Parker Solar Probe

(Robotic Spacecraft EN Route the Outer Corona of the Sun)

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***Abstract*: Parker solar approach, as fast as probe mission will revolutionize our understanding of the sun. Parker solar probe will provide new data on solar activity and make critical contributions to our ability to forecast major space-weather events that impact life on the earth.**

The mission are trace the flow of energy and the heating of the solar corona and explore that accelerates the solar wind.

Key words: Robotics, parker solar probe, outer corona of the sun.

I. INTRODUCTION

Parker solar probe is a mission some sixty years in the making. It is a NASA robotic spacecraft en route to probe the outer corona of the Sun. It was approach to within 8.86 solar radii from the photosphere of the Sun and will travel, at closest 430,000mph (700,000 km/hr). It is the first-ever mission to “touch” the Sun. The spacecraft about the size of a small car, will travel directly into the Sun’s atmosphere about 4 million miles from the surface.

At closest approach, the front of the Parker solar probe’s solar shield faces temperatures approaches 2,500 F (1,377 C). The spacecraft will travel through material with temperatures greater than a million degrees Fahrenheit while being bombarded with intense sun light. Parker solar probe has been designed to withstand the extreme conditions and temperature fluctuations for the mission. The key custom heat shield and an autonomous system that helps protect the mission from the Sun’s intense light emission, but allow the corona to “touch” the space craft.

II. MISSION TO TOUCH THE SUN

- 6.12 million km-closest parker mission will get to sun.
- 1,300 c-expected temperatures on protective front heat shield.
- 190 km/s- super fast speed parker will attain (120mi/s)
- 60- Years since the mission like parker first proposed.

III. OBJECTIVES

Trace the flow of energy that heats and accelerates the solar corona and solar wind.

Determine the structure and dynamics of plasma and magnetic fields at the sources of the solar wind.

Explore mechanism that accelerate and transport energetic particles.

IV. EXISTING METHODOLOGY

The mysteries of the corona, but also protect a society that is increasingly dependent on technology from the threats of space weather, they send the solar probe to touch the sun. On the final three orbits, Parker solar probe will fly to within 9 solar radii of the sun’s “surface”9 solar radii is 9 times of the radius of the sun, or about 3.83 million miles. That is about seven times close solar pass, the Helios spacecraft. This mission will provide insight on a critical link in the sun-earth connection. The corona is unstable, producing the solar wind, flares and coronal mass ejections.

The millions of tons of highly magnetized material can erupt from the sun at speeds of several million miles an hour- fast enough to get from Washington to LA in seconds.

V. ABOUT SATELLITE

- NASA selected instrument suites.
- 685 kg maximum launch wet mass.

A.Dimensions:

- S\C height: 3 m
- TPS Maximum diameter: 2.3 m
- S\C Bus diameter: 1 m
- C-C Thermal protection system
- Hexagonal prism s\c bus configuration
- Actively cooled solar arrays
- 388W electrical power at encounter
- Solar array total area: 1.55 m2
- Radiator area under TPS: 4 m2
- 0.6 m HGA, 34 W TWTA Ka- band sciences DL
- Science downlink rate: 167kb/s at 1 AU
- Blow down mono prop hydrazine propulsion
- Wheels for attitude control

VI. THE SHIELD PROTECTS IT

Of course, thousands of degrees Fahrenheit it is still fantastically hot. (For comparison, lava from volcano eruptions can be anywhere between 1,300 and 2,200 F (700 and 1,200 C) And to withstand that heat, Parker Solar Probe makes use of a heat shield known as the Thermal Protection System, or TPS, which is 8 feet (2.4 meters) in diameter and 4.5 inches (about 115 mm) thick. Those few inches of protection mean that just on the other side of the shield, the spacecraft body will sit at a comfortable 85 F (30 C).

The TPS was designed by the Carbon-Carbon Advanced Technologies, using carbon composite foam sandwiched between two carbon plates. This lightweight insulation will be accompanied by a finishing touch of white ceramic paint on the sun-facing plate, to reflect as much heat as possible. Tested to withstand up to 3,000 F (1,650 C), the TPS can handle any heat the Sun can send its way, keeping almost all instrumentation Safe.

In space, the temperature can be thousands of degrees without providing significant heat to a given object or feeling hot. Temperature measures how fast particles are moving, whereas heat measures the total amount of energy that they transfer. Particles may be moving fast (high temperature), but if there are very few of them, they won't transfer much energy (low heat). Since space is mostly empty, there are very few particles that can transfer energy to the spacecraft. But not all of the Solar Parker Probe instruments will be behind the TPS. Poking out over the heat shield, the Solar Probe Cup is one of two instruments on Parker Solar Probe that will not be protected by the heat shield. This instrument is what's known as a Faraday cup, a sensor designed to measure the ion and electron fluxes and flow angles from the solar wind. Due to the intensity of the solar atmosphere, unique technologies had to be engineered to make sure that not only can the instrument survive, but also the electronics aboard can send back accurate readings. The cup itself is made from sheets of Titanium-Zirconium-Molybdenum, an alloy of molybdenum, with a melting point of about 4,260 F (2,349 C). The chips that produce an electric field for the Solar Probe Cup are made from tungsten, a metal with the highest known melting point of 6,192 F (3,422 C). Normally lasers are used to etch the gridlines in these chips -- however due to the high melting point acid had to be used instead.

Another challenge came in the form of the electronic wiring -- most cables would melt from exposure to heat radiation at such close proximity to the Sun. To solve this problem, the team grew sapphire crystal tubes to suspend the wiring, and made the wires from niobium. Several other designs on the spacecraft keep Parker Solar Probe sheltered from the heat. Without protection, the solar panels -- which use energy from the very star being studied to power the spacecraft -- can overheat. At each approach to the Sun, the solar arrays retract behind the heat shield's shadow, leaving only a small segment exposed to the Sun's intense rays. But that close to the Sun, even more protection is needed. The solar arrays have a surprisingly simple cooling system: a heated tank that keeps the coolant from freezing during launch, two radiators that will keep the coolant from freezing, aluminum fins to maximize the cooling surface, and pumps to circulate the coolant. The cooling system is powerful enough to cool an average sized living room, and will keep the solar arrays and instrumentation cool and functioning while in the heat of the Sun.

The coolant used for a solar probe about a gallon (3.7 liters) of de ionized water. While plenty of chemical coolants exist, the range of temperatures the spacecraft will be exposed to varies between 50 F (10 C) and 257 F (125 C). Very few liquids can handle those ranges like water. To keep the water from boiling at the higher end of the temperatures, it will be pressurized so the boiling point is over 257 F (125 C). Another issue with protecting any spacecraft is figuring out how to communicate with it. Parker Solar Probe will largely be alone on its journey. It takes light eight minutes to reach Earth -- meaning if engineers had to control the spacecraft from Earth, by the time something went wrong it would be too late to correct it. So, the spacecraft is designed to autonomously keep itself safe and on track to the Sun. Several sensors, about half the size of a cell phone, are attached to the body of the spacecraft along the edge of the shadow from the heat shield. If any of these sensors detect sunlight, they alert the central computer and the spacecraft can correct its position to keep the sensors, and the rest of the instruments, safely protected. This all has to happen without any human intervention, so the central computer software has been programmed and extensively tested to make sure all corrections can be made on the fly.

VII. PROPOSING METHODOLOGY

It will swoop to within 4 million miles of the sun’s surface, facing heat and radiation like no spacecraft before it. To get there, it takes an innovative route.

Parker solar probe will use seven Venus flybys over nearly seven years to gradually shrink its orbit around the sun, coming as close as 3.83 million miles (and 6.16 million kilometers) to the sun, well within the orbit of Mercury and about seven times closer than any spacecraft has come before. Parker solar probe is a true mission of explores, the spacecraft will go close enough to the sun to watch the solar wind speed up from subsonic to supersonic, and it will fly through the birth place of the highest- energy solar particles. Still, as with any great mission of discovery, Parker Solar probe is likely to generate 24 orbits, 7 Venus gravity assist flybys.

VIII. CONCLUSION

Parker solar probe will provide further deceleration relative to its heliocentric orbit with help of the solar wind electrons alphas and protons investigation.

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