

High reflectivity brings Heaven to Earth

Global Design News

by David J. Bak, Executive Editor

Brooklyn, New York – if the streets of Paradise aren't paved with gold, at least those telescopes searching for them are. Gold's high reflectivity and resistance to oxidation, for example, make it the coating material carried on the Mars Orbiter Laser Altimeter (MOLA). Deployed on the Global Surveyor launched November 1996, and scheduled for a two-year operating period, MOLA will generate a detailed topographic map of the Red Planet's entire surface.

The surveyor's infrared beam pulses off the Martian surface ten times a second. A gold-coated telescope-mirror captures the reflected IR beam while the altimeter measures the laser light's round-trip travel time. Variations in transmission time help scientists determine to an accuracy of a single meter the height and shape of landscape features.

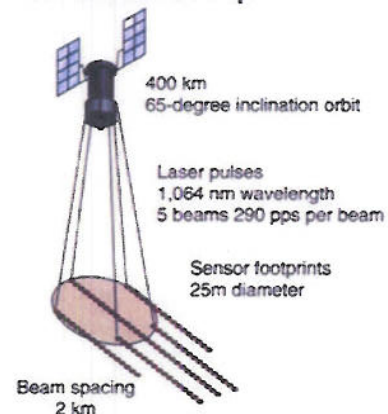


MOLA's primary mirror lens measures about a half-meter in diameter. Supplied by Brush Wellman Inc. (Cleveland, Ohio), the mirror blank is made of Beryllium. An electrochemical plating process, known as Laser Gold™, deposits the coating.

"As many as 15 separate tanks may comprise the electrochemical plating process," explains David Epner of Epner Technology Inc., the company responsible for the telescope-mirror's gold coating. Parts are first plated with electroless nickel which is chemically deoxidized and activated to promote adhesion of the LaserGold. Immersion in a tank equipped with platinum anodes and proprietary electrolyte deposits the gold. The electrolyte, Epner points out, contains more than 5 kg of gold—albeit in the form of ionized cyanide salt, a deadly poison.

Reflectance of the finished part, Epner claims, reaches 97% at 2 microns, "where it remains flat well into the far infrared." Manipulating the many variables associated with electrochemical plating, he adds, creates gold surfaces with a hardness of more than 200 Knoop, as compared to a hardness of about 75 Knoop for "pure" 24-karat gold.

VCL mission concept



"The mirror's gold coating is essential to the mapping operation, giving the telescope optimum sensitivity for detecting reflected laser light, confirms Tom Thorpe, science systems manager for the Mars Global Surveyor project at the Jet Propulsion Laboratory (Pasadena, California).

In addition to MOLA, LaserGold coats the three secondary IR mirrors for Hawaii's Keck Observatory; the radiation shields on the AXAF telescope; and the mirrors on NASA's Vegetation Canopy Lidar, scheduled for launch in early 2000. Less-than-heavenly terrestrial applications include reflectors in semiconductor-wafer processing systems, computer disc drives, and automotive paint-dry ovens.

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