

SOLAR PROBE PLUS IS SET TO LAUNCH DURING A 20-DAY WINDOW THAT OPENS JULY 31, 2018. OVER 24 ORBITS, THE SPACECRAFT WILL USE SEVEN FLYBYS OF VENUS TO REDUCE ITS DISTANCE FROM THE SUN. (ARTIST'S IMPRESSION OF THE SOLAR PROBE PLUS SPACECRAFT. CREDIT: NASA/JHUAPL.)



OVER THE past half century, we have enjoyed the fictional journeys of the *Starship Enterprise*, which explored the galaxies beyond us. We have watched dozens of Sci Fi films the best of which some may agree was Matt Damon's struggle to survive in the, "The Martian."

We have reached out beyond our solar system with unmanned space vehicles millions of miles into the unknown. But there is one area closer to home that we still know little about. It is the nuclear-powered star we call our Sun, only 93-million miles (149,5-million km) from us.

Scientists think the core temperature is about 3,6 million to 12,6 million degrees Fahrenheit (2-million to 7-million degrees Celsius) with 10 000 degrees Fahrenheit (5 500 Celsius) on the surface. For unknown reasons, however, temperatures rise again in the Sun's atmosphere, hitting up to 3,6-million degrees Fahrenheit in the star's outermost corona.

In the summer of 2018, NASA is sending a 10-foot-high probe on an historic mission that will put it closer to the Sun than any spacecraft has ever reached before. It is not a journey that any human can make.

Wearing a 4,5-inch (114 mm) coat of carbon-composite solar shields, NASA's Parker Solar Probe will explore the Sun's atmosphere. The probe is named in honour of astrophysicist Eugene Parker, who published research predicting the existence of the solar wind in 1958, when he was a young professor at the University of Chicago's Enrico Fermi institute.

This is NASA's first mission to the Sun and its outermost atmosphere, called the corona. The probe will have to withstand heat and radiation never before experienced by any spacecraft. The mission will also address questions that have never been answered. Scientists hope that by understanding the makeup of the Sun in greater detail it can shed light on questions about Earth relative to the rest of the solar system.

Solar wind is the flow of charged gases from the Sun that is present in most of the solar system. That wind rockets past Earth at over a million mph, and disturbances of the solar wind cause disruptive space weather that affects Earth.

The probe will eventually orbit within 3,7-million miles of the Sun's surface. Scientists hope that the observations and data collected will offer insight about the physics of stars, change what we know about the mysterious corona, increase our understanding of the solar wind, and help improve forecasting of major space



SCIENTISTS TO TOUCH THE SUN

By Henry M. Holden



MEMBERS OF THE INTEGRATION AND TESTING TEAM PREPARE PARKER SOLAR PROBE FOR ENVIRONMENTAL TESTING IN THE ACOUSTIC TEST CHAMBER AT NASA'S GODDARD SPACE FLIGHT CENTRE IN GREENBELT, MARYLAND. NOV 2017 PHOTO: NASA/JOHNS HOPKINS APL/ED WHITMAN

weather events. "Those events can affect satellites, astronauts, the power grid, and radiation exposure on airline flights," NASA said.

THE CORONAL MYSTERY

The mission's goals include tracing the flow of energy that heats and accelerates the Sun's corona, and solar wind. It will attempt, to determine the structure and dynamics of the plasma, and magnetic fields at the sources of the solar wind, and discover mechanisms that accelerate and transport energetic particles.

"We've been inside the orbit of Mercury and done amazing things, but unless you go and touch the Sun, you can't answer these questions," said Nicola Fox, the mission project scientist for Parker Solar Probe. "Why has it taken us 60 years?" Fox asked rhetorically. "The materials didn't exist to allow us to do what we are about to do. We had to make a heat shield, something that can withstand the extreme hot and cold temperature shifts."

Space weather may not sound like something that should concern us on Earth, but the National Academy of Sciences has estimated that a solar event without warning could cause \$2-trillion in damage in the United States or Europe, and leave large areas without power for a year or more.

"To understand space weather, we need to get close to its source," said Parker. "To reach an orbit around the Sun, the probe

will make seven flybys of Venus that will give the probe a gravity assist, closing its orbit around the Sun over the course of nearly seven years."

The probe will eventually be closer to the Sun than Mercury. It will be close enough to watch solar wind whip up from subsonic to supersonic.

When closest to the Sun, the probe's thick carbon-composite solar shields will have to withstand temperatures close to 2 500 degrees Fahrenheit (1 371 degrees Celsius). Due to its design, the inside of the spacecraft, and its instruments, will still be at a comfortable room temperature.

The probe will reach a speed of 450 000 mph (724 205 km/h) around the Sun. On Earth, this speed would enable someone to get from Qacha's Nek to Durban, about 140 miles (225km), in one second. The mission will also pass through the origin of the solar particles with the highest energy.

"The solar probe is going to a region of space that has never been explored before," Parker said. "It's very exciting that we'll finally get a look. One would like to have some more detailed measurements of what's going on in the solar wind. I'm sure that there will be some surprises. There always are."

The mission will end in June 2025. →