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The Juno Mission and the Role of Earth-Based Supporting Observations

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The Juno spacecraft was launched in 2011 and passed close to the Earth for a gravity assist in 2013. It will reach Jupiter in July of 2016 and enter orbit around Jupiter, with the first of over thirty highly elliptical polar orbits whose periapsis distances are inside the radiation belts. The purpose of the mission is to determine the abundance and distribution of water in the deep atmosphere of Jupiter, map the close-in gravity field, and map the electromagnetic environment over all longitudes. These investigations will determine the structure, composition and dynamics of the interior of Jupiter. It will relate features that are easily detectable in the exterior of Jupiter to movement in the deep interior. Understanding these processes will provide clues to formation and evolution of Jupiter, providing insight into the formation of giant planets in general. The complement of scientific instruments on board Juno consists of in-situ instruments that measure the electromagnetic environment of Jupiter and remote-sensing instruments that cover a broad, but incomplete, spectral range. The Ultraviolet Spectrometer (UVS) will cover 70-205 nm, the Juno IR Auroral Mapper (JIRAM) will cover 2-5 μm, and the Microwave Radiometer (MWR) will cover 1.3-50 cm. In addition, a public-outreach camera, JunoCam, will produce images in broad-band red, green and blue filters, together with a narrow-band 890-nm filter centered on a CH_4 gaseous absorption feature. Juno will make over thirty orbits of Jupiter, but remote sensing will only be a priority on orbits 1 and 3 through 8, although the instruments will remain functioning during the remaining gravity-sensing orbits. The mission will benefit from substantial levels of Earth-based support. Spectral ranges not covered by remote-sensing instruments contain valuable information. JunoCam will not produce calibrated imaging, and so a broad range of narrow-band and spectroscopic information at wavelengths of 0.3-2.0-μm would provide information on cloud properties in the troposphere. Near-infrared high-resolution spectroscopy will supplement JIRAM by providing sensitivity to lines of minor constituents that serve as tracers of vertical winds. No Juno instrumentation will cover infrared wavelengths greater than 5 μm (the mid-infrared), which provide direct information on temperature structure and the distribution of trace gases in both the troposphere and stratosphere, as well as cloud properties in the upper troposphere (pressures of 1 bar or less). Another key element of support will be the need to supply the spatial context for remote sensing instruments that will have pole-to-pole latitudinal coverage but only in strips that are 5 to 10 degrees in longitude. Equally important during this period will be observations of changes in time, both to monitor the history and evolution of features that fall into the remote-sensing coverage of Juno as well as to determine velocity fields around features. Prior to solar conjunction in mid-2016, it will be important to assess the extent and lifetime of features that might be captured in the coverage of the atmosphere, e.g. the Great Red Spot, Oval BA, brown barges or other cyclonic features, and blue-gray regions that are associated with clear and dry atmospheric conditions. This assessment will inform the precise timing of the orbit-reduction maneuver in order to increase the probability of measuring any of these features of interest around close passes with Jupiter. We are soliciting both professional and amateur observations, with the author serving as the point of contact for input. Support for this work was provided by the Juno Project through an award from the National Aeronautics and Space Administration.

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