



APL

Solar Probe Plus

A NASA Mission to Touch the Sun

Solar Probe Plus is an exciting mission of exploration and discovery, a journey to the Sun itself.

By flying into the Sun's outer atmosphere—called the corona—Solar Probe Plus will gather data on the processes that heat the corona and accelerate the solar wind, solving two fundamental mysteries that have been top-priority science goals for many decades. This mission will transform our understanding of the Sun and stars like it, and enable further exploration through our own solar system.

Measuring in Place

Solar Probe Plus will study the streams of charged particles the Sun hurls into space from a vantage point where the processes that produce the solar wind actually occur. At closest approach, Solar Probe will zip past the Sun at 125 miles per second, protected by a carbon-composite heat shield that must withstand up to 2,600° Fahrenheit and survive blasts of radiation and energized dust at levels not experienced by any previous spacecraft.

By making direct in-place measurements of the region where some of the most hazardous solar energetic particles are energized, Solar Probe Plus will make a fundamental contribution to our ability to characterize and forecast the radiation environment in which future space explorers will work and live.

Built for Science

The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, is designing and will build Solar Probe Plus for NASA, on a schedule to launch in 2015. The compact, solar-powered probe will weigh about 1,000 pounds; preliminary designs include a 9-foot-diameter, 6-inch-thick, carbon-foam-filled solar shield atop the spacecraft body. At its closest passes the spacecraft must survive solar intensity more than 500 times what spacecraft experience while orbiting Earth.

Solar Probe Plus will employ a combination of measurements to achieve the mission's primary scientific goals:

- Determine the structure and dynamics of the magnetic fields at the sources of solar wind
- Trace the flow of energy that heats the corona and accelerates the solar wind
- Determine what mechanisms accelerate and transport energetic particle
- Explore the influence of dusty plasma on solar wind and energetic particle formation

Five decades in the making—under various concepts—Solar Probe Plus is the keystone of NASA's Living With a Star program, providing a detailed study of the "star" itself, our Sun.

Fire Walking

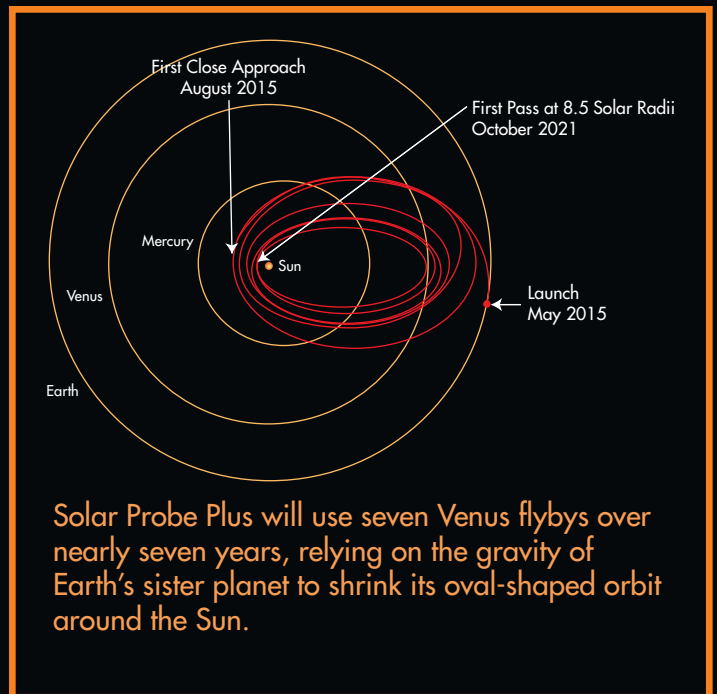
After the 2015 launch, Solar Probe Plus will orbit the Sun 24 times, gradually “walking in” toward the Sun with each pass. The closest points of each orbit come well within the path of Mercury—the closest planet to the Sun. On the final three orbits, Solar Probe Plus will fly to within 8.5 solar radii of the Sun’s “surface;” 8.5 solar radii is 8.5 times the radius of the Sun, or about 3.9 million miles. That is about seven times closer than the current record-holder for a close solar pass, the Helios spacecraft.

Sun-Earth Experience

The Applied Physics Lab’s experience in developing spacecraft to study the Sun–Earth relationship – or to work near the Sun – includes ACE, which has sampled energetic particles between Earth and the Sun for more than a decade; TIMED, currently examining solar effects on Earth’s upper atmosphere; the twin STEREO probes, which have snapped the first 3-D images of explosive solar events called coronal mass ejections; and the Radiation Belt Storm Probes, which will examine the regions of energetic particles trapped by Earth’s magnetic field.

Solar Probe Plus will be fortified with heat-resistant technologies developed for APL’s MESSENGER spacecraft, which will begin orbiting the planet Mercury in 2011. Solar Probe’s sun shield concept was partially influenced by designs of MESSENGER’s sunshade.

At closest approach to the Sun, while Solar Probe Plus’ shield faces searing heat of 2,600° Fahrenheit (or 2,000° Celsius), the spacecraft’s payload will be at room temperature.



Living With a Star

Solar Probe Plus is part of NASA’s Living with a Star Program, designed to learn more about the Sun and its effects on planetary systems and human activities. NASA’s Goddard Space Flight Center in Greenbelt, Maryland, manages the program for the Science Mission Directorate at NASA Headquarters, Washington.

ON THE WEB:

Solar Probe Plus

<http://solarprobe.jhuapl.edu/>

Living with a Star

<http://lws.gsfc.nasa.gov/>