MAGELLAN MISSION PROGRESS REPORT; Thomas W. Thompson and Magellan Flight Team, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California

The Magellan spacecraft was launched from Cape Kennedy on May 4, 1989 and was inserted into orbit around Venus on August 10, 1990. The Magellan spacecraft carries a radar instrument that makes synthetic aperture radar (SAR) images of the surface, measures the altitude of the Venusian surface directly below the spacecraft, and obtains radiometric observations of the surface. Radar and radiometric observations of the Venusian surface commenced on September 15, 1990 and continued until September 15, 1992. Gravity observations began on 24 September 1992 and will continue until late May 1993. The radar observations have produced SAR images and surface topography for 99 percent of the surface. These radar observations support the objective of improving the knowledge of the geological history of Venus by analysis of surface morphology and the processes that control them. The gravity observations that are being conducted now support the Magellan objective of improving the knowledge of the geophysics of Venus, principally its density distribution and dynamics. Also, Magellan has generated more digital planetary image data than all previous planetary missions.

During the two years of radar observations, Venus rotated three times under the orbit defining the first 3 mission cycles. The first mission cycle from 15 September 1990 until mid-May 1991 emphasized the acquisition of radar data with images from the left side of the spacecraft. Since periapsis is near 10-degrees north, the first mission cycle imaging from the North Pole to as far south as possible. Some 84 percent of the surface was observed in this first mission cycle. At the end of this first mission cycle, the large unimaged areas were at the south pole and from longitudes of 30 to 50 degrees. During October and November 1990, Venus went through a Superior Conjunction phase when radar observations were not conducted because the Sun interfered with communications between Earth and the Magellan Spacecraft.

The second mission cycle from mid-May 1991 until mid-January 1992 emphasized the filling of these two large gaps. To image the South Pole the spacecraft was rotated and radar observations were made of areas on the right side of the orbit. Also, an Orbit Trim Maneuver (OTM) was conducted at the beginning of cycle 2 to interleave the altimeter footprints for cycles 1 and 2 in the equatorial areas of Venus. (The altimeter footprint of 10 kilometers undersamples the near-equatorial regions because the orbit-to-orbit spacing at the equator is 22 kilometers. The second mission cycle suffered from overheating. Thermal evasions by pointing the large antenna toward the Sun decreased the data downlink to Earth. However, about half of Venus was imaged and cumulative coverage rose to 94 percent at the end of second mission cycle. Unfortunately, a downlink transponder failure late in mission cycle 2 curtailed observations in the third mission cycle.

The third mission cycle was conducted from mid-January until mid-September 1993. Radar observations were once again from areas from the left side of the orbit. A Stereo Test in mid-Cycle 2 showed that Magellan could produce images equivalent to terrestrial stereo photographs from aircraft by reimaging areas observed earlier in Cycle-1 with different look directions. The transponder failure forced the use of a previously degraded back-up unit. However, about 25 percent of the surface was observed with a geometry that complemented those of the first mission cycle. In addition, the last large gap was imaged when the Ushas,

Inni, and Hathor volcanoes were observed at the end of mission Cycle-3. Cumulative coverage rose to 99 percent of the surface at this mission cycle. (Figure 1.)

The radar was turned off so the large antenna could be used for gravity observations in the fourth mission cycle, which commenced in mid-September 1992 and continues today. Another Orbit Trim Maneuver (OTM) was performed on 16 September 1992; it lowered periapsis from 275 km to 184 kilometers to provide better lateral resolution of the gravity observations. This fourth mission cycle will continue until late-May 1993. The Magellan Project is currently planning limited aerobraking during the summer of 1993.

Magellan radar products are available as analog photographs and as digital compact disks (CD-ROMs) at the National Space Science Center (NSSDC) at the Goddard Space Flight Center in Greenbelt, Maryland. Over 1000 radar mosaics are available. In addition, altimetry and radiometry products produced by MIT and cartographic products produced by the USGS are available.

Figure 1.