solar orbiter

→ LAUNCH MEDIA KIT

#SolarOrbiter #WeAreAllSolarOrbiters

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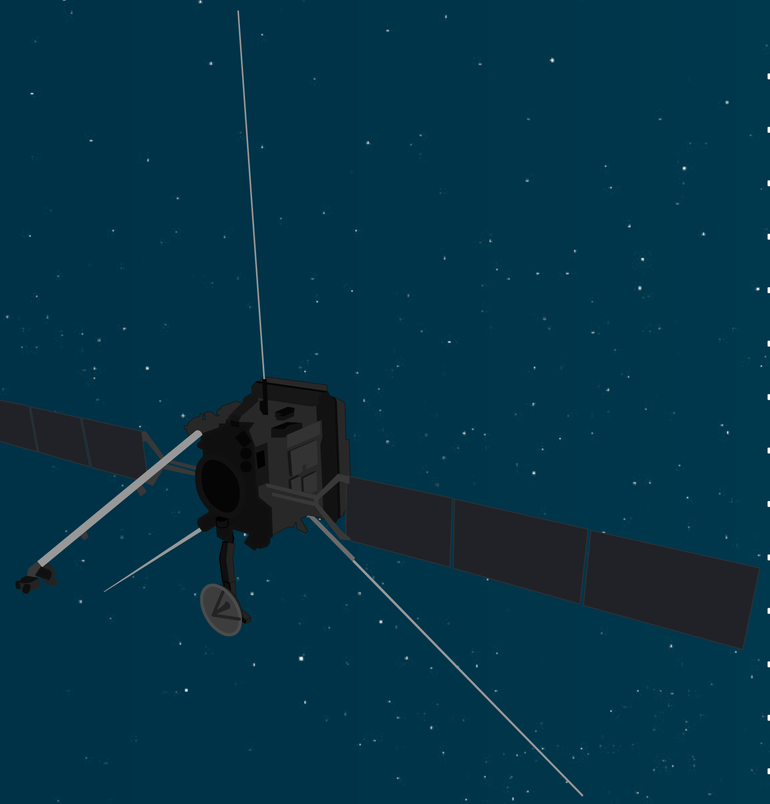
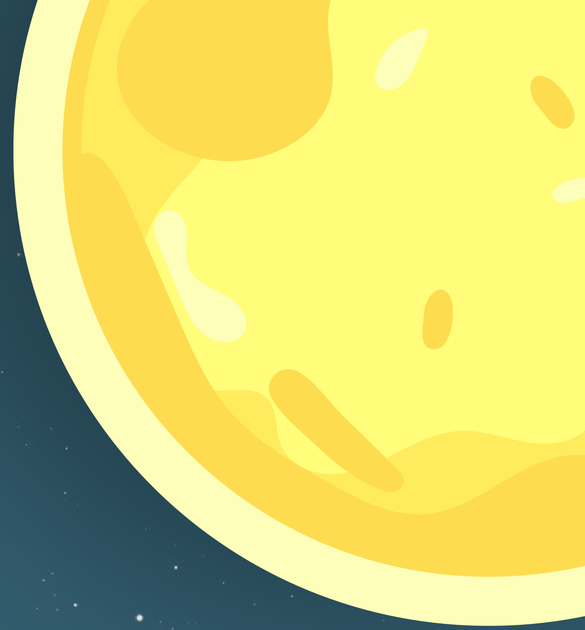




INTRODUCTION

Solar Orbiter is scheduled to launch on an Atlas V 411 rocket from Cape Canaveral in Florida, USA, at 05:03 CET on 10 February 2020 (23:03 EST on 9 February).

Mission overview

Solar Orbiter's mission is to perform unprecedented close-up observations of the Sun and from high-latitudes, providing the first images of the uncharted polar regions of the Sun, and investigating the Sun-Earth connection.

The spacecraft carries 10 state-of-the-art instruments. Remote sensing payloads will perform high-resolution imaging of the Sun's atmosphere – the corona – as well as the solar disc. Other instruments will measure the solar wind and the solar magnetic fields in the vicinity of the orbiter. This will provide unprecedented insight into how our parent star works in terms of the 11-year solar cycle, and how we can better predict periods of stormy space weather.

Solar Orbiter will take just under two years to reach its initial operational orbit, taking advantage of gravity-assist flybys of Earth and Venus to enter a highly elliptical orbit around the Sun.

Solar Orbiter follows in the legacy of missions such as Ulysses (1990-2009) and SOHO (1995-present) and will also provide complementary datasets to NASA's Parker Solar Probe that will allow more science to be distilled from the two missions than either could achieve on their own.

Exploring the Sun

Solar Orbiter will address big questions in space science to help us understand how our star creates and controls the giant bubble of plasma – the heliosphere – that surrounds the whole Solar System and influences the planets within it. It will concentrate on four main areas of investigation; very broadly:

- **Solar wind:** What drives the solar wind and the acceleration of solar wind particles?
- **Polar regions:** What happens in the polar regions when the solar magnetic field flips polarity?
- **Magnetic field:** How is magnetic field generated inside the Sun and how does it propagate through the Sun's atmosphere and outwards into space?
- **Space weather:** How do sudden events like flares and coronal mass ejections impact the Solar System, and how do solar eruptions produce the energetic particles that lead to extreme space weather at Earth?

Operating in extreme environments

Solar Orbiter must operate for years in one of the most hostile regions of the Solar System. At closest approach, approximately 42 million kilometres from the Sun, it will be at just over a quarter of the distance between the star and our planet, well inside the orbit of inner planet Mercury. This close to the Sun, the spacecraft will be exposed to sunlight 13 times more intense than what we feel on Earth. The spacecraft must also endure powerful bursts of particle radiation from explosions in the solar atmosphere. The spacecraft's heatshield is key to making this mission possible, which can withstand temperatures of 500°C. Small sliding doors with heat resistant windows let sunlight in to the science instruments located directly behind the protective heatshield.

Operations

Solar Orbiter will communicate with Earth via ESA's deep space tracking network, ESTRACK. All operations are conducted by the European Space Operations Centre (ESOC) in Darmstadt, Germany. The Science Operations Centre located at ESA's European Space Astronomy Centre, ESAC, in Villanueva de la Cañada, Spain, will be responsible for science operations planning, and for archiving the mission's data for scientists to use.

Partners

Solar Orbiter is a space mission of international collaboration between ESA and NASA. The spacecraft has been developed by Airbus. Numerous industrial partners and scientific institutes across ESA Member States and the US have contributed to the construction of the spacecraft and the scientific instruments.

About this media kit

This is an interactive media kit. Navigate between pages from the contents page or with the arrows at the bottom of each page. Explore scientific and technological themes of the Solar Orbiter mission through the series of infographics. Roll over the graphic elements to discover hyperlinks to more information on related webpages. Click on the symbol ⬇ to directly access the infographic download page. Links to recommended images, videos and animations are provided towards the end of this media kit. An internet connection is required to access the external webpages.

EVENT PROGRAMME

Provisional schedule at ESA's Space Operations Centre (ESOC), Darmstadt, Germany. All times local CET (Central European Time). Check esa.int/solarorbiter for programme and updates.

10 February

Main media launch briefing

Programme begins one hour before launch.

Experts will present the mission, supplemented with live transmissions from Cape Canaveral including the moment of liftoff. The spacecraft will separate from the launcher around 53 minutes after launch, followed by the announcement of acquisition of spacecraft signal, which will be communicated live from ESOC.

A Q&A session and opportunities for individual interviews will be included in the programme.

The briefing will end approximately one hour after launch with breakfast.

How to get to ESOC

LIVE UPDATES

Webstreaming

ESA will cover the launch live at esawebtv.esa.int starting approximately 30 minutes before launch. Check website for schedule.

Twitter

For live updates throughout the launch period follow @ESASolarOrbiter,

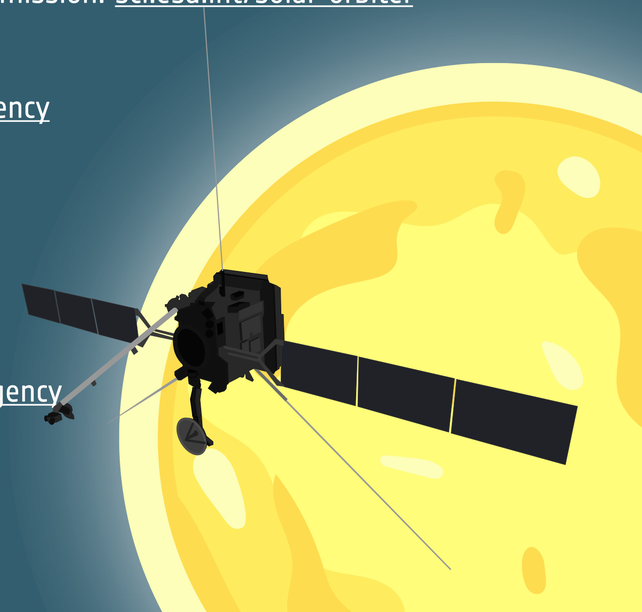
The official hashtags are *#WeAreAllSolarOrbiters* *#SolarOrbiter*

General information about the mission: esa.int/solarorbiter
In-depth information about the mission: sci.esa.int/solar-orbiter

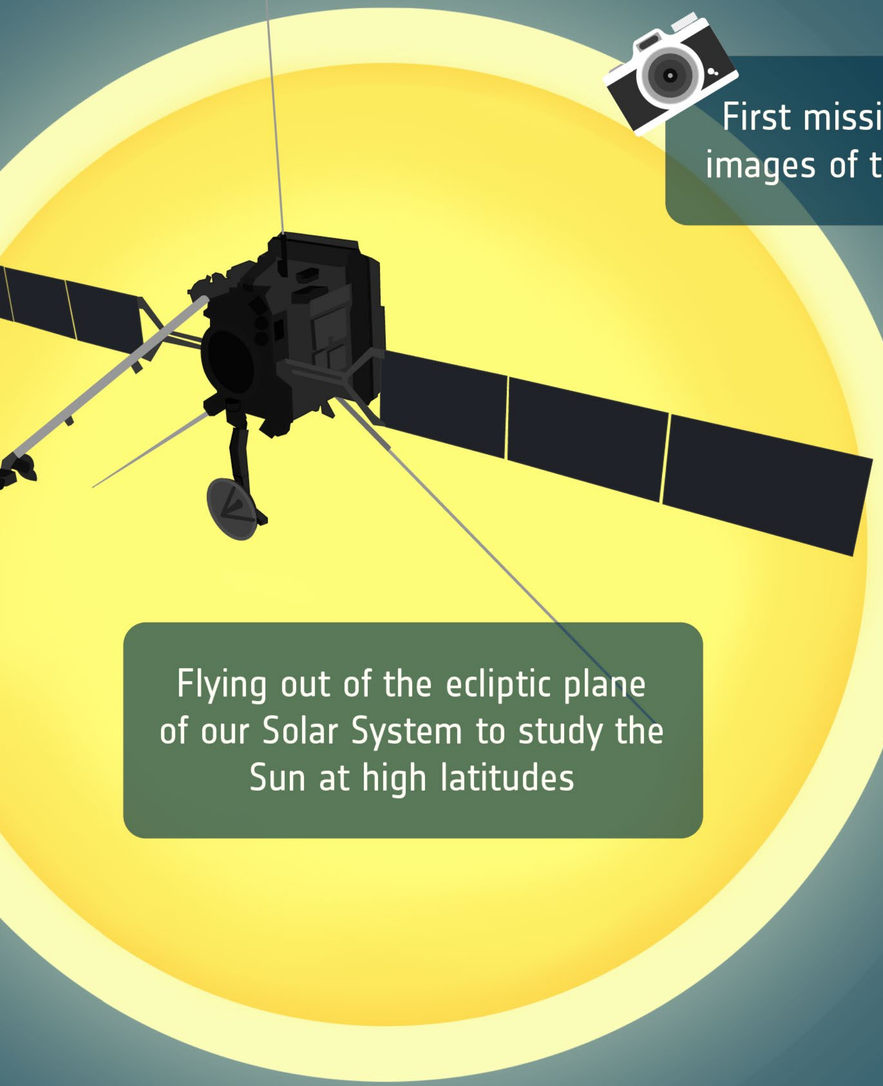
Facebook.com/EuropeanSpaceAgency

Youtube.com/ESA

Instagram.com/europeanspaceagency



SOLAR ORBITER: WHAT'S NEW



First mission to provide images of the Sun's poles

Driving future space exploration with new high-temperature technologies

Exploring the Sun-Earth connection to better understand space weather

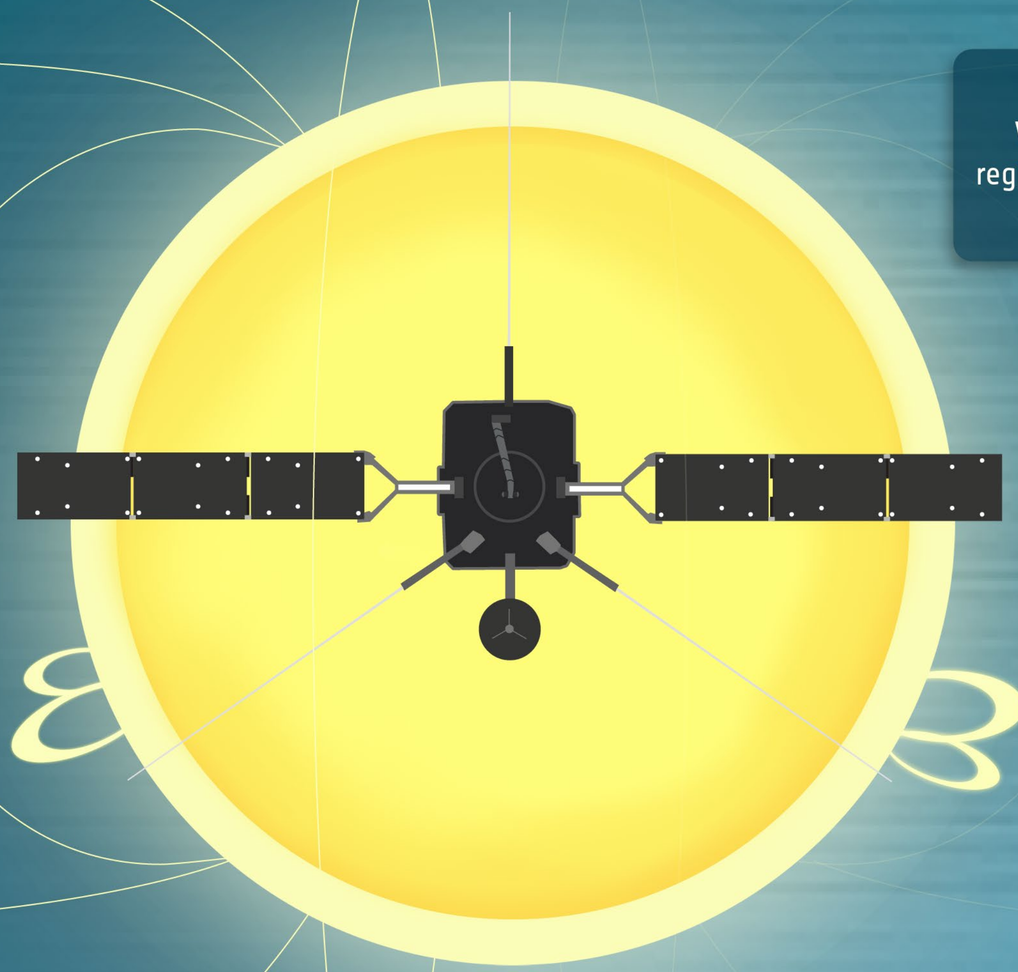
Unlocking the secrets of how our star works by combining in-situ and remote sensing observations

Taking Europe to within the orbit of planet Mercury for the first time

Flying out of the ecliptic plane of our Solar System to study the Sun at high latitudes

A world-class scientific mission in collaboration with NASA

SOLAR ORBITER: ANSWERING THE BIG QUESTIONS



Polar regions
What happens in the polar regions when the solar magnetic field flips polarity?

Magnetic field
How is the Sun's magnetic field generated inside the Sun, and how does it propagate through the corona outwards into space?

Solar wind
What drives the solar wind, and the acceleration of solar wind particles?

Space weather
How do sudden solar events like flares and coronal mass ejections impact the Solar System?

How do solar eruptions produce the energetic particles that lead to extreme space weather at Earth?

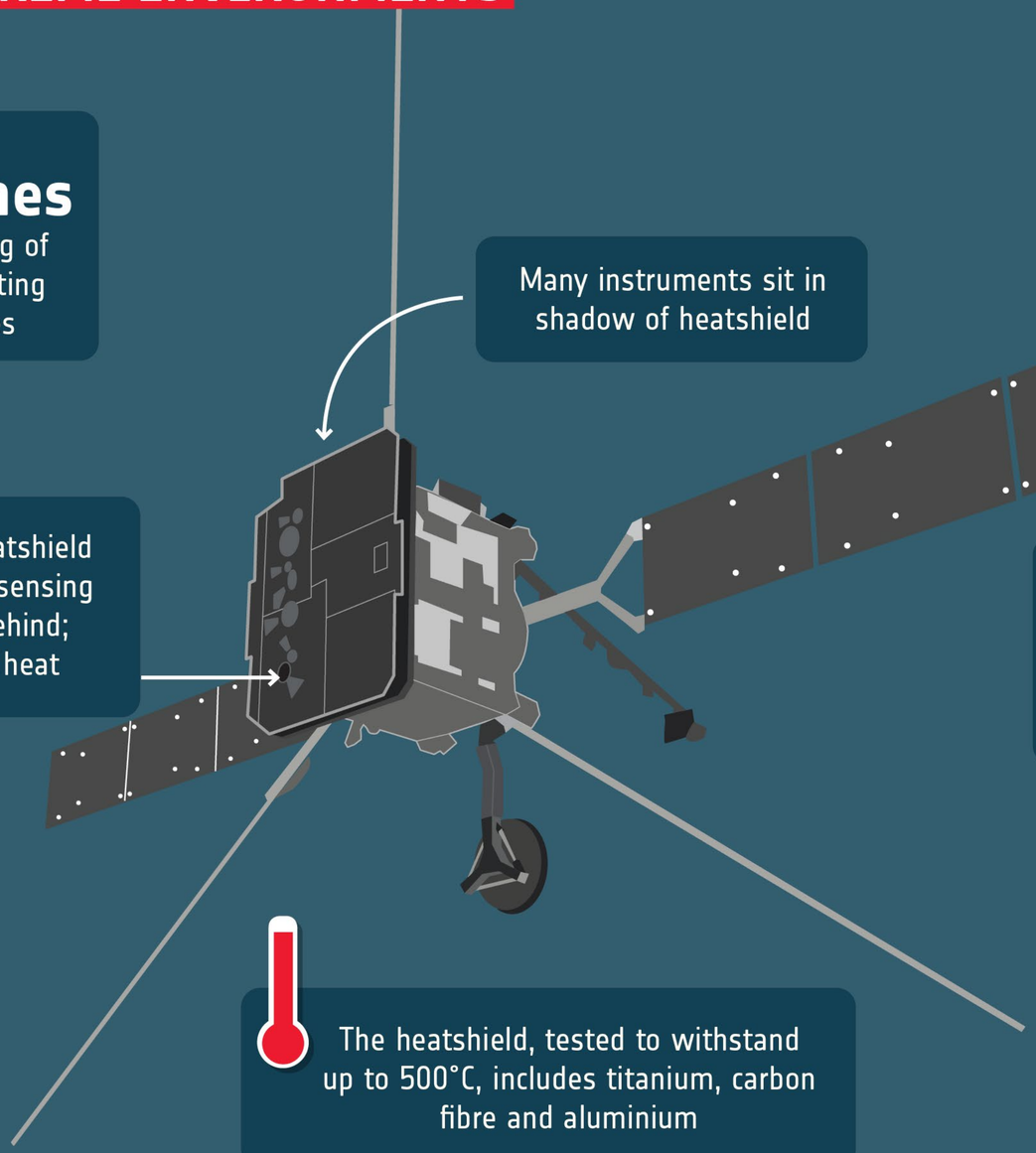
SOLAR ORBITER: OPERATING IN EXTREME ENVIRONMENTS

up to
13 times
the heating of Earth-orbiting satellites

Many instruments sit in shadow of heatshield

42 million kilometres
Closest approach to the Sun, inside the orbit of planet Mercury

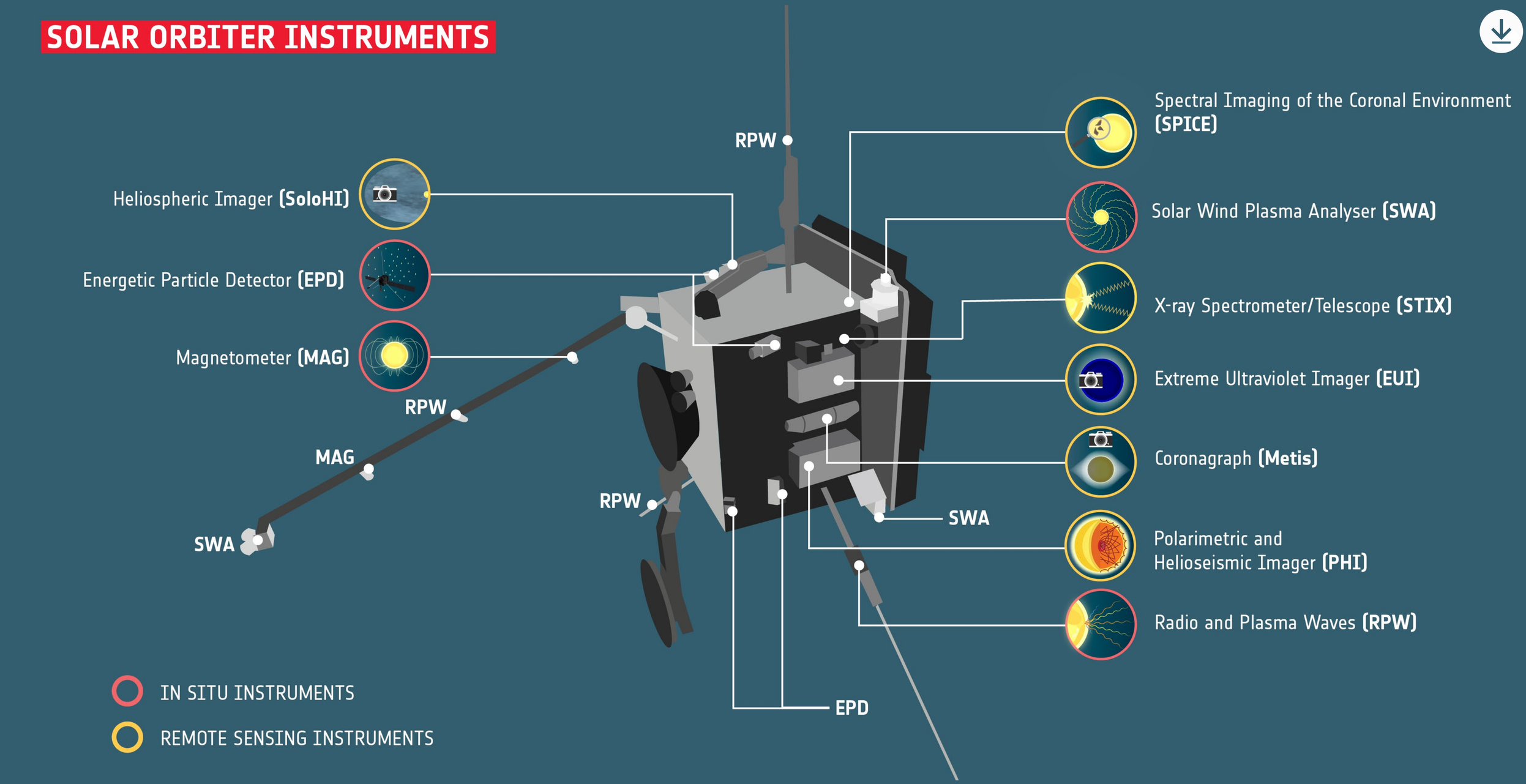
Small sliding doors in heatshield let sunlight in to remote sensing instruments situated behind; special windows block heat



Rotating solar arrays point away from Sun to prevent damage when close-by, or face-on when farther way to generate enough power

The heatshield, tested to withstand up to 500°C, includes titanium, carbon fibre and aluminium

SOLAR ORBITER INSTRUMENTS



SOLAR ORBITER LAUNCH AND DEPLOYMENT SEQUENCE

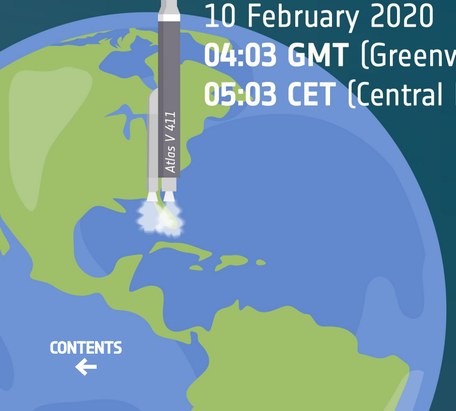
L+ 53 min
Solar Orbiter separation

L+ 4 min 27 sec
Fairing separation

L+ 4 min 09 sec
Atlas-Centaur
stage separation

L+ 2 min 20 sec
Booster separation

Launch
9 February 2020
23:03 EST (Eastern Standard Time)
10 February 2020
04:03 GMT (Greenwich Mean Time)
05:03 CET (Central European Time)



2
L+29 hours
Radio and Plasma Waves (RPW)
antenna deployment

1
L+57 min
Earliest acquisition of signal
Solar array deployment

1

3
L+ 36 hours
Instrument boom
deployment

4
L+ 42 hours
RPW antenna
deployment

6
L+ 49 hours
High gain
antenna deployment

5
L+ 42 hours
RPW antenna
deployment

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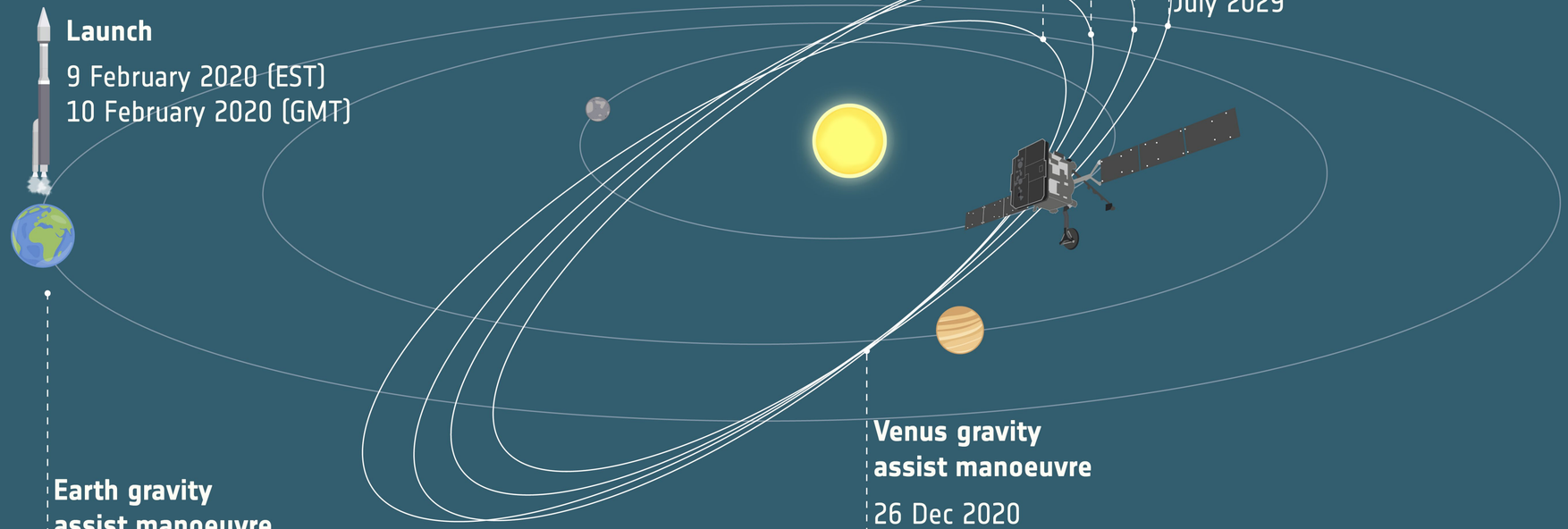
SOLAR ORBITER JOURNEY AROUND THE SUN



Launch
9 February 2020 (EST)
10 February 2020 (GMT)

Earth gravity assist manoeuvre
26 Nov 2021

Close approaches to the Sun
Feb 2021 – within 0.5 au*
Oct 2022 – within 0.3 au

First polar pass > 17° latitude
Mar 2025

First polar pass > 24° latitude
Jan 2027

First polar pass > 30° latitude
Apr 2028

Polar pass > 33° latitude
July 2029

Venus gravity assist manoeuvre
26 Dec 2020
08 Aug 2021
03 Sep 2022
18 Feb 2025
24 Dec 2026
17 Mar 2028
10 Jun 2029
02 Sep 2030

300 million km
Maximum distance between Earth and Solar Orbiter

16.5 min
Maximum time for a radio signal to travel one way between Earth and Solar Orbiter

22 orbits
around the Sun

Nov 2021
Start of main mission

Dec 2026
Expected start of extended mission

**1 au = average distance between Sun and Earth (149 597 870 700 m)*

EXTREME EXPLORATION WITH SOLAR ORBITER AND PARKER SOLAR PROBE

Solar Orbiter

42 million
kilometres to the Sun
at closest approach

10 instruments
to observe the turbulent solar surface, its hot outer atmosphere, and changes in the solar wind

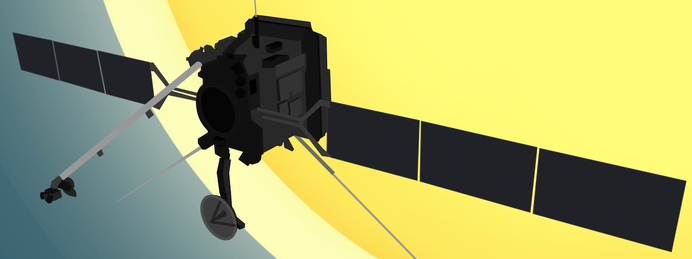
Combination of **in situ** and **remote sensing** observations

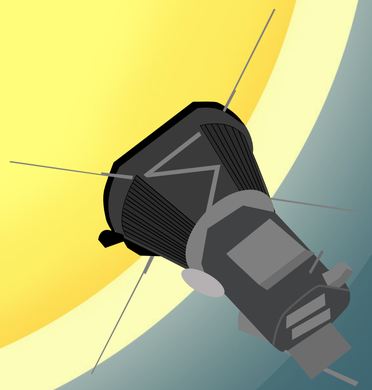
first images
of the Sun's poles: the key to understanding the Sun's activity and solar cycle

Providing **complementary measurements** and putting each other's **data in context**

Answering key questions about **how our star works** and the fundamental processes that lead to **space weather at Earth**

Using the **gravity of Venus** to get closer and closer to the Sun





Parker Solar Probe

6.2 million
kilometres to the Sun
at closest approach

4 instruments
to study magnetic fields, plasma, energetic particles and solar wind

Flies through the Sun's inner atmosphere to trace how energy flows through the corona

ANATOMY OF THE SUN

Sunspots
Darker, cooler areas on the photosphere with concentrations of magnetic field

Prominence
Large structure, often many thousands of kilometres in extent

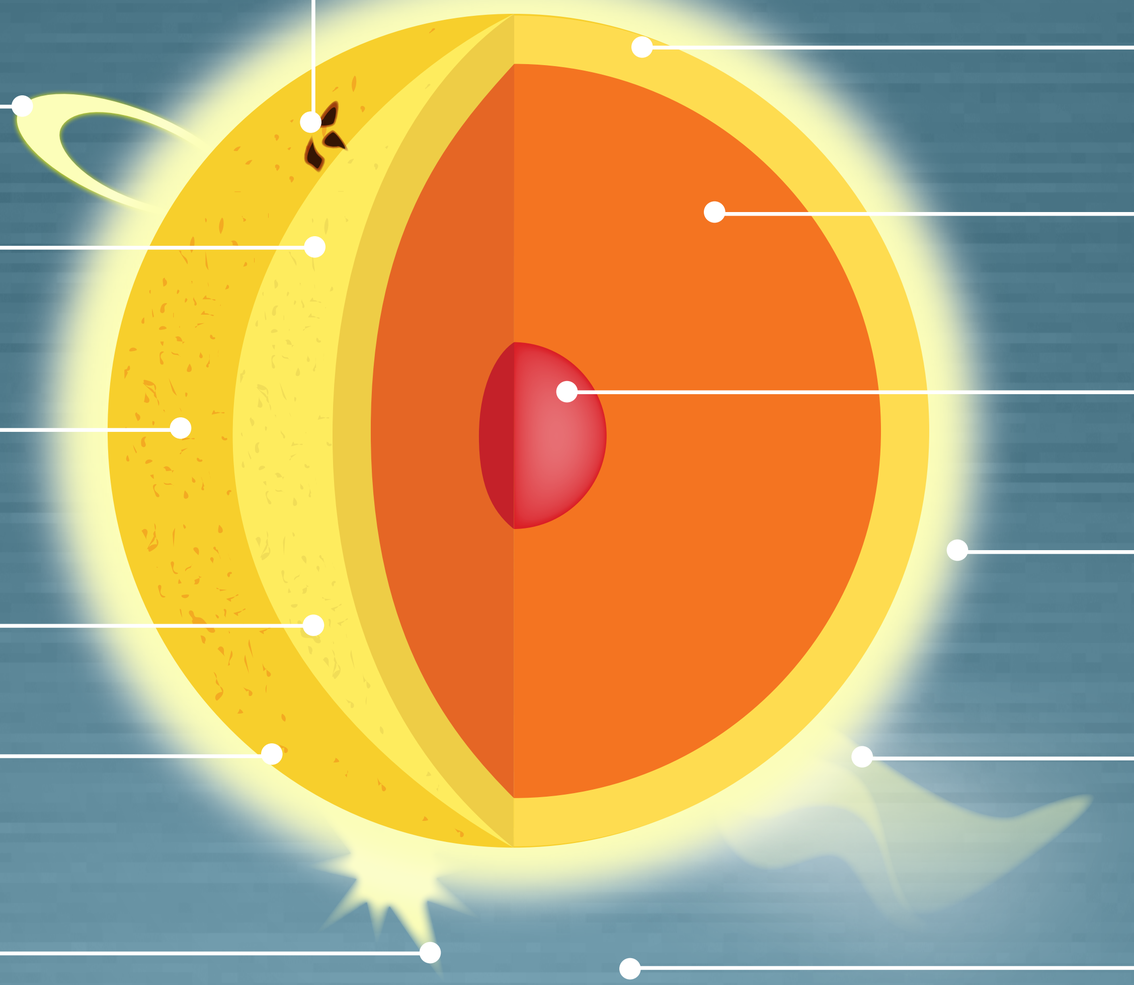
Granulation
Small, short-lived grainy features that cover the Sun, caused by thermal currents rising from below

Chromosphere
Layer above the photosphere, where the density of plasma drops dramatically

Photosphere
The visible 'surface' of the Sun

Transition region
Thin, irregular layer that separates the relatively cool chromosphere from the much hotter corona

Flare
Sudden release of energy in the form of radiation



Convective zone
Rapid heating of plasma creates currents of heated and cooled gas

Radiative zone
Energy created in the core diffuses slowly through the plasma

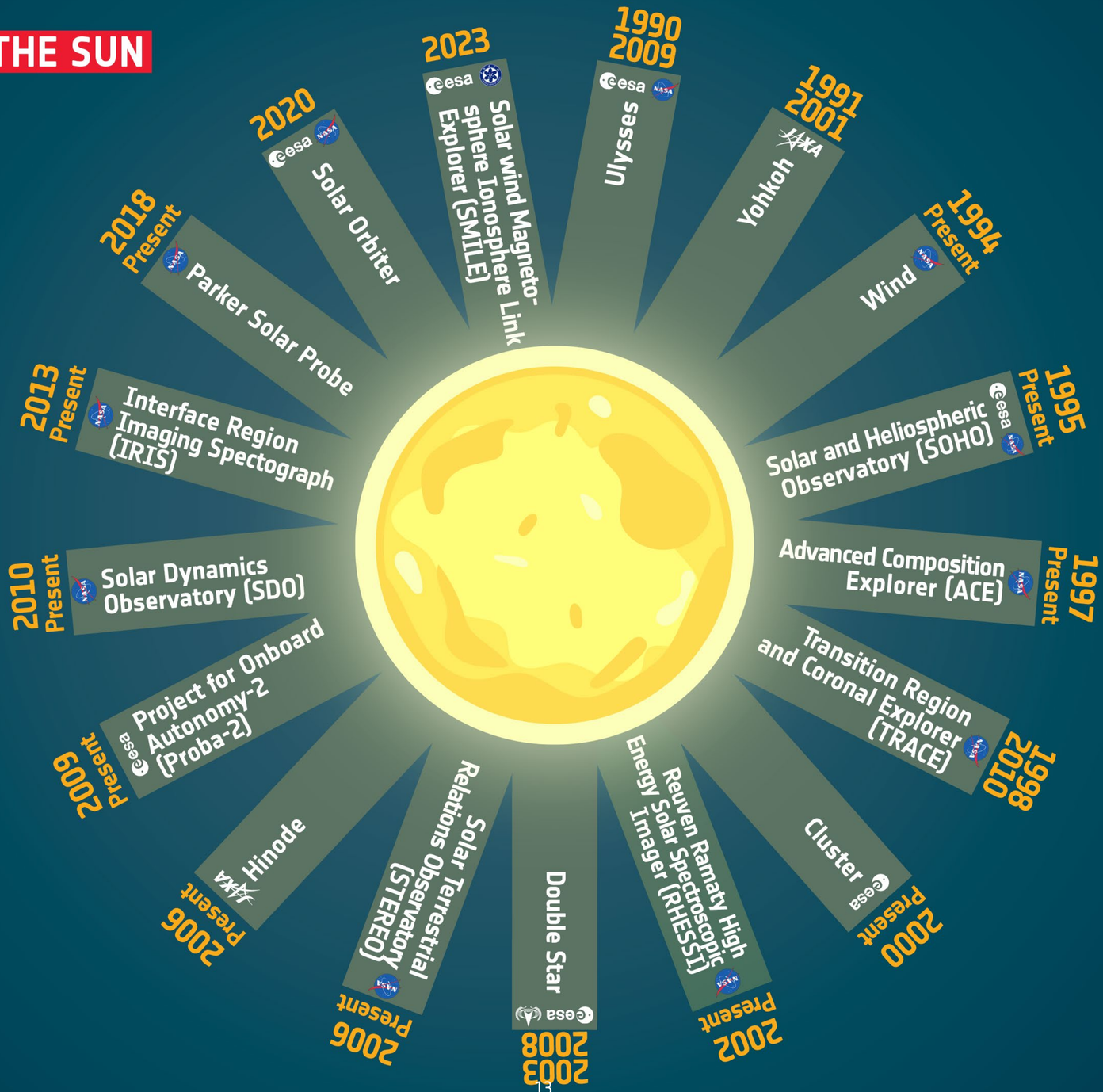
Core
Where the Sun generates its energy via thermonuclear reactions

Corona
The Sun's outer atmosphere, which extends millions of kilometres into outer space

Coronal mass ejection
Vast eruption of billions of tonnes of plasma and accompanying magnetic fields from the Sun's corona

Solar wind
A continuous stream of charged particles released from the corona

MISSIONS STUDYING THE SUN



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MEET THE SUN

Diameter

about 109 Earth diameters

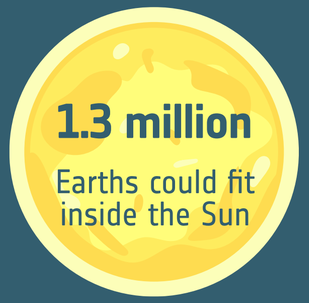
Mass

1.9×10^{30} kg

about 333 060 Earths

Volume

1.4×10^{27} m^3



Temperature

15 million°C
in the Sun's core

1 million°C
in the Sun's corona

5500°C
at the Sun's surface

Age

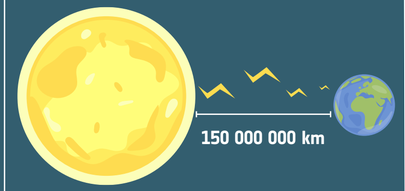
years

The Sun is halfway through its life

Light travel time

8 min

for light to reach Earth



Rotation

36 days
at the poles

25 days
at the equator

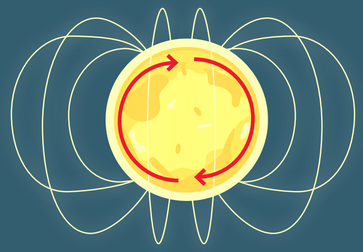
Speed

250 million years to orbit the centre of the Milky Way

Impressive characteristics

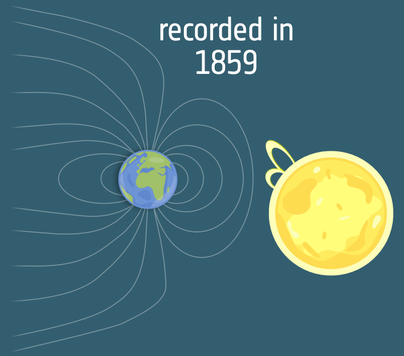
Flipping magnetic field

every 11 years



Biggest solar storm to hit Earth

recorded in 1859



Largest sunspot

measured in 1947

35 times
Earth's area

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SOLAR ORBITER TEAM

KEY MISSION SPOKESPEOPLE

César García Marirrodriga
ESA Project Manager

Anne Pacros
ESA Payload Manager

Daniel Mueller
ESA Project Scientist

Yannis Zouganelis
ESA Deputy Project Scientist

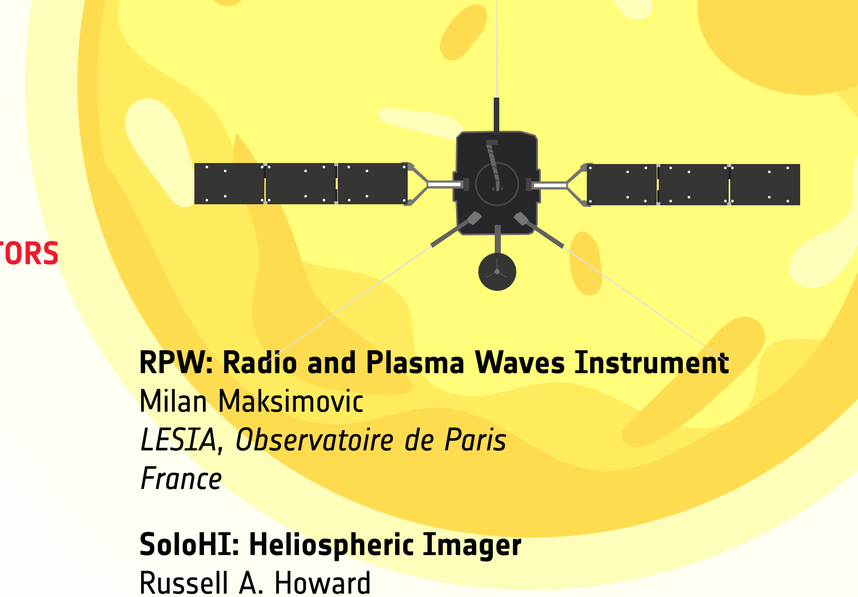
Andrea Accomazzo
ESA Flight Director

Sylvain Lodiot
ESA Spacecraft Operations Manager

Haydee Maldonado
NASA Project Manager

Holly Gilbert
NASA Project Scientist

Teresa Nieves-Chinchilla
NASA Deputy Project Scientist



SCIENCE TEAM PRINCIPAL INVESTIGATORS

EPD: Energetic Particle Detector
Javier Rodríguez-Pacheco
University of Alcalá
Spain

EUI: Extreme Ultraviolet Imager
David Berghmans
Royal Observatory
Belgium

MAG: Magnetometer
Tim Horbury
Imperial College London
United Kingdom

Metis: Coronagraph
Marco Romoli
INAF, University of Florence
Italy

PHI: Polarimetric and Helioseismic Imager
Sami Solanki
Max-Planck-Institut für Sonnensystemforschung
Germany

RPW: Radio and Plasma Waves Instrument
Milan Maksimovic
LESIA, Observatoire de Paris
France

SoloHI: Heliospheric Imager
Russell A. Howard
US Naval Research Laboratory
Washington, D.C., USA

SPICE: Spectral Imaging of the Coronal Environment
Frédéric Auchère
IAS, Orsay
France

STIX: X-ray Spectrometer/Telescope
Säm Krucker
FHNW, Windisch
Switzerland

SWA: Solar Wind Plasma Analyser
Christopher Owen
Mullard Space Science Laboratory
United Kingdom

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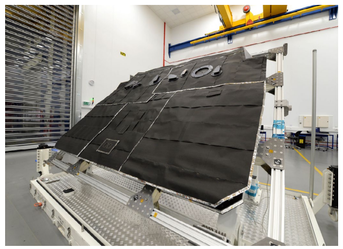
SELECTED MULTIMEDIA

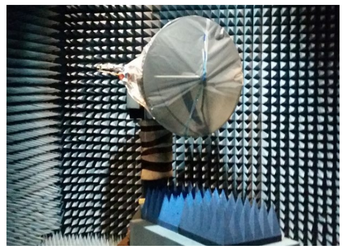
PHOTOS

SOLAR ORBITER SUNSHIELD

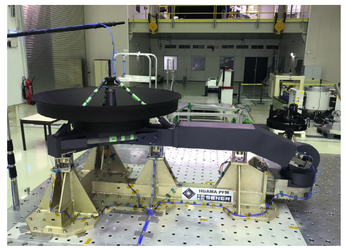


SOLAR ORBITER – STRUCTURAL AND THERMAL MODEL OF HEAT SHIELD

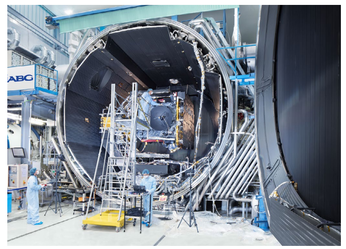
SOLAR ORBITER - STRUCTURAL AND THERMAL MODEL



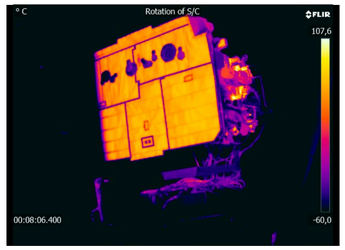
SOLAR ORBITER HIGH-GAIN ANTENNA RADIO FREQUENCY TESTING



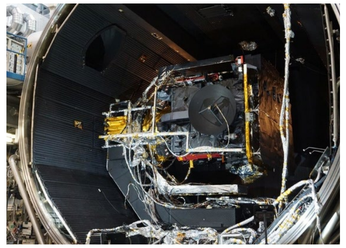
SOLAR ORBITER HIGH-GAIN ANTENNA DURING VIBRATION TESTING



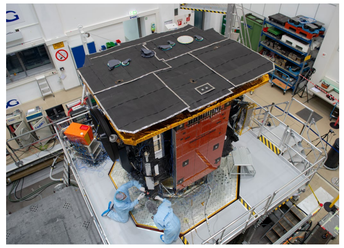
SOLAR ORBITER IN SPACE SIMULATION CHAMBER



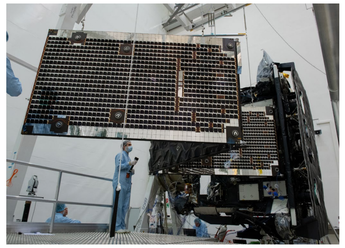
SOLAR ORBITER DURING THERMAL-VACUUM TESTS



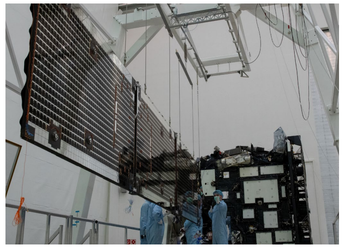
THERMAL TESTING OF SOLAR ORBITER



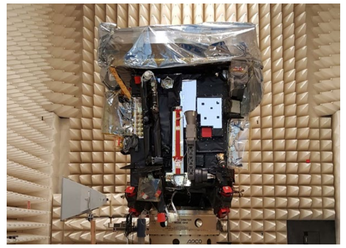
SOLAR ORBITER VIBRATION TEST



SOLAR ORBITER ARRAY DEPLOYMENT TEST

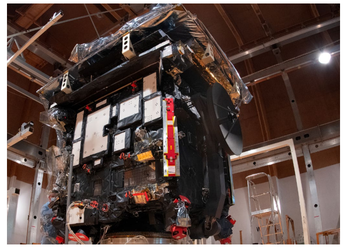


SOLAR ORBITER ARRAY DEPLOYMENT TEST

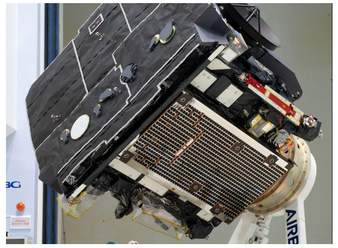


SOLAR ORBITER IN THE ANECHOIC CHAMBER

SOLAR ORBITER IN THE MAGNETIC FIELD SIMULATION FACILITY



SOLAR ORBITER IN THE MAGNETIC FIELD SIMULATION FACILITY



SOLAR ORBITER AT IABG

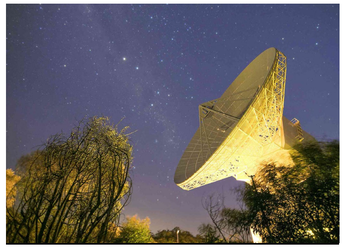
SOLAR ORBITER AT IABG

ATLAS V ROCKET BOOSTER

SOLAR ORBITER UNPACKED AT ASTROTECH

SOLAR ORBITER FUELLING

ESA MISSION CONTROL DARMSTADT



NEW NORCIA GROUND TRACKING STATION

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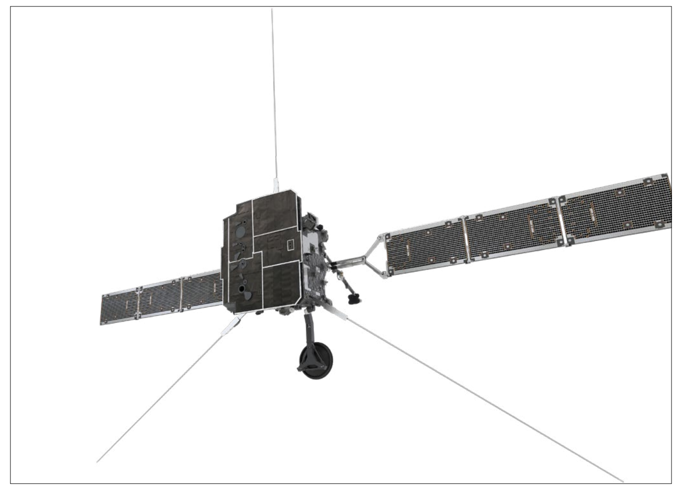
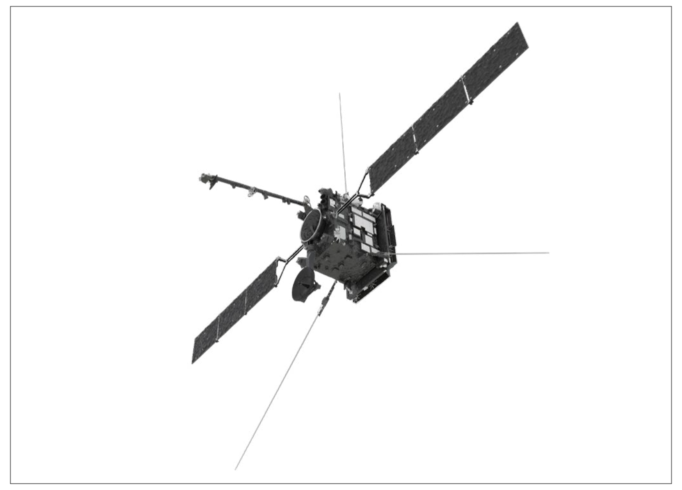
ARTIST IMPRESSIONS


SOLAR ORBITER SATELLITE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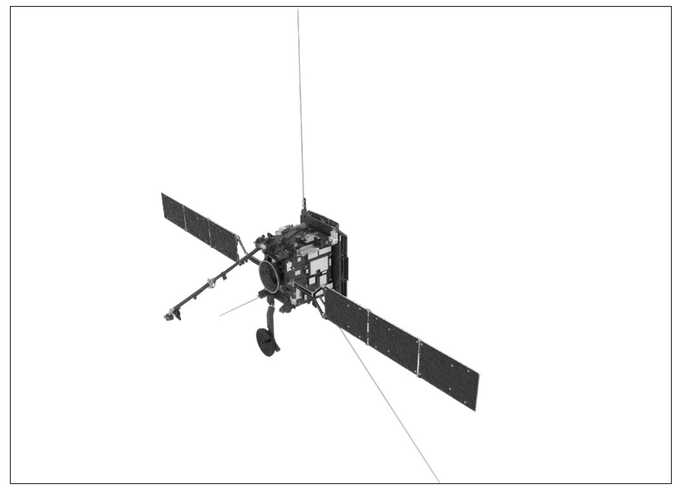
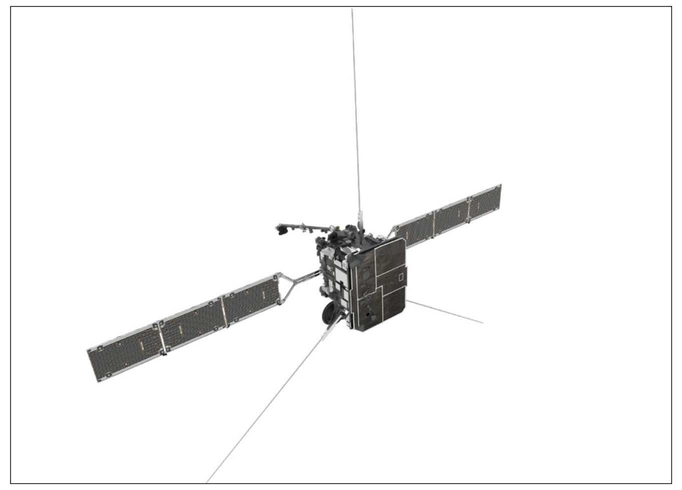

SOLAR ORBITER SATELLITE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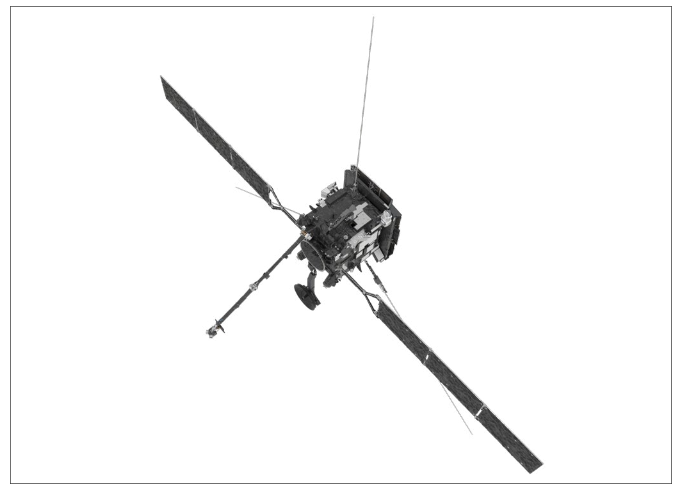
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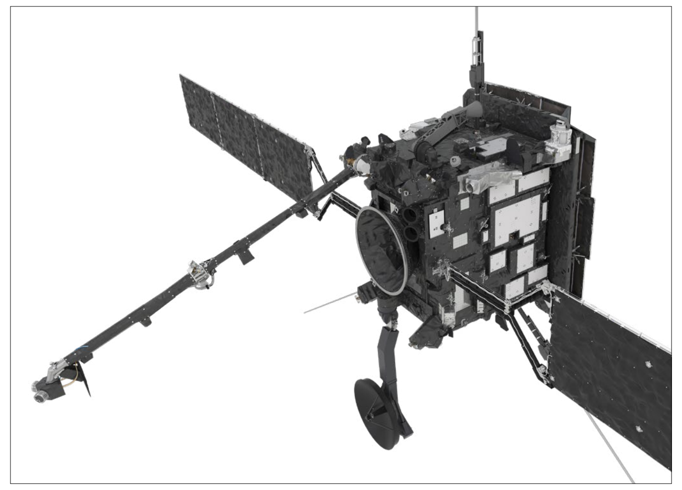
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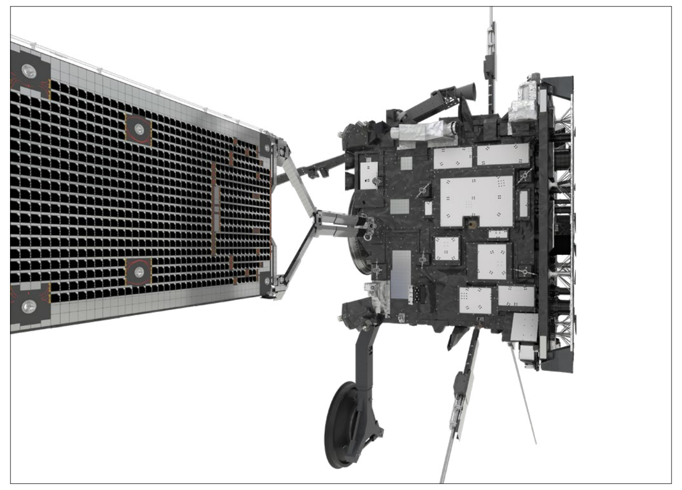
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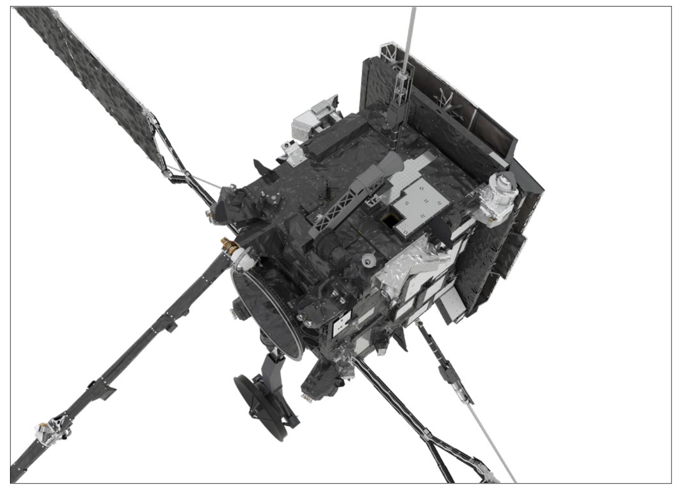
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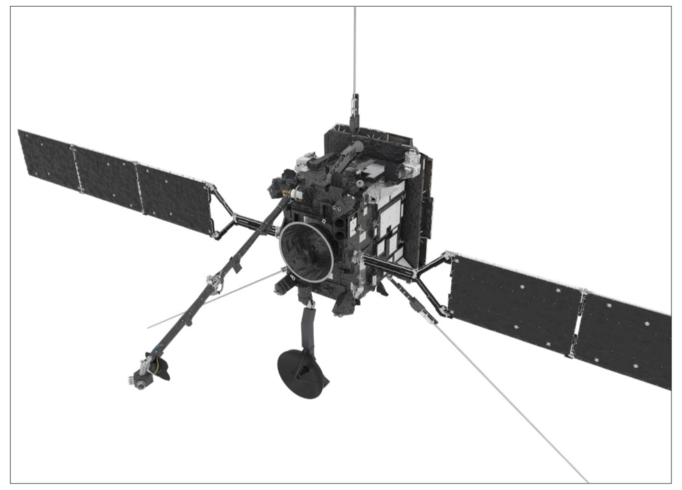
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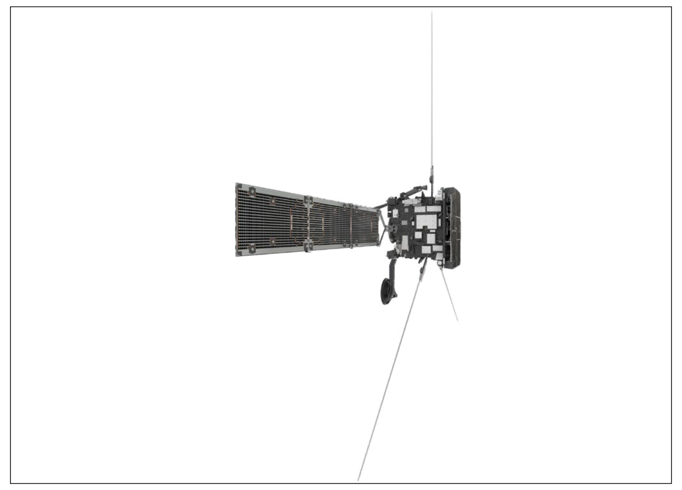
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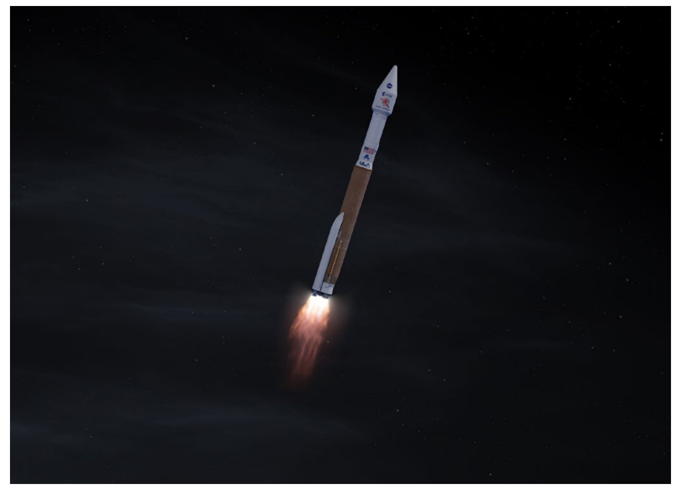
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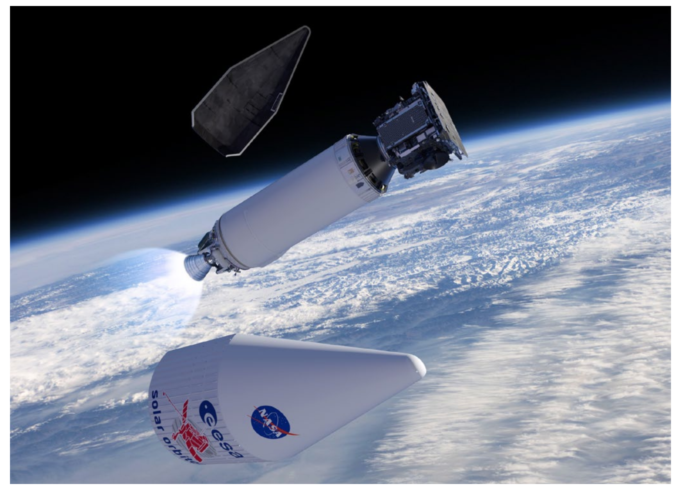
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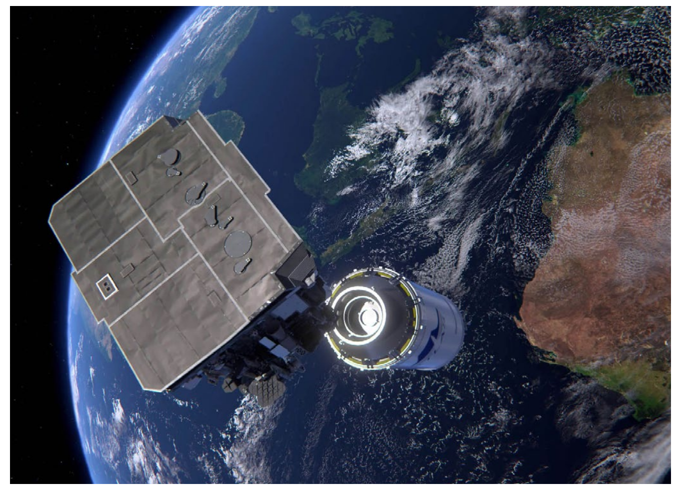
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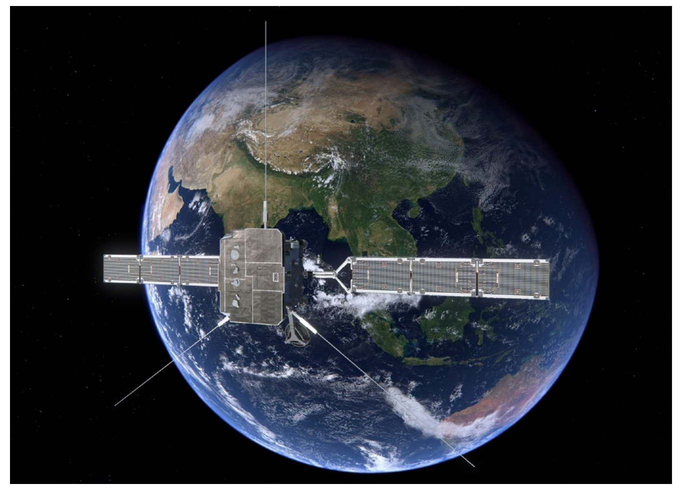
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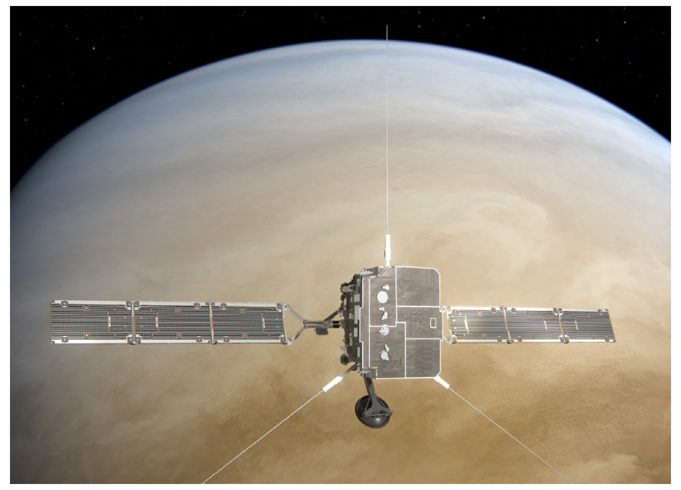
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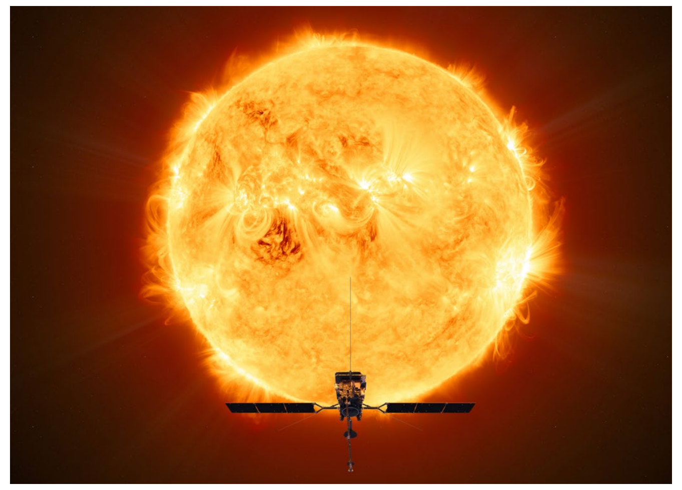
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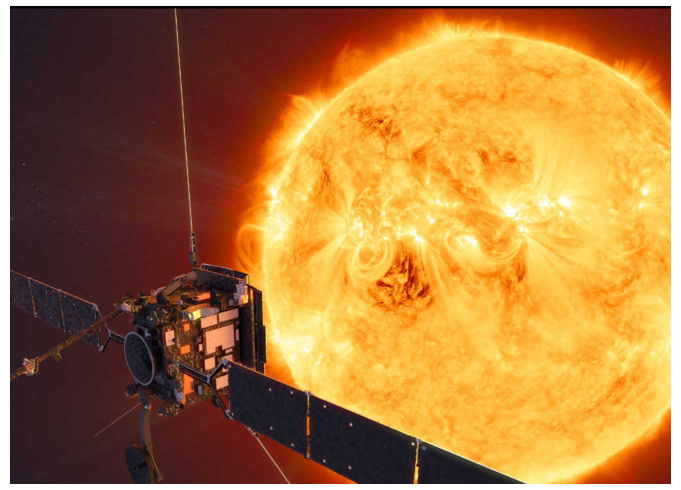
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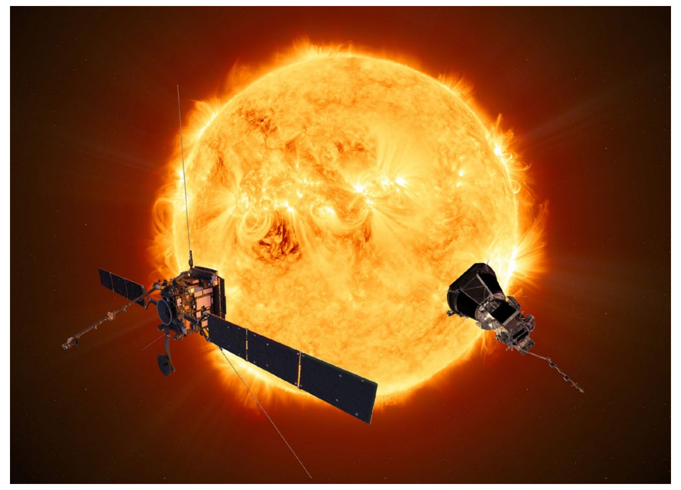
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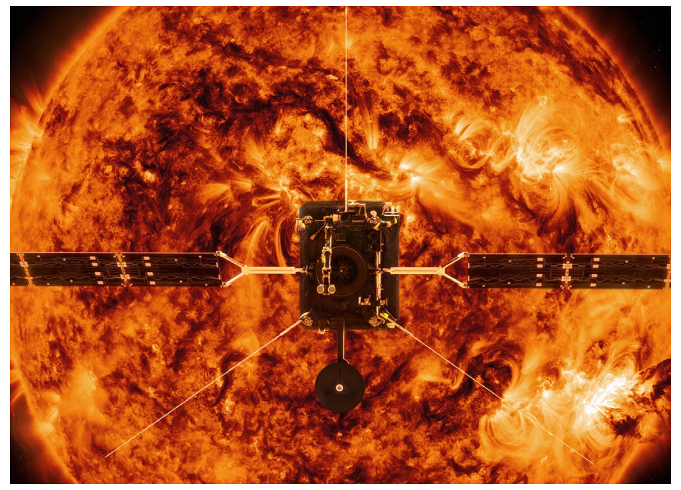
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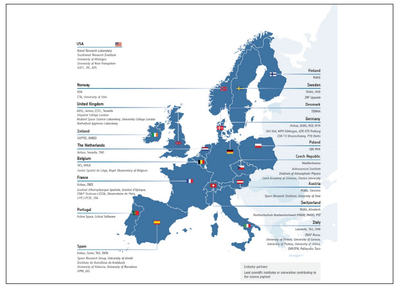

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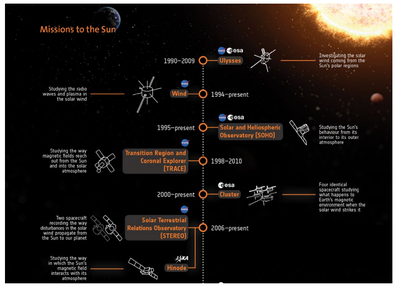

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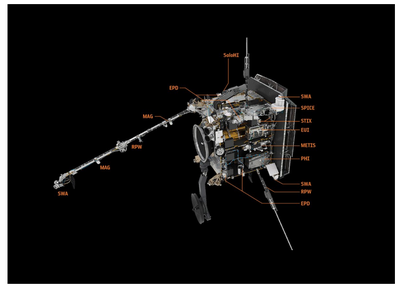

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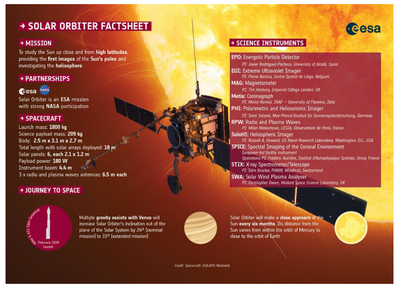

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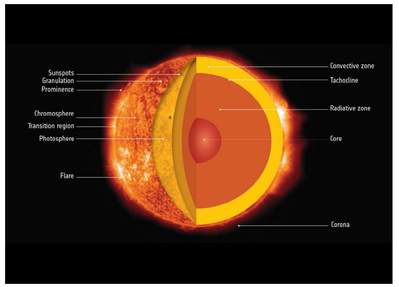

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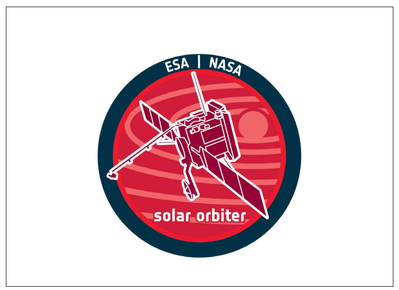

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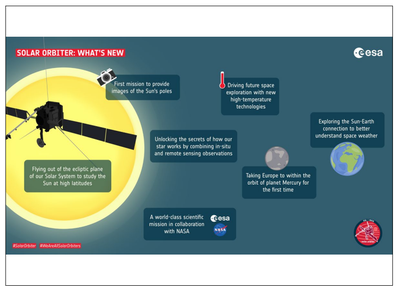

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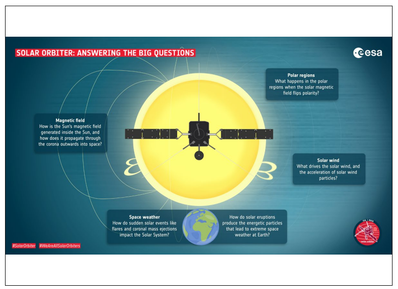

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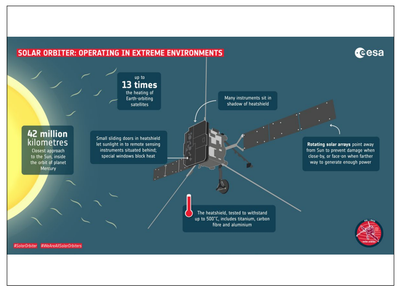

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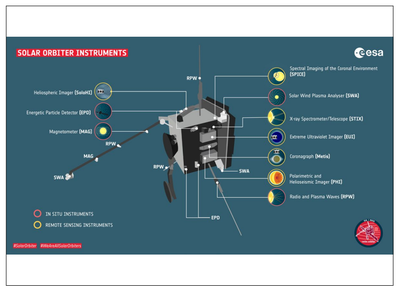

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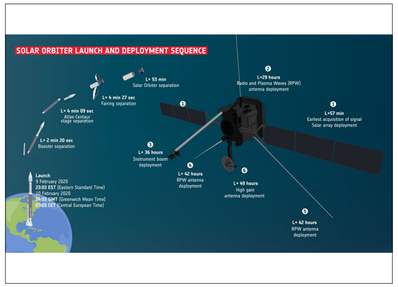

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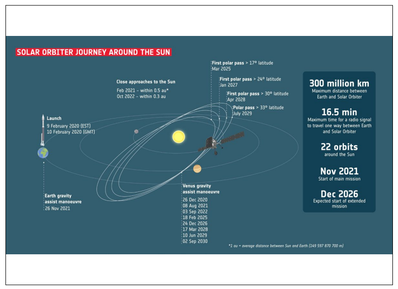

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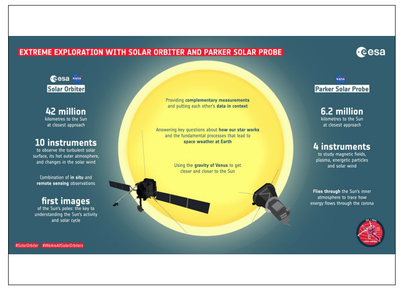

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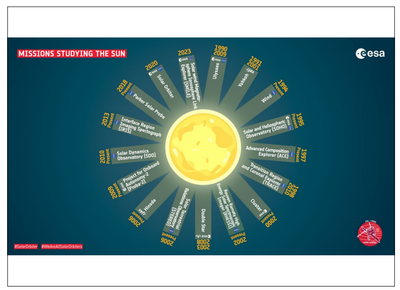

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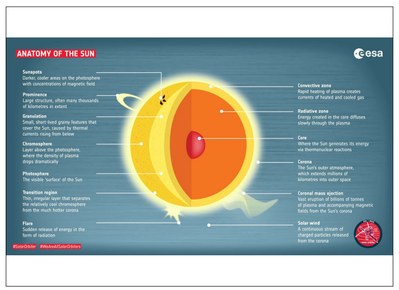

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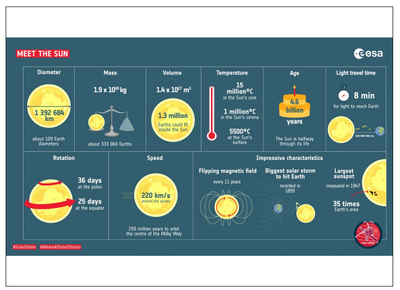

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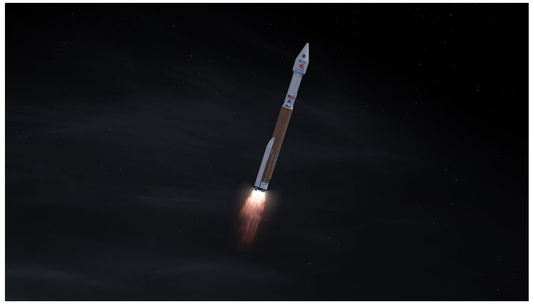

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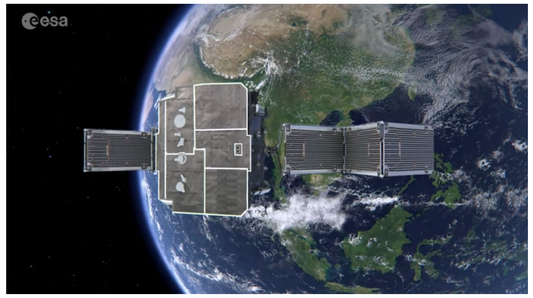

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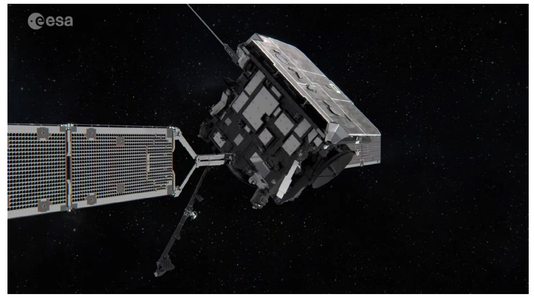

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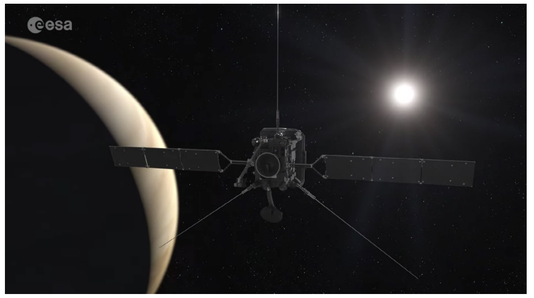

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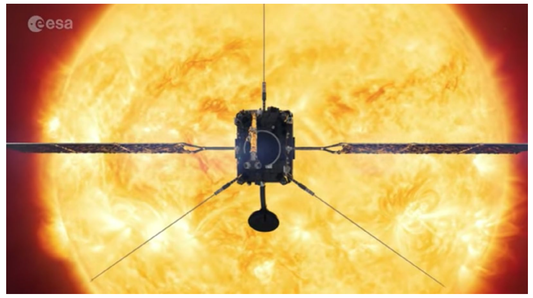

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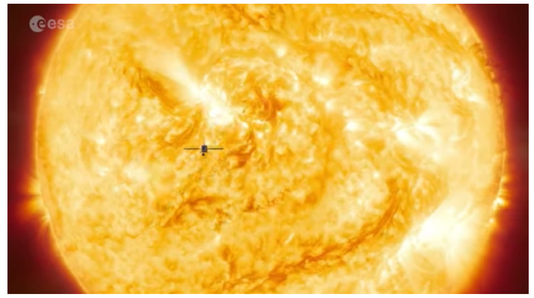

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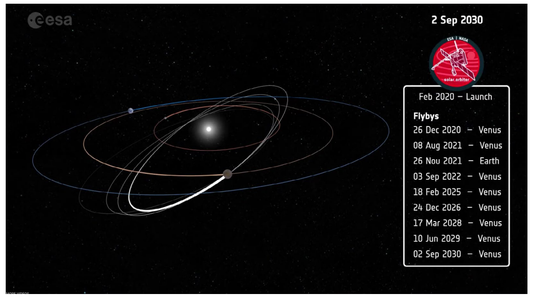


SOLAR ORBITER'S JOURNEY AROUND THE SUN

MEDIA SERVICES

European Space Agency
ESA Media Relations
media@esa.int

Media relations
Partner agencies and institutes

NASA
Headquarters, Washington
Grey Hautaluoma
grey.hautaluoma-1@nasa.gov

Karen Fox
karen.fox@nasa.gov

ASI
Giuseppina Piccirilli
giuseppina.piccirilli@asi.it

CNES
Claire Dramas
claire.dramas@cnes.fr

Raphaël Sart
Raphael.Sart@cnes.fr

DLR
Elisabeth Mittelbach
Elisabeth.Mittelbach@dlr.de

FHNW University of Applied Science
Sandro Nydegger
sandro.nydegger@fhnw.ch

Imperial College London
Hayley Dunning
h.dunning@imperial.ac.uk

INAF - Osservatorio Astronomico di Capodimonte
Clementina Sasso
clementina.sasso@inaf.it

INAF - Osservatorio Astrofisico di Torino
Federico Landini
federico.landini@inaf.it

Institut d'Astrophysique Spatiale
Miho Janvier
miho.janvier@ias.u-psud.fr

LESIA - Observatoire de Paris/Université PSL
Milan Maksimovic
milan.maksimovic@obspm.fr

Max Planck Institute for Solar System Research
Birgit Krummheuer
krummheuer@mps.mpg.de

PMOD/WRC Davos
Sara Niedermann
sara.niedermann@dinatum.ch

RAL Space
Madeleine Russell
madeleine.russell@stfc.ac.uk

Royal Observatory Belgium
Petra Vanlommel
petra.vanlommel@oma.be

Swiss Space Office
Kamlesh Brocard
Kamlesh.brocard@sbfi.admin.ch

University of Alcalá
Teresa Varela
teresa.varela@uah.es

University College London
Rebecca Caygill
r.caygill@ucl.ac.uk

UKSA
Chris Noble
Chris.Noble@ukspaceagency.gov.uk

HOW TO FOLLOW THE MISSION

Multimedia

A variety of photographs, illustrations, graphics and animations are available via:
- ESA Space in Images
- ESA Space in Videos
- ESA's Photo Library for Professionals
- ESA's Video Library for Professionals

See also pages 16-19 in this media kit for recommended multimedia products

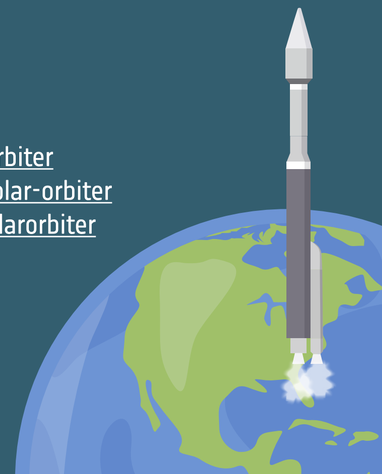
Solar Orbiter on social media

Twitter: @ESASolarOrbiter
Official hashtags: *#WeAreAllSolarOrbiters* *#SolarOrbiter*

Facebook: Facebook.com/EuropeanSpaceAgency
Youtube: Youtube.com/ESA
Instagram: Instagram.com/europeanspaceagency

Solar Orbiter online

General information: esa.int/solarorbiter
In-depth information: sci.esa.int/solar-orbiter
Solar Orbiter at NASA: nasa.gov/solarorbiter

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