National Aeronautics and Space Administration



KaSTLE

Ka Steerable Terminal for Lunar Environments

On-The-Move Lunar Communications

Unlocking the Mysteries of the Moon

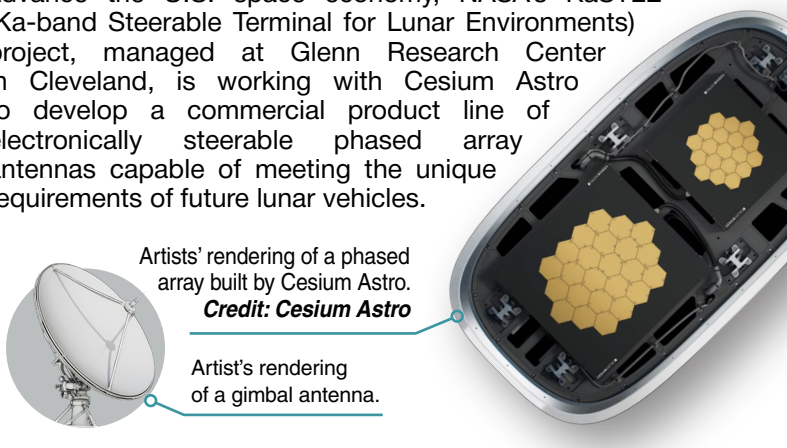
NASA is embarking on one of the most ambitious engineering and exploration endeavors in history: building the Moon Base, humanity's first lunar outpost. Moon Base will be built near the lunar South Pole, a region of environment extremes that offers unique opportunities for scientific discovery, exploration, and an enduring human presence. However, the same conditions that make the area valuable for discovery also make it one of the most demanding environments humans have ever attempted to explore. From rugged terrain to abrasive lunar dust, the location presents unique challenges for communications.

Phased Array Technology

Astronauts and robotic explorers will need powerful, dependable communications systems when exploring the Moon, driving the development of new technologies. NASA's Space Communications and Navigation (SCaN) division is working with industry to develop electronically steerable antennas that can enable on-the-move communications for lunar vehicles. These antennas, known as phased arrays, are composed of many small antennas that work together to electronically steer communications signals toward their target in a focused beam, even as it moves away from the target or makes unexpected turns.

Phased array antennas are used frequently on Earth, but they have never been deployed on the Moon. Installing this technology on lunar rovers will enhance astronaut safety while increasing science and exploration opportunities by providing live feedback with Mission Control as vehicles are in motion, opposed to using traditional gimble antennas, which require frequent pauses and readjustments to send data.

To accelerate technology maturation for Moon Base and advance the U.S. space economy, NASA's KaSTLE (Ka-band Steerable Terminal for Lunar Environments) project, managed at Glenn Research Center in Cleveland, is working with Cesium Astro to develop a commercial product line of electronically steerable phased array antennas capable of meeting the unique requirements of future lunar vehicles.



Artists' rendering of a phased array built by Cesium Astro.
Credit: Cesium Astro

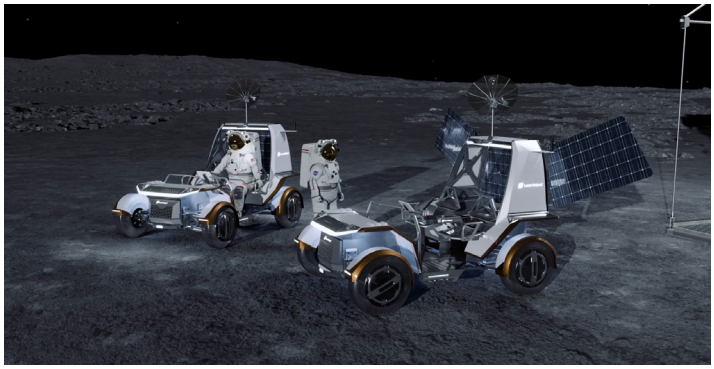
Artist's rendering of a gimbal antenna.

Lunar Terrain Vehicles

As astronauts explore the South Pole region of the Moon, they will be able to go farther and conduct more science than ever before thanks to a new lunar terrain vehicle (LTV), which will function like a cross between an Apollo-style lunar rover and a Mars-style uncrewed rover. NASA has awarded Astrolab and Lunar Outpost contracts to build and deliver the first phase of LTVs to the Moon by 2028.



Artist's rendering of Astrolab's Crewed Lunar Vehicle, or CLV-1 on the Moon.
Credit: Astrolab



An artist's rendering of Lunar Outpost's Pegasus LTV on the Moon.
Credit: Lunar Outpost

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