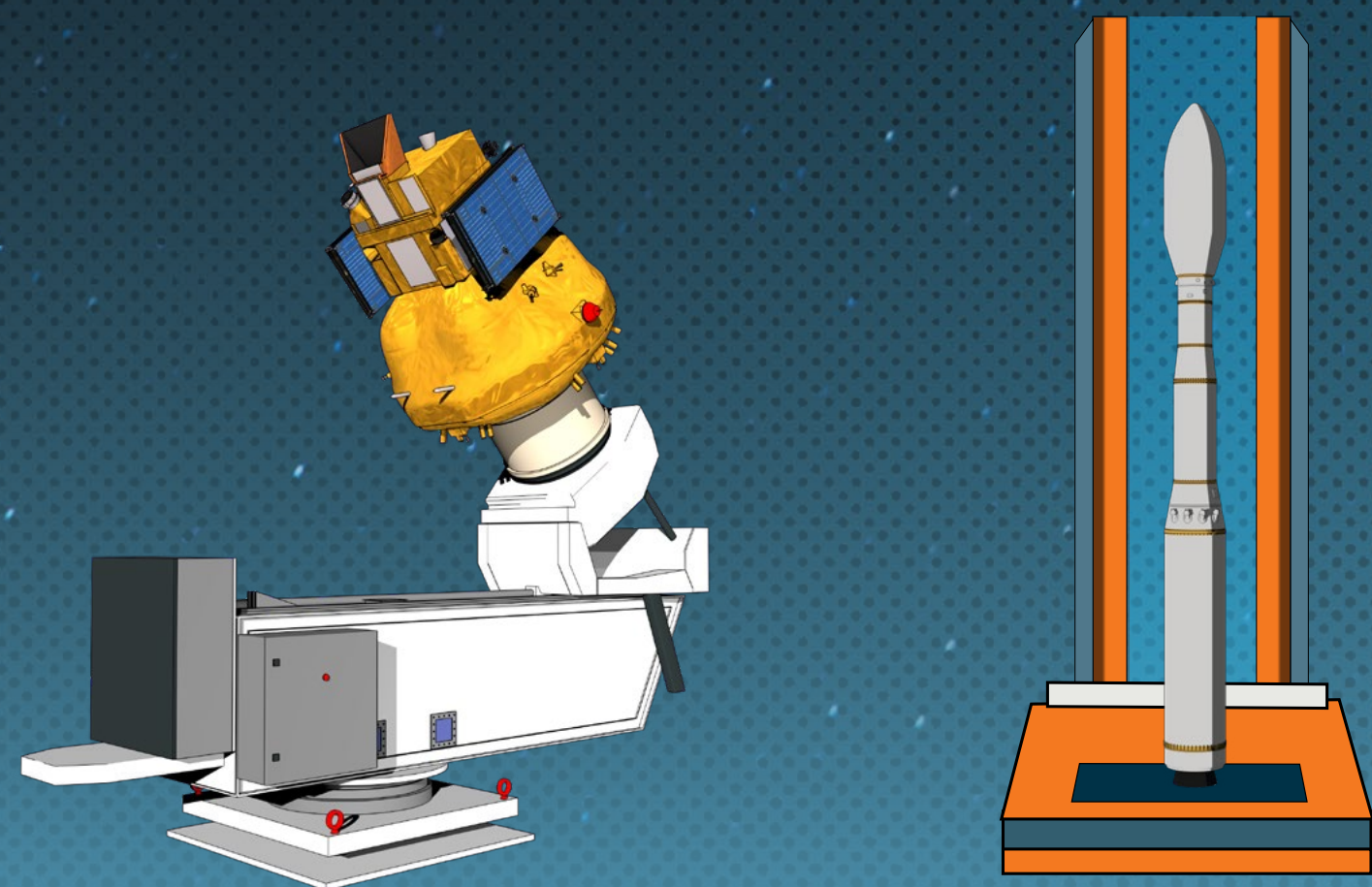


**ESA
RESPONSIBILITY**

**CAS
RESPONSIBILITY**

- **Soft X-ray imager instrument** (imaging Earth's magnetic field in X-rays)
- **Payload module** (carrying three of the four science instruments)
- **Integration & test facilities** (at ESA's technical heart in the Netherlands)
- **Vega-C rocket** (launching from Europe's Spaceport, French Guiana)

- **Ultraviolet imager*, Magnetometer and Light ion analyser instruments**
- **Platform** (carrying one science instrument, as well as everything else needed for functioning, e.g. power and steering)
- **Assembly, integration and testing** (at ESTEC)
- **Operations in space***



Both partners are involved in all stages of mission development, launch and operations. Each has its own list of key responsibilities.



*Significant contributions from ESA

SMILE'S SCIENCE TOOLBOX



Smile will reveal the interaction between the solar wind and Earth using four unique instruments. Each will collect a vital puzzle piece of information that, when combined with information from the other three instruments, will reveal our magnetosphere in a whole new light.

First camera to record the northern lights for 45 hours at a time



Ultraviolet aurora imager (UVI)

Led by CAS, contributions from ESA

Recording the northern lights to see how the interaction between the solar wind and the magnetosphere influences the auroras

First camera to take detailed, long-running X-ray images of Earth's magnetic field



Soft X-ray imager (SXI)

Led by ESA

Photographing the magnetosphere to see how Earth's magnetic shield defends us against dangers from the Sun.

Light ion analyser (LIA)

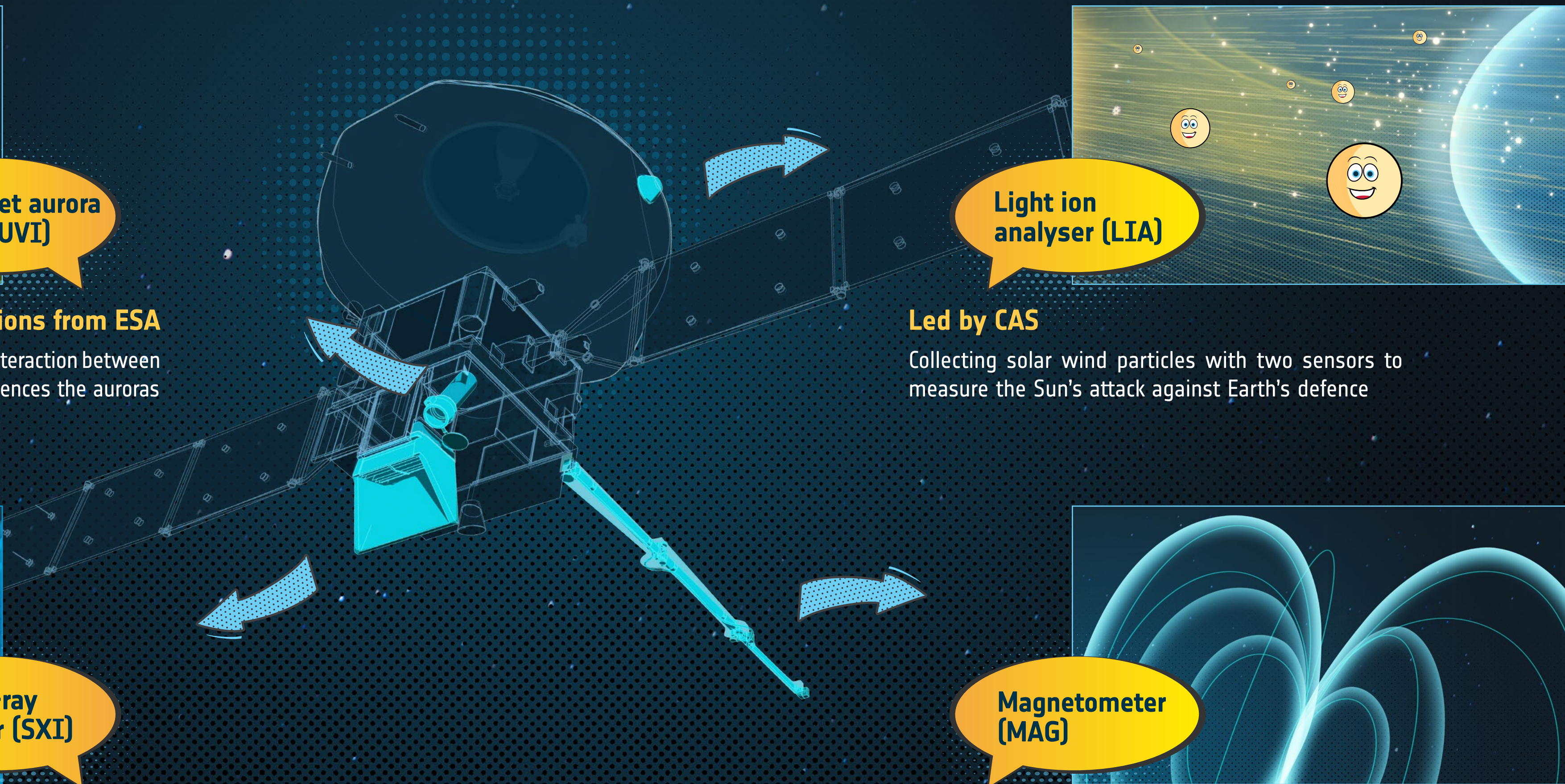
Led by CAS

Collecting solar wind particles with two sensors to measure the Sun's attack against Earth's defence

Magnetometer (MAG)

Led by CAS

Measuring the magnetic field carried by the solar wind, to compare the Sun's attack against Earth's defence



SMILE'S X-RAY VISION

Using its soft X-ray imager (SXI), Smile will be the first-ever mission to make detailed, long-running X-ray observations of Earth's magnetic field. These photos will reveal how Earth defends itself from the solar wind and solar storms.

2
SXI will photograph the X-rays released to map how Earth's magnetic shield moves and changes shape in response to the solar wind.

1
When charged solar wind particles meet neutral particles in Earth's upper atmosphere, they emit X-rays.

3
Meanwhile, Smile's ultraviolet aurora imager (UVI) will take UV photos of the northern lights.

SXI&UVI IMAGES

By comparing the SXI and UVI images, we will get our first-ever simultaneous view of how the interaction of the solar wind with Earth's magnetic field creates the auroras



SXI: THE FACTS

- Smile's largest instrument
- X-ray telescope with a wide field of view
- The interaction between solar wind and neutral particles produces mostly soft (low-energy) X-rays
- Optical technology inspired by lobsters' eyes
- Lightweight, well-established, cost-efficient X-ray focusing technique
- Largest CCDs ever flown in space, cooled to -120 °C
- Developed and built by the University of Leicester (UK) on behalf of ESA

SMILE'S ULTRAVIOLET VISION

The solar wind leads to 'magnetic storms' in Earth's magnetosphere that ultimately cause the auroras. Using its ultraviolet imager (UVI), Smile will be the first-ever mission to take ultraviolet photos and videos of the northern lights for 45 hours at a time.

1

Smile's special orbit will take it far above the north pole. It will look down on the northern lights while Earth rotates below.

2

Thanks to its ultraviolet vision, UVI will see the northern lights on both the day and night sides of Earth.

3

Meanwhile, Smile's soft X-ray imager (SXI) will photograph the edge of Earth's magnetic field.

SXI&UVI IMAGES

Magnetic storms usually last two to three days. With Smile's 45-hour observations, we will get a better idea of how they lead to auroras.



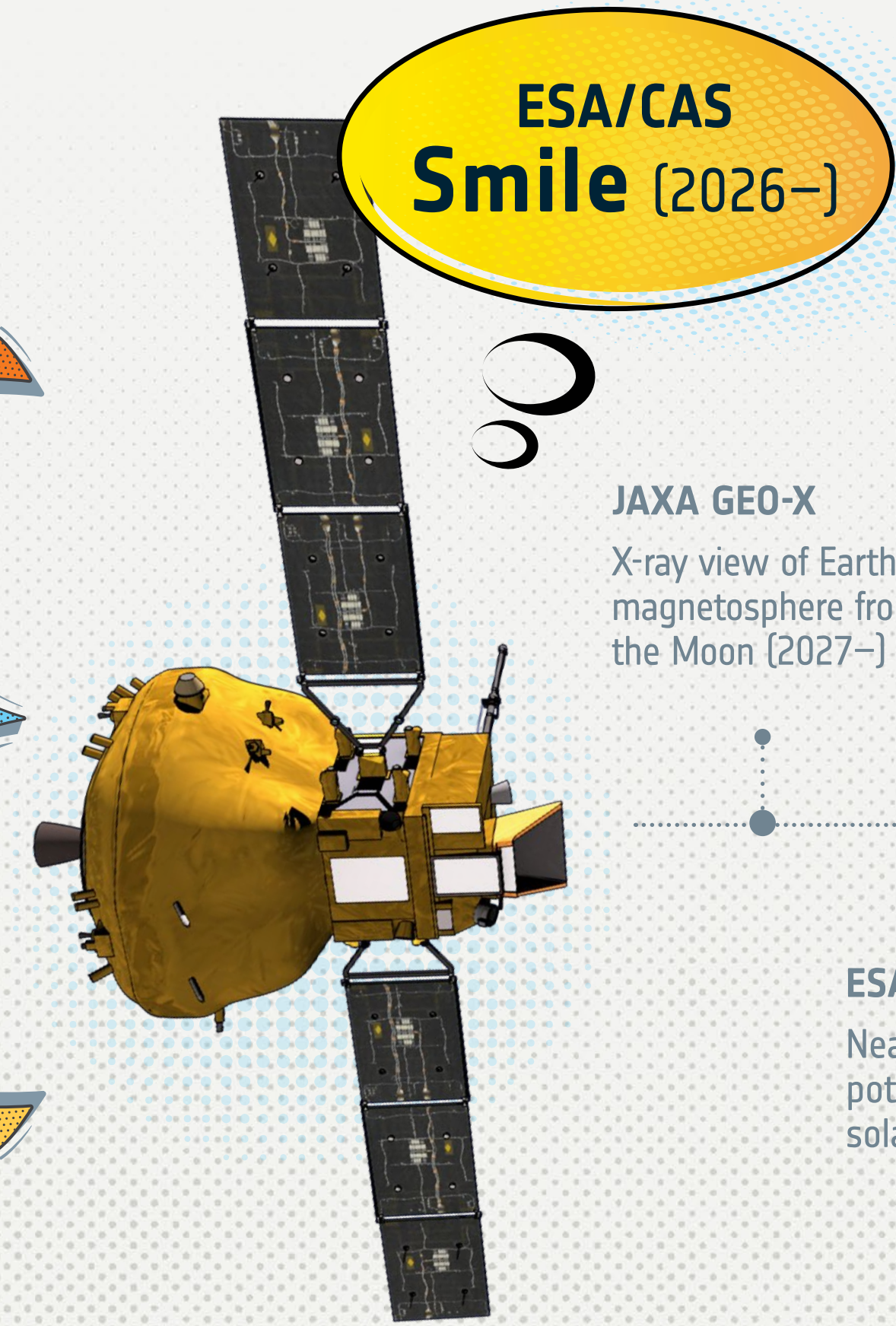
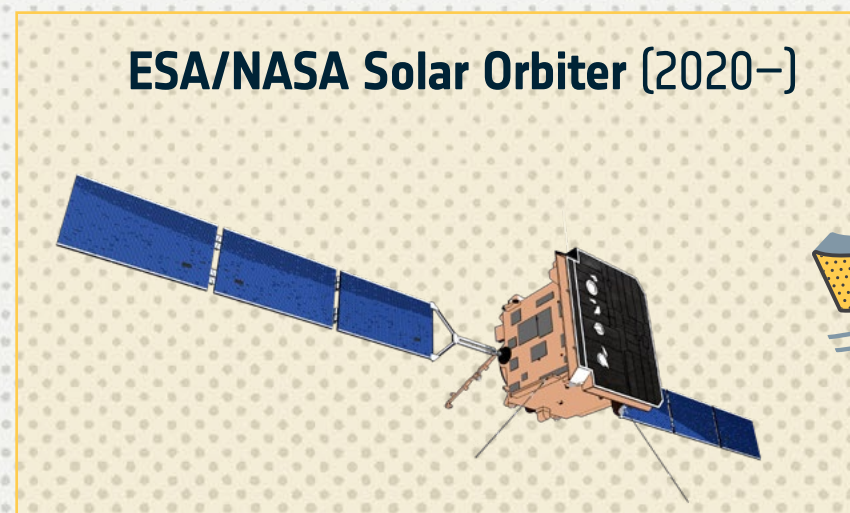
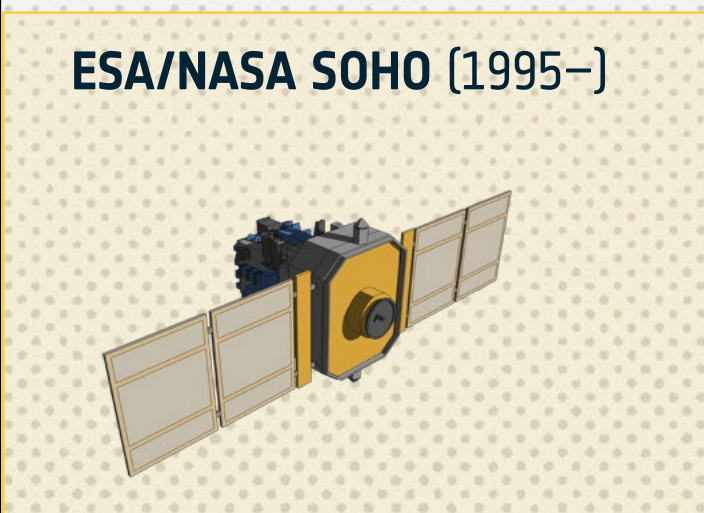
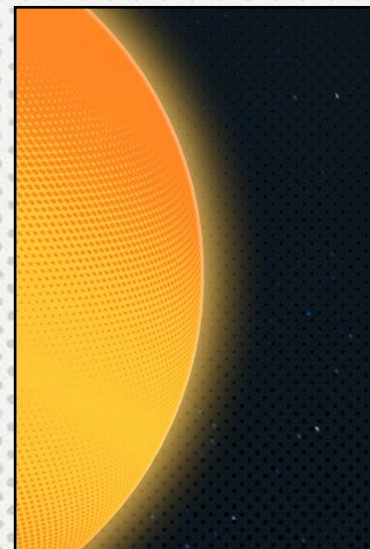
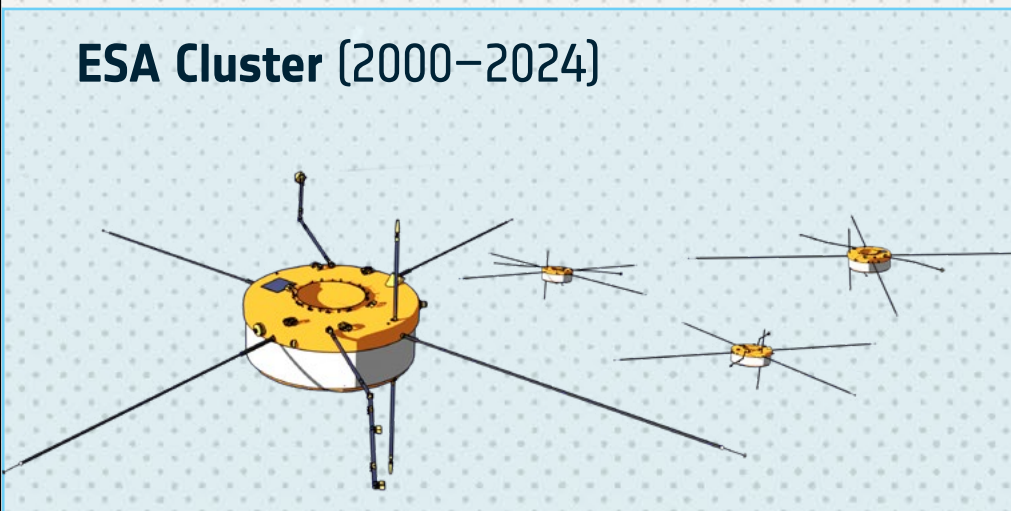
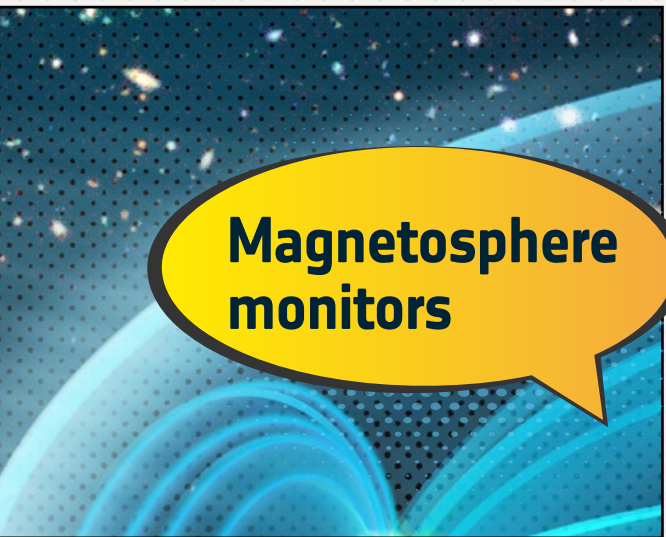
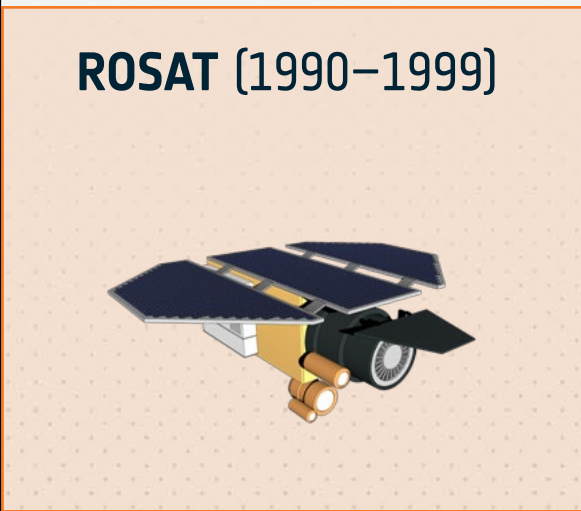
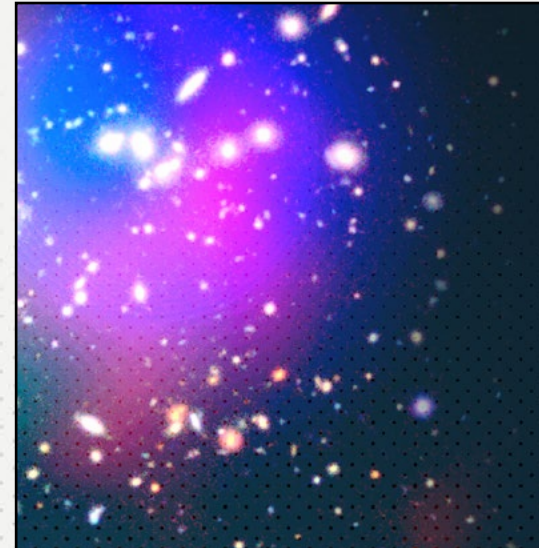
UVI: THE FACTS

- First images and videos of the full auroral oval since 2008
- Capturing the northern lights for 45 hours at a time (previous record: ~15 hours)
- Filtering ultraviolet 'dayglow' on the dayside of Earth
- Developed by the National Space Science Centre (China), with contributions by ESA

SMILE'S SCIENTIFIC LEGACY



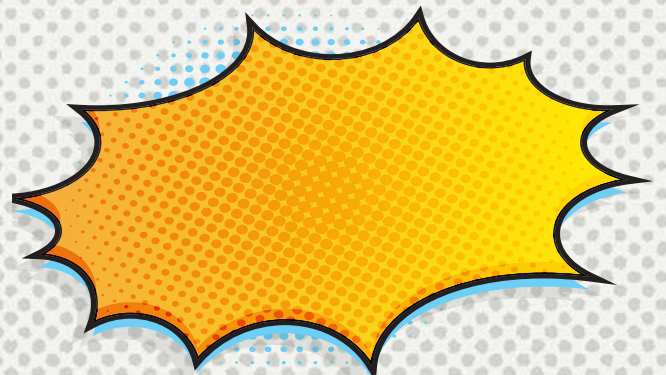
Smile builds on scientific and technological heritage from previous space science missions. It will collect data that complements past and current missions. And it is already paving the way for future space weather research.



JAXA GEO-X
X-ray view of Earth's magnetosphere from the Moon (2027–)

ESA Aurora constellation
Monitoring the auroras and geomagnetic (sub-)storms

ESA Vigil
Near real-time data on potentially hazardous solar activity (2031–)

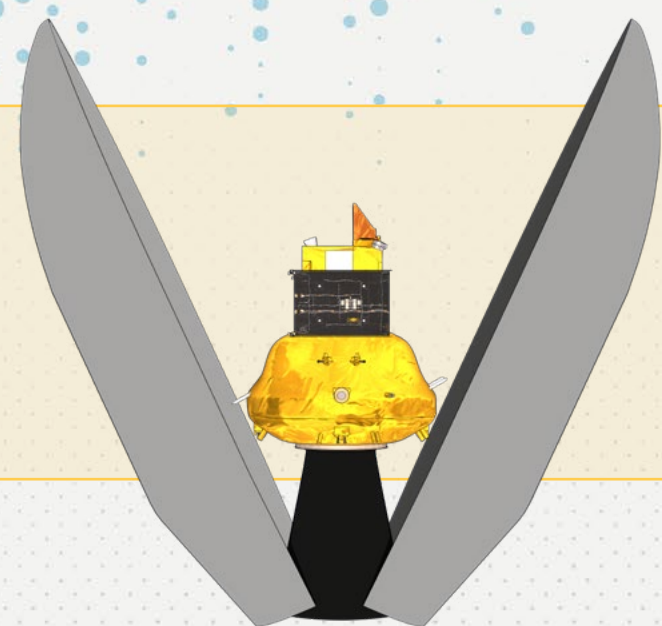


LAUNCH TIMELINE



VEGA-C: A WORLD-CLASS LAUNCHER

Smile will launch into space on a Vega-C, a single-body rocket that weighs 210 tonnes on the launch pad.

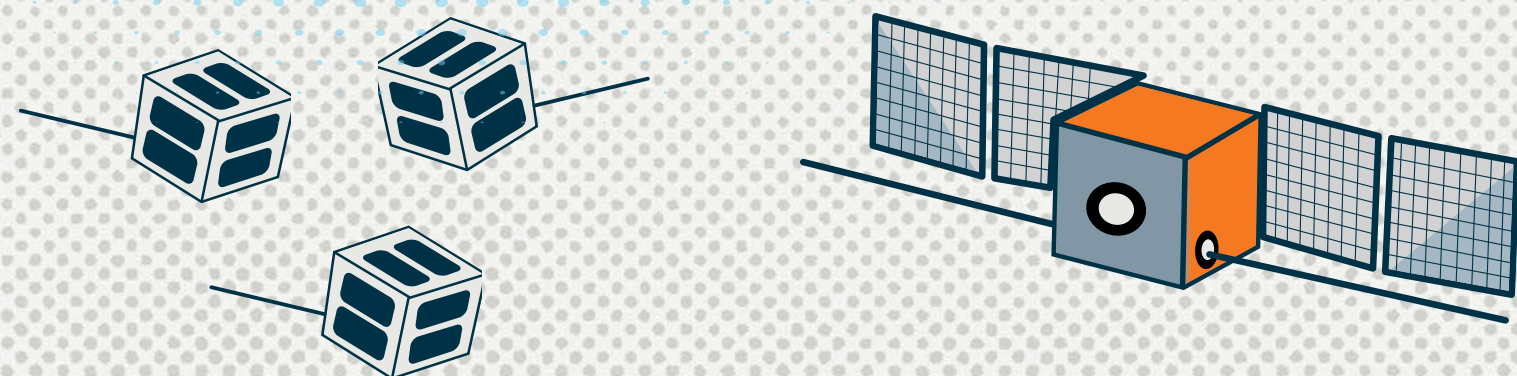


The **fairing** – a nosecone that splits vertically into two and is over 9 m tall. Made of carbon fibre this structure protects the satellites as they ascend to space.

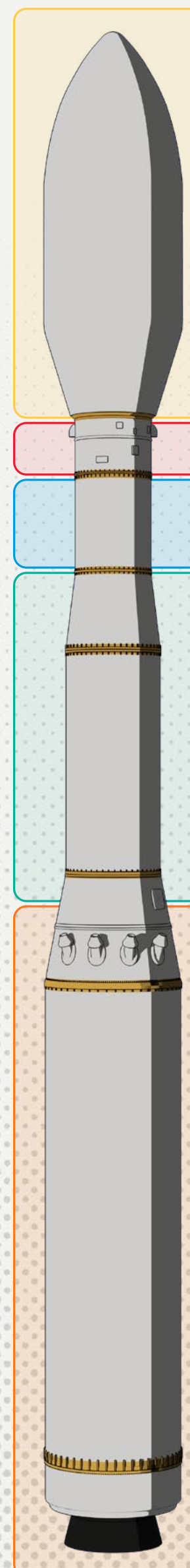
The **third stage** Zefiro-9, was used on Vega-C's predecessor Vega and burns through 10 tonnes of solid propellant.

The **second stage** is powered by the new Zefiro-40 motor and uses 36 tonnes of solid propellant, providing an average thrust of 1100 kN.

Vega-C can accommodate mixed cargo shapes and sizes, ranging from CubeSats to a large single payload like Smile.



3.4 m



34.8 m

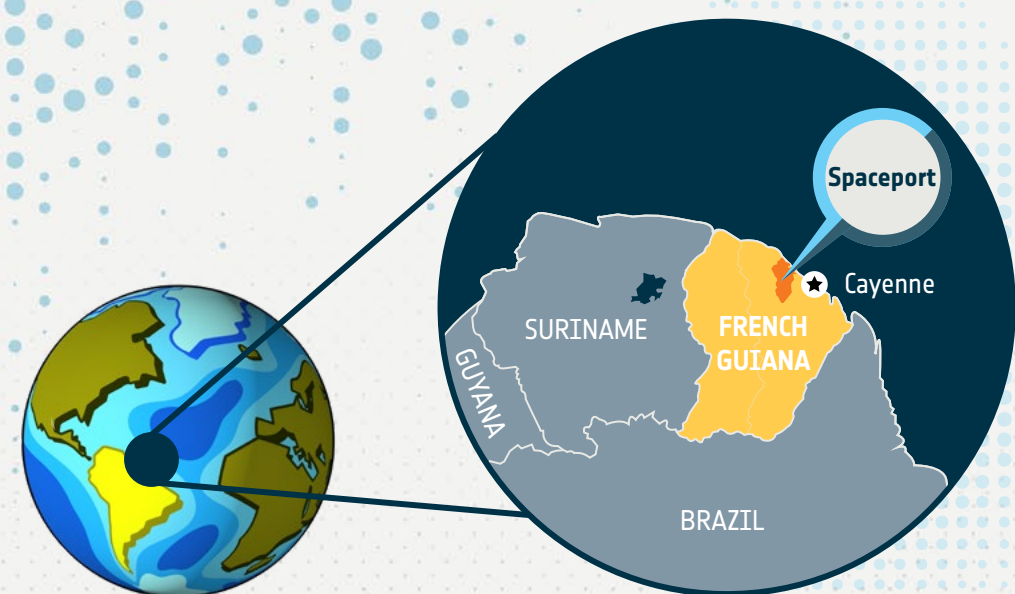


The **fourth stage**, Attitude Vernier Upper Module or AVUM+, orients and positions the payloads in space allowing Vega-C to reach a range of orbits and deliver multiple payloads. It holds 740 kg of propellant and provides an average thrust of 2.45 kN.

The **first stage** P120C motor is one of the largest carbon-fibre solid-propellant rocket motors ever built in one piece. The P120C is also used as the boosters on the Ariane 6 rocket.

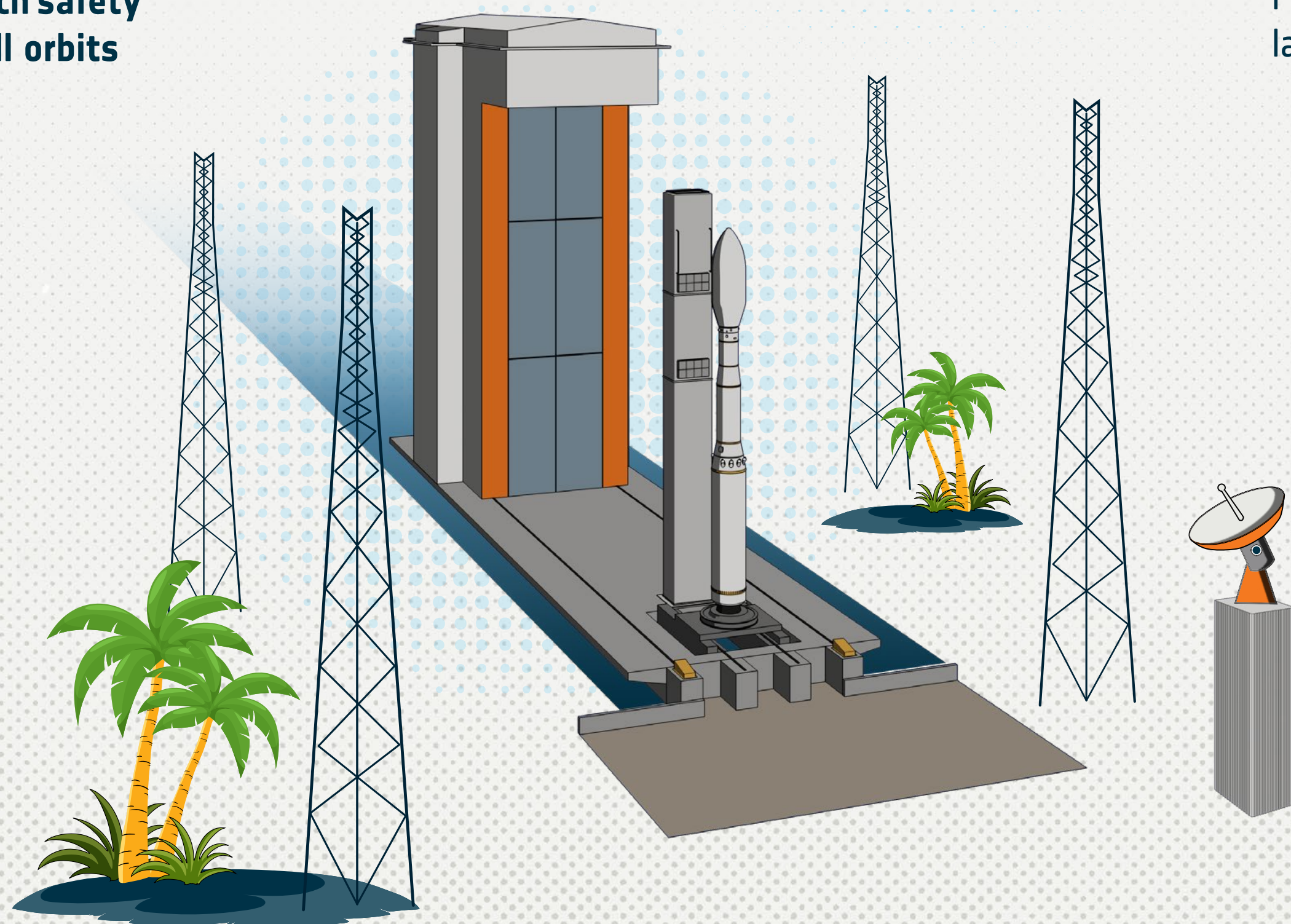


EUROPE'S SPACEPORT IN FRENCH GUIANA



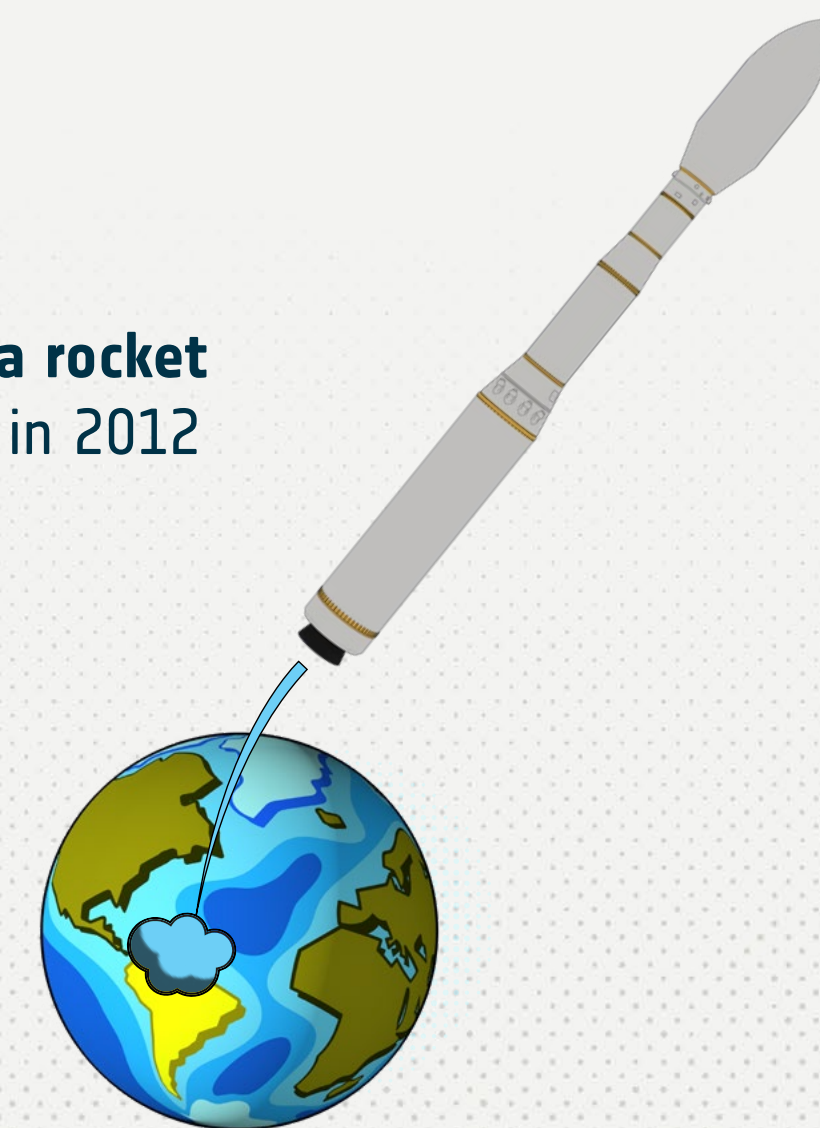
Open sea to the north and east means **maximum launch safety** and **great access to all orbits**

With **690 km²** jungle, the Spaceport is a large natural area hosting an abundance of wildlife and plants



**VEGA-C
LAUNCH ZONE**

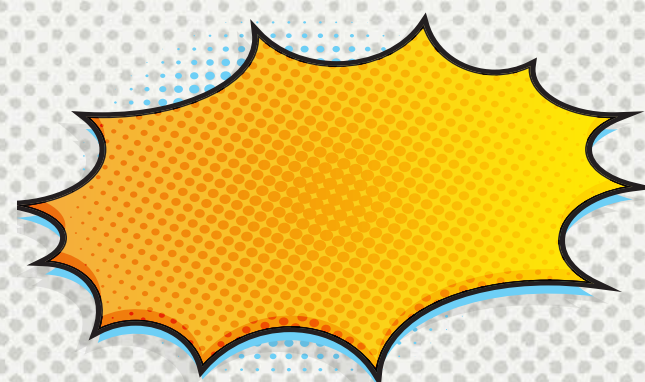
First **Vega rocket** launched in 2012



25+ Vega launches from French Guiana

Operational since **1968**

- High efficiency, safety and reliability** through European teamwork
- No risk** of cyclones or earthquakes



Customers from **all over the world**

EUROPEAN PARTNERS

As a collaboration between the European Space Agency and the Chinese Academy of Sciences, Smile is a truly international endeavour, involving companies and research centres across Europe and around the world. The prime contractor for the Smile payload module is Airbus.

Austria

- **Spacelock** (SXI hold down release mechanism)
- **Austrian Academy of Sciences** (SXI electronics box)
- **University of Vienna** (SXI software)

Belgium

- **Centre Spatial de Liège** (UVI mirror coating)

Denmark

- **Terma** (SXI electronics box power supply unit)

France

- **Winlight System** (UVI mirrors)
- **Syrlinks** (Payload module X-band transmitter)

Germany

- **German Aerospace Center** (O'Higgins ground station)

Italy

- **Avio** (Vega-C rocket)

Luxembourg

- **Euro-Composites** (Payload module structure)

The Netherlands

- **European Test Services** (test facilities/services)

Norway

- **University of Bergen**
(SXI radiation shutter mechanism and electronics)

Spain

- **Airbus** (Payload module)
- **Instituto Nacional de Técnica Aeroespacial** (SXI detector plane assembly)
- **Airbus Crisa** (Payload module extended control unit)
- **Sener** (Payload module X-band antenna)

Switzerland

- **University of Applied Sciences Northwestern Switzerland**
- **Koegl Space**
- **Space Acoustics**
(all three: SXI thermal subsystem)

United Kingdom

- **Teledyne UK** (SXI CCDs)
- **Thales Alenia Space-UK** (SXI baffle)
- **Photek** (UVI intensifier)
- **University of Leicester** (SXI lead)
- **RAL Space** (SXI proto-flight model testing)
- **Mullard Space Science Laboratory, University College London** (SXI front-end electronics, LIA calibration)
- **Open University** (SXI CCD testing)
- **CGI** (Payload module application software)



This map highlights the largest European contributions to the mission. All ESA Member States contribute indirectly through the agency's Science Programme.

KEY:

- Funded by ESA directly
- Funded through ESA PRODEX scheme
- Funded by UK Space Agency
- Funded by Ministry of Economy and Competitiveness
- Airbus sub-contractor



MEET THE ESA TEAM

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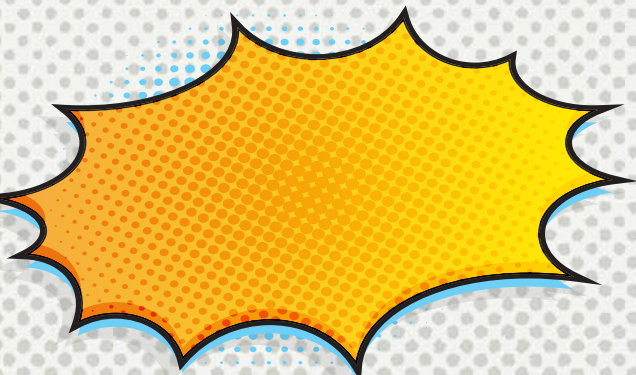
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THE EUROPEAN SPACE AGENCY

Established in 1975, ESA now has 23 Member States and cooperates with many others. These countries are home to more than 500 million European citizens. If you're one of them, then we're working for you.

Our mission is the peaceful exploration and use of space for the benefit of everyone. We watch over Earth, develop and launch inspiring and unique space projects, fly astronauts and push the boundaries of science and technology, seeking answers to the big questions about the Universe.

We are a family of scientists, engineers and business professionals from all over Europe, working together in a diverse and multinational environment.

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