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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.
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

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

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

Exploring the Sun-Earth connection to better understand space weather

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

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

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

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

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

Many instruments sit in shadow of heatshield

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

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

up to 13 times
the heating of Earth-orbiting satellites
SOLAR ORBITER LAUNCH AND DEPLOYMENT SEQUENCE

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)

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

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

3
L+ 42 hours
RPW antenna deployment

4
L+ 49 hours
High gain antenna deployment

5
L+42 hours
RPW antenna deployment

6
L+ 36 hours
Instrument boom deployment

1
L+ 4 min 27 sec
Fairing separation

2
L+ 53 min
Solar Orbiter separation

3
L+ 2 min 20 sec
Booster separation

4
L+ 4 min 09 sec
Atlas-Centaur stage separation
SOLAR ORBITER JOURNEY AROUND THE SUN

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

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

Earth gravity assist manoeuvre
26 Nov 2021

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

Using the *gravity of Venus* to get closer and closer to the Sun
Convection 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
### MEET THE SUN

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Mass</th>
<th>Volume</th>
<th>Temperature</th>
<th>Age</th>
<th>Light travel time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 392 684 km</td>
<td>1.9 x 10³⁰ kg</td>
<td>1.4 x 10²⁷ m³</td>
<td>15 million°C in the Sun’s core</td>
<td>4.6 billion years</td>
<td>8 min</td>
</tr>
<tr>
<td>about 109 Earth diameters</td>
<td>about 333 060 Earths</td>
<td>1.3 million Earths could fit inside the Sun</td>
<td>1 million°C in the Sun’s corona</td>
<td>The Sun is halfway through its life</td>
<td>for light to reach Earth</td>
</tr>
<tr>
<td>250 million years to orbit the centre of the Milky Way</td>
<td>5500°C at the Sun’s surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rotation
- 36 days at the poles
- 25 days at the equator

### Speed
- 220 km/s around the galaxy
- Earths could fit inside the Sun

### Impressive characteristics
- Flipping magnetic field every 11 years recorded in 1859
- Biggest solar storm to hit Earth measured in 1947
- Largest sunspot 35 times Earth’s area
- Diameter: 1 392 684 km
- Mass: 1.9 x 10³⁰ kg
- Volume: 1.4 x 10²⁷ m³
- Temperature: 15 million°C in the Sun’s core
- Age: 4.6 billion years
- Light travel time: 8 min for light to reach Earth
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
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

SOLAR ORBITER AT IABG
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
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 UNPAIGNED AT ASTROTECH
SOLAR ORBITER FUELING
ESA MISSION CONTROL DARMSTÄDT
NEW NORCIA GROUND TRACKING STATION

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ANIMATIONS AND VIDEOS

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BUILDING SOLAR ORBITER TIMELAPSE
SOLAR ORBITER LAUNCH
SOLAR ORBITER FAIRING SEPARATION

SOLAR ORBITER SEPARATION FROM LAUNCHER
SOLAR ORBITER SOLAR ARRAY DEPLOYMENT
SOLAR ORBITER BOOM AND ANTENNA DEPLOYMENTS
SOLAR ORBITER EARTH FLYBY

SOLAR ORBITER VENUS FLYBY
SOLAR ORBITER FACING THE SUN
SOLAR ORBITER FACING THE SUN
SOLAR ORBITER'S JOURNEY AROUND THE SUN
Media relations
Partner agencies and institutes

NASA
Headquarters, Washington
Grey Hautaluoma
greyhautaluoma-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 Vantommel
petra.vantommel@oma.be

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

University of Alcalá
Teresa Varela
teresavarela@uah.es

University College London
Rebecca Caygill
rcaygill@ucl.ac.uk

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

European Space Agency
ESA Media Relations
media@esa.int

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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HOW TO FOLLOW THE MISSION
THANK YOU FOR JOINING US FOR THE LAUNCH OF SOLAR ORBITER!