RADIOMETRIC CALIBRATION OF THE MAGELLAN RADAR; S. D. Wall and W. T. K. Johnson, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

The Magellan mission will provide a global radar map of Venus with the purpose of enhancing our understanding of its geology and geophysics. The single scientific instrument onboard the spacecraft, a microwave radar, will collect various data from a near-polar, highly elliptical orbit using an observation wavelength of about 13 cm (S-band) to penetrate the optically opaque atmosphere. The raw science data acquired by the radar sensor will be transmitted to Earth for subsequent processing and reduction into useful scientific products. The primary end results will be global, high-resolution images of the Venusian terrain using the synthetic aperture radar (SAR) mode of the sensor. Mosaicked products will also provide planet-wide maps at lower resolutions. In addition, the sensor will acquire altimetric information using a dedicated altimeter antenna and receive radiothermal emissions from the planet in a passive radiometer mode. This paper reports the radiometric calibration procedures employed by Magellan and the expected accuracy of all three modes and briefly describes the data products that Magellan will provide to the scientific community for analysis.

Various factors arise in the sensor hardware and processor which affect the absolute measurement of the radar normalized backscatter coefficient, σ^o. An extensive pre-launch radiometric calibration program has produced data characterizing the sensor which will be used to calibrate the data. Transmit power variations, receiver gain states, and other operational variations will be used to correct the SAR and altimetry data products. The SAR data collection strategy is to change the incidence angle smoothly as a function of latitude to compensate for the signal-to-noise variations resulting from Magellan's elliptical orbit. Therefore, in the SAR products a nominal backscatter function will be removed from the data as the incidence angle changes along track. Cross-track antenna pattern will be removed from the SAR data, and the mosaicking effort will further reduce the pass-to-pass radiometric artifacts. The resultant amplitude-calibrated SAR and altimetry returns will be combined to produce model-dependent estimates of the surface electrical properties. Radiometry data will be calibrated using both pre-launch data and in-flight "cold sky" measurements.

SAR images will have resolution equal to or better than 300 m on the surface at 16 equivalent looks, with a dynamic range of at least 30 dB. Relative radiometric accuracy (defined as the difference in measured normalized cross-section between any two identical distributed targets viewed at the same incidence angle within 1000 km along track) will be less than 2 dB. Absolute radiometric accuracy (defined as the difference between measured and actual cross-section) will be within 5 dB. Radiometric measurements will have absolute accuracy of 3 dB and relative accuracy of 1 dB. The radiometer is expected to have a measurement accuracy of 2-3K.

Magellan data products will be available through the Planetary Data System and the National Space Sciences Data Center. Digital SAR products meeting the above specifications will include the Basic Image Data Record at both full and 3x-reduced resolutions, and the Mosaicked Image Data Records in full, 3x-, 9x- and 27x-reduced resolution forms. Altimetry and radiometry products will be produced in a time-ordered fashion in the basic data record and in globally gridded forms. Reduced products from SAR and altimetry will be globally gridded.

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