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New Millennium Mission Concepts for Deep Space-5

by Steve L. Cornford, Ralph B, Roncoli, and Kin F. Man

NASA's vision for Earth and space science in the 21st century calls for frequent launches of exciting, affordable missions with highly focused science objectives. In order to realize such a vision, great strides in efficiency, capability, and cost reduction must be made in the planning and execution of future science missions. The New Millennium Program (NMP) was created to enable this vision by identifying, developing, and flight validating revolutionary technologies and architectures which significantly contribute to lowering life cycle costs and increasing scientific returns. Breakthrough technologies from all sectors of the US "technology pipeline" including NASA, industry, academia, and other government agencies are brought to flight readiness in partnership with these organizations. As a technology validation program, the New Millennium Program is also willing to accept a higher risk than a typical science program would. This risk is not in the nature of increased risk of mission failure, but rather in the nature of technology development and validation. Thus, the primary objective of the New Millennium Program is to validate high-payoff technologies that would otherwise be unavailable to future science missions due to the inherently high risk associated with their first use. The validation data obtained can be used to assess and extrapolate the expected changes in performance parameters and characteristics to other mission environments.

Planning has recently been initiated to define mission concepts of the fifth mission (DS5) in a series of New Millennium Program deep space technology validation flights. DS5 is currently envisioned as a low-cost mission with a total life-cycle cost of approximately $35M and a launch date sometime in the year 2004. Several different concepts are currently being considered. With the low cost constraint, these concepts inevitably involve some innovative piggy-back implementation options to reduce cost. Like all NMP missions, DS5 is expected to return meaningful science data, in addition to data for validating the operation of the technologies in flight.

This paper will describe the concepts currently being considered as possible candidates for DS5. These concepts include, but are not limited to: (1) Aerobots on Venus or Mars - to demonstrate mobility, control, and steering; balloon and gondola materials and structure; as well as measuring gaseous composition of planetary atmospheres and studying surface morphology. (2) Solar sails - to demonstrate solar sail propulsion; sail fabrication, deployment and control; as well as making in-situ measurements. (3) Inflatable structures - to demonstrate inflatable, deployable structures for use as antennas, sun shades, booms, structural elements, or as optical telescope components. (4) In-situ detector network - to demonstrate the precise deployment, tracking, and operational control of a network of long-life sensors on the surface of a body, and to validate high-volume data handling and processing, and long-life power generation.