THE IMPLEMENTATION OF THE MARS SCIENCE LABORATORY SAMPLE CACHE. J. S. Karcz[1], M. Cappuccio[2], A. G. Demo[2], H. J. Eisen[3], J. Feldman[3], K. Gheno[5], C. E. Kruger[2], M. Liu[2], J. H. Reimer[6], O. Santos[2], O. E. Serviss[3], P. K. Tong[5], [1]SETI Institute, 515 North Whisman Road, Mountain View, CA 94043. john.s.karcz@nasa.gov, [2]NASA Ames Research Center, Moffett Field, CA 94035, [3]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, [4]Lockheed Martin Mission Services, P.O. Box 168, Moffett Field, CA 94035, [5]Lockheed Martin Space Systems, 3251 Hanover Street, Palo Alto, CA 94304, [6]ASRC Aerospace Corporation, Moffett Field, CA 94035.

Introduction: We are developing a sample cache for the 2009 Mars Science Laboratory rover. It will be able to accept 5–10 rock samples, each ~ 0.5–1.5 cm across, delivered by MSL's preexisting soil scoop. The samples will be held in a common container designed to allow photo-documentation of the samples over the course of the mission. The design is simple and intended to survive at least ten Earth years on Mars on a presumed-dormant rover. It is intended to allow convenient removal and repackaging, if desired, by a future sample-return rover. Care has been taken to limit contamination of samples by the cache system and to provide means to aid later identification of any contamination which does occur.

Description: The cache will be located at the front of the rover, within the workspace of MSL's arm. The cache will be a passive system, with no moving or electrical parts. It will consist of two components: a sample container and a cradle. The cradle will hold the container to the rover and provide a funnel for delivering samples from the scoop into the container. The container will be removable—tabs holding it into the cradle will bend away when the container is pulled with a predetermined force.

The sample container: The container's geometry (a cylinder 7 cm in diameter and 2.5 cm in height) and mass (200 g full) were chosen for convenient return. It would occupy ~ 40 % of the capacity of recent MSR Orbiting-Sample Container concepts, leaving room for freshly-acquired samples. Samples will be deposited through a top opening. The volume of MSL's scoop is similar to that of the cache, and the scoop, designed to acquire only rock-free soil, has no proven capability to discard any excess soil scooped up with targeted rocks. Therefore the container's sides and face will be meshed to allow soil to fall through in order for the cache to accommodate the desired number of samples. The samples will be uncovered, exposed to the environment for their entire stay on MSL. The top opening will be large to prevent clogging while depositing samples and to allow viewing through the funnel of the cache's contents by the microscopic imager at the end of MSL's arm, the Mars Hand Lens Imager (MAHLI).

Caching operations: The tasks which will comprise each caching event follow from the need to acquire and deliver the sample rocks using a scoop designed for soil alone and from the requirement to photo-document the samples. The contents of the cache will be imaged prior to any other operations to assess the volume available and to photo-document previously cached contents from which some soil may have fallen away. Imaging and other feasible characterization of targeted rocks on the ground will be performed prior to acquisition by the scoop. Separation of targeted rocks from incidentally scooped soil may be possible through manipulation of the scoop; if so, this will be done after acquisition. If possible, rocks will be imaged using the HazCams located on the front of the rover while in the scoop. The contents of the container will again be imaged after the samples have been dropped into the cache.

Illustration 1: An oblique view of the cache, looking into the funnel.

Sample contamination: To limit contamination, few materials will be used to fabricate the cache. Those that will be used, and the cleaning procedures for them, have been chosen based on recommendations from the Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM). A copy of the flight cache, witness coupons, and spare materials will be curated on Earth to aid in the future identification of terrestrial contamination. As the container will be open on Mars and the samples exposed, the comparison of the curated materials with the flown cache, if returned, may also provide information on any contamination which occurs during the mission.