Mechanics/Machinery

System for Packaging Planetary Samples for Return to Earth

System completes all the necessary steps for proper preservation.

NASA's Jet Propulsion Laboratory, Pasadena, California

A system is proposed for packaging material samples on a remote planet (especially Mars) in sealed sample tubes in preparation for later return to Earth. The sample tubes (Figure 1) would comprise (1) tubes initially having open tops and closed bottoms; (2) small, bellowslike collapsible bodies inside the tubes at their bottoms; and (3) plugs to be eventually used to close the tops of the tubes. The top inner surface of each tube would be coated with solder. The side of each plug, which would fit snugly into a tube, would feature a solder-filled ring groove. The system would include equipment for storing, manipulating, filling, and sealing the tubes.

The containerization system (see Figure 2) will be organized in stations and will include: the storage station, the loading station, and the heating station. These stations can be structured in circular or linear pattern to minimize the manipulator complexity, allowing for compact design and mass efficiency. The manipulation of the sample tube between stations is done by a simple manipulator arm. The storage station contains the unloaded sample tubes and the plugs before sealing as well as the sealed sample tubes with samples after loading and sealing. The chambers at the storage station also allow for plug insertion into the sample tube. At the loading station the sample is poured or inserted into the sample tube and then the tube is topped off. At the heating station the plug is heated so the solder ring melts and seals the plug to the sample tube.

The process is performed as follows: Each tube is filled or slightly overfilled with sample material and the excess sample material is wiped off the top. Then, the plug is inserted into the top section of the tube packing the sample material against the collapsible bellowslike body allowing the accommodation of the sample volume. The plug and the top of the tube are heated momentarily to melt the solder in order to seal the tube.

This work was done by Mircea Badescu, Yoseph Bar-Cohen, Paul G. Backes, Stewart Sherrit, Xiaoqi Bao, and James S. Scott of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP *(see page 1)**. NPO-46089*

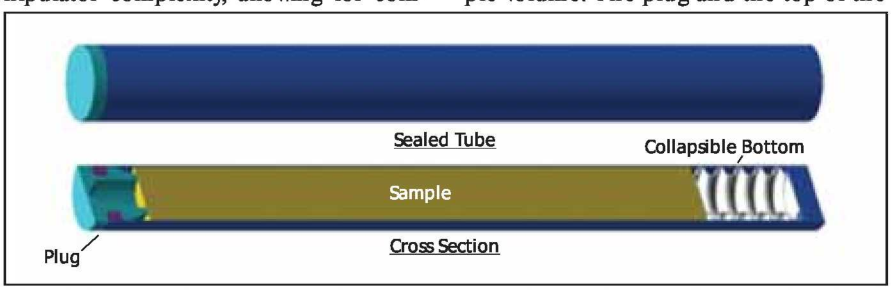

Figure 1: A **Sample Tube** is shown with collapsible bottom (on the right), sample, and sealed plug.

Figure 2: **Containerization System** includes loading, heating/sealing, and storage stations.

Offset Compound Gear Drive

A 50-percent reduction ratio is achieved with two stages utilizing four gears.

John H. Glenn Research Center, Cleveland, Ohio

The Offset Compound Gear Drive is an in-line, discrete, two-speed device utilizing a special offset compound gear that has both an internal tooth configuration on the input end and external tooth configuration on the output end, thus allowing it to mesh in series, simultaneously, with both a smaller external tooth input gear and a larger internal tooth output gear. This unique geometry and offset axis permits the compound gear to mesh with the smaller diameter input gear and the larger diameter output gear, both of which are on the same central, or primary, centerline. This configuration results in a compact in-line reduction gear set consisting of fewer gears and bearings than a conventional planetary gear train. Switching between the two output ratios is accomplished through a main control clutch and sprag. Power flow to the above is transmitted through concentric power paths.

Low-speed operation is accomplished in two meshes. For the purpose of illustrating the low-speed output operation, the following example pitch diameters