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Cost-Effective Mission Design for a Small Solar Probe

by

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one of the last unexplored regions of the solar system is that within 0.3 AU of the Sun. The goal of the Solar Probe mission is to go to within three solar radii of the Sun's surface. This will enable *in situ* observations of phenomena related to the origin and acceleration of the solar wind, the energy balance within the corona, and the plasma and dust to be found there.

Until 1992 all concepts for this mission consisted of large spacecraft with payloads exceeding 100 kg. Even though these designs would be launched on large launch vehicles they still required trajectories with long flight times. in this way the required launch energies and/or the required post-launch maneuver budgets could be accommodated in the flight system design. When considering life-cycle costs the Potential existed for the operations budget to push the concept above acceptable limits.

in February 1992 the Jet Propulsion Laboratory responded to the current fiscal environment by proposing to the Space Physics Division at NASA Headquarters that a Small Solar Probe concept be developed. It would be of the order of a few hundreds of kilograms and should be able to be launched on a small launch vehicle (such as an Atlas or a Delta). In addition the flight time should be constrained to be of the order of three years to perihelion.

The mission design uses a direct flight to a Jupiter gravity assist and then follows a polar trajectory by the Sun. This paper will describe the mission design including the impact on the spacecraft design and operations planning. Top level system trades will be described that enable control of life cycle costs for a highly constrain mission. Estimates will be given of cost sensitivities providing guidance on which technologies need to be supported for the provision of an affordable, exciting mission to the Sun,

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