

**SAMPLE COLLECTION FOR INVESTIGATION OF MARS (SCIM): STUDY OF AN EARLY MARS SAMPLE RETURN MISSION THROUGH THE MARS SCOUT PROGRAM.** L. A. Leshin<sup>1,2</sup>, A. Yen<sup>3</sup>, B. Clark<sup>4</sup>, L. Forney<sup>5</sup>, T. Gamber<sup>4</sup>, S. Jones<sup>3</sup>, A. Jurewicz<sup>3</sup>, M. Richardson<sup>6</sup>, T. Sharp<sup>1</sup>, M. Thiemens<sup>7</sup>, M. Zolensky<sup>8</sup>; <sup>1</sup>Dept. of Geological Sciences, <sup>2</sup>Center for Meteorite Studies, ASU, Tempe, AZ 85287-1404, USA; <sup>3</sup>JPL, 4800 Oak Grove Dr., Pasadena, CA 91109, <sup>4</sup>Lockheed-Martin Astronautics, P.O. Box 179, MS S-8000, Denver, CO 80201, <sup>5</sup>Dept. of Chemical Engineering, Georgia Tech. Atlanta, GA 30340, <sup>6</sup>Div. of Geological and Planetary Science, Caltech, Pasadena, CA 91125, <sup>7</sup>Dept. of Chemistry, UCSD, San Diego, CA 92093, <sup>8</sup>SN2, NASA JSC, Houston, Texas 77058. (laurie.leshin@asu.edu)

The Mars Scout Program intends to fly competitively-selected science missions (similar to Discovery Missions) to complement the baseline core missions in the Mars Program. The first launch is anticipated to occur in the 2007 opportunity. In this abstract we describe a Mars mission concept proposed in response to NASA's request for Mars Scout Concept Study Proposals.

The Sample Collection for Investigation of Mars (SCIM) concept is a mission designed to (1) make a ~40 km pass through the Martian atmosphere, (2) collect dust and atmospheric gas, and (3) return the samples to Earth for analysis. This mission concept is compelling because it will return a Martian sample within this decade without assuming the substantial risk, complexity, and cost of landing on and launching from the surface.

SCIM Science Goals:

- Determine the extent of aqueous processing (weathering) of Martian crustal materials
- Quantitatively establish the chemical, isotopic and mineralogical composition of Martian dust
- Quantify the size- and compositional- distribution of dust in the Martian atmosphere
- Provide ground truth for past and future remote sensing observations of martian surface materials
- Unambiguously demonstrate whether Martian (SNC) meteorites are indeed samples of Mars
- Discover evidence relevant to Mars' original volatile inventory and its subsequent evolution
- Investigate current atmospheric chemical phenomena such as escape to space

To meet the science goals outlined above, return of samples to Earth for analysis is necessary. Remote sensing data will continue to suffer from lack of "ground truth," and remote geochemical methods are inflexible and imprecise relative to Earth-based laboratories. The return of even a small amount of Martian material will provide an enormous advance in our scientific understanding of Mars.

Initial calculations of mission parameters indicate that an atmospheric pass at 40 km altitude in the southern hemisphere near summer solstice, (Ls ~270±40) would allow a significant amount of dust to be collected. Mission calculations "flying" a 100 cm<sup>2</sup> collector through a model martian atmosphere shows that ~11 million particles >2 μm in diameter would be

encountered. The size distribution of these particles is skewed towards the smallest sizes, but thousands of particles with diameters ≥10 μm should be encountered. Initial calculations show that the large particles should reach the SCIM dust collector (an aerogel design broadly similar to Stardust) intact, and with relatively little heating. Further work on both the dust distribution in the atmosphere and the dust collection efficiency and approach are underway.

The SCIM flight system, designed by Lockheed Martin Astronautics, is capable of launch aboard a Delta 7925 in Sept. 2007. The atmospheric pass would take place in July 2009, and the samples returned to Earth in May 2010.

Planetary protection concerns for the returned samples would likely be significantly less than for a returned Mars surface sample, because the dust has been exposed to extreme UV conditions in the martian atmosphere, and it is heated to denaturation temperatures during collection. However, Planetary Protection implications of the SCIM concept are currently being explored with NASA. The intention would be to have samples handled in a similar way to Stardust, with eventual curation at JSC (probably after some quarantine/preliminary examination period) and with grains and gas aliquots made available to many individual investigators through a proposal process.