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FARVIEW – An In-Situ Manufactured Lunar Farside Radio Observatory

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We present results from a NASA Institute for Advance Concepts study of *FarView*, a low frequency (5-40 MHz) radio observatory that will be manufactured on the lunar far side using almost exclusively lunar materials. We discuss *FarView's* science, enabling technology, system architecture, and implementation approach as well as technology roadmaps and precursor missions, within the context of a science and technology roadmap for lunar far side radio science.

FarView is a sparse array of ~100,000 10-meter dipole antennas covering a ~200 km^2 area to be built on the lunar far side to shield it from Earth's radio noise that would limit its performance. The innovative elements enabling *FarView* are the near exclusive use of in-situ resources and manufacturing to build the expansive observatory, including the antennas and power generation infrastructure.

FarView will measure the power spectrum of the 21-cm Dark Ages signal. Interferometric measurements of the spatial fluctuations will uniquely test the standard cosmological model at the onset of structure formation, without the complication of highly non-linear baryonic effects. Any departure from these well-constrained predictions will provide important new insights on the physics of structure formation, the nature of dark matter, early dark energy, or any exotic physics. Fundamentally, such observations could also measure the ultimate number of linear modes in the 3D density field and lead to exquisite cosmological constraints, including the masses of neutrinos and their hierarchy, the non-Gaussianity of initial density perturbation, and the imprints of primordial gravitational waves to reveal the complexity and energy scale of cosmic inflation.

FarView is enabled by two Lunar Resources' developed technologies: molten regolith electrolysis and vacuum vapor deposition. These revolutionary technologies first extract metals and oxygen from lunar regolith and then use the extracted metals including aluminum, silicon, and magnesium, to manufacture antennas, solar cells, and batteries by vapor deposition (Figure 1). By landing ~1.5 MT of "tools" we can extract and manufacture many tons of functional products. *FarView* will be fully serviceable using in-situ manufacturing, reconfigurable as needed, and able to be periodically upgraded by novel lunar technologies.

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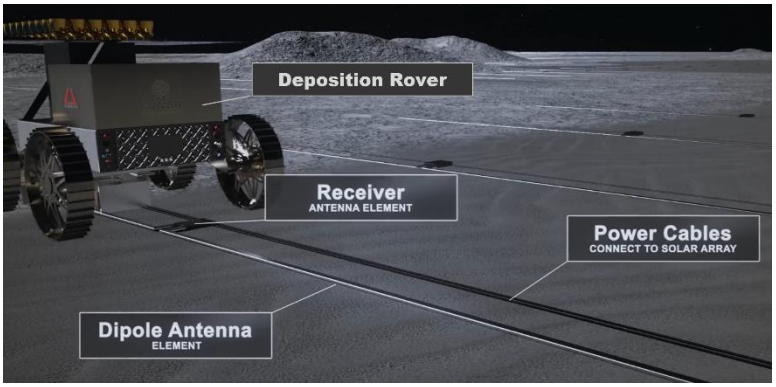

Figure 1. Artist rendition of deposition rover manufacturing dipoles and support systems for the *FarView* observatory