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JPL Advanced Thermal Control Technology Roadmap

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Abstract

National Aeronautics and Space Administration is planning a wide range of deep space science missions for the exploration of the universe. These missions include planetary orbiters, planetary landers/rovers, planet/comet flybys, and planet/comet sample return missions. Many of these missions are very challenging in terms of engineering due to the high quality science returns expected from these missions while severe limitations are placed on the costs and schedule. Advanced technologies are needed in order to enable these challenging missions so that expected science returns can be achieved. Because of the wide range of thermal environment which the spacecraft experience during the mission, developing an appropriate thermal control system for the spacecraft is both complicated and challenging. Advanced thermal control technologies, the key to enabling many of these missions, are being developed at the Jet Propulsion Laboratory (JPL). The technologies that are being pursued include miniature loop heat pipes, advanced mechanically pumped cooling systems, phase change material thermal storage, variable emittance electrochromic devices, wax actuated heat switch, light weight thermal insulation for mars applications. The wide range of applications include: spacecraft temperature control, minimizing heat losses, precision temperature control of large structures, universal thermal architecture for future missions, microspacecraft thermal control, and high power density heat removal through micro-electromechanical system based thermal technologies for micro/nano sciencecraft.

The presentation will describe the JPL roadmap of these technologies.