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U.S. Plans Lunar Nuclear Reactor by 2030, Led by Sean Duffy

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On August 5, 2025, U.S. Secretary of Transportation and interim National Aeronautics and Space Administration (NASA) Administrator Sean Duffy announced plans to expedite the development of a nuclear reactor on the moon by 2030, aiming to secure a reliable power source for future lunar missions. The directive, first reported by Politico, emphasizes the urgency of beating China and Russia in a new space race, citing their joint plans for a similar reactor by the mid-2030s.

The initiative targets a 100-kilowatt nuclear reactor, capable of powering approximately 80 U.S. households, to support NASA's Artemis program, which seeks to establish a sustained human presence on the moon. Unlike solar panels, which falter during the moon's two-week-long nights, a fission-based reactor would provide continuous energy for habitats, scientific experiments, and potential lunar mining operations. Duffy's directive, dated July 31, 2025, orders NASA to solicit industry proposals within 60 days and appoint a program executive within 30 days to oversee the Fission Surface Power (FSP) project, designed to ensure reliable energy for lunar and Mars exploration.

Duffy highlighted the strategic importance of the project, stating, "We're in a race to the moon, in a race with China to the moon. And to have a base on the moon, we need energy." He emphasized that key lunar locations, particularly those with ice and sunlight, are critical for establishing a U.S. presence. The directive warns that if China or Russia deploys a reactor first, they could claim a "keep-out zone," potentially restricting U.S. access under the Artemis Accords, an international agreement on lunar cooperation signed in 2020. This concern stems from China and Russia's announcements since March 2024 to develop a lunar reactor by the mid-2030s.

NASA has prior experience with nuclear power, having used radioisotope thermoelectric generators (RTGs) with plutonium-238 to power spacecraft since the 1960s. In 2022, NASA awarded three $5 million contracts to Lockheed Martin, Westinghouse, and a collaboration between Intuitive Machines and X-Energy to design a 40-kilowatt reactor, though those designs exceeded the six-metric-ton weight limit. The new 100-kilowatt reactor, to be delivered by a heavy-class lander with a 15-metric-ton payload capacity, poses significant technical challenges, including heat dissipation in the moon's airless environment and ensuring safe launches.

Experts express mixed views on the timeline's feasibility. Bhavya Lal, a former NASA official, noted that a reactor could transform space exploration by enabling robust operations, comparing it to the shift from candlelight to grid electricity on Earth. However, Kathryn Huff, a nuclear engineering professor at the University of Illinois, called the 2030 deadline "very aggressive" and questioned its necessity without a planned lunar outpost. Safety concerns include launching radioactive material and managing reactor disposal, with Huff referencing the 1978 Kosmos 954 incident, where a Soviet satellite spread radioactive debris over Canada.

Duffy's directive also coincides with NASA's push to replace the aging International Space Station (ISS), set to retire by 2030, with commercial stations. This dual focus reflects a broader strategy to advance U.S. space exploration amid budget cuts, including a proposed 24% reduction to NASA's 2026 funding. The nuclear reactor plan underscores the priority of maintaining U.S. leadership in space.