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Aeroassist Systems: An Important Element in NASA's New Era of Planetary Exploration

SPURRED by Dan Goldin's faster, better, cheaper initiative, NASA is in the midst of a new era of planetary exploration. Rather than flying one or two spacecraft that take a decade or more to develop, this new exploration era is characterized by campaigns of low-cost, interdependent spacecraft with typical development times of three years. In this manner, numerous technically viable and scientifically interesting missions are being developed and flown at a fraction of the cost of previous exploration projects. Each of these missions focuses on an overarching science quest in which fundamental issues of our origins, evolution, and destiny are being addressed.

One means for accomplishing this reduction in mission cost is through the infusion of advanced technology. *Aeroassist*, defined as the use of atmospheric forces to improve mission performance, is an example of such a technology. Aeroassist applications include aerobraking, direct entry, aerocapture, and precision landing. These mission design strategies allow for flight through a planetary atmosphere, greatly reducing the propellant required by a traditional mission approach. Mars Pathfinder's direct entry, descent, and landing on July 4, 1997, and Mars Global Surveyor's use of aerobraking as a primary mission element are examples of the successful use of this technology. Sixty-five percent of the missions planned for the present decade (1995–2005) will use an aeroassist system as a primary mission element to reduce launch cost, a larger percentage than in any previous exploration era. In the coming years, NASA's reliance on this technology will increase as the agency moves from scientific campaigns characterized largely by one-way missions to roundtrip missions to Mars and elsewhere, all of which plan to bring samples back to Earth. Aeroassist systems are also a critical element to the goal of human exploration beyond low Earth orbit.

This issue of the *Journal of Spacecraft and Rockets* (*JSR*) contains 22 papers focused on recent advances in planetary entry systems. Articles pertaining to the design, development, and flight of six entry systems are presented. Aerodynamic, aerothermodynamic, heat-shield response, and flight dynamic issues are central to this set of papers. At the time of this writing, three of these systems (Galileo, Mars Global Surveyor, and Mars Pathfinder) have successfully completed the atmospheric flight segment of their missions. The other three missions (Mars Microprobe, Mars Polar Lander, and Stardust) are en route to their final destinations. The flight of these entry systems would not have been possible without the combined effort of many people, including personnel from the Jet Propulsion Laboratory, Lockheed Martin Astronautics, and the NASA Ames and Langley Research Centers. Each of these organizations is represented in this special edition of the *JSR*. Future editions of the *JSR* will include insight on these and other entry systems, including systems for the Mars Surveyor 2001, Genesis, and Mars Sample Return missions.

Robert D. Braun
NASA Langley Research Center