Defining a Global Lunar Position, Navigation, and Timing System

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As NASA seeks to fulfill its mission of extending humanity's reach through exploration as delineated in the Moon to Mars Strategy and Objectives Development and the Moon to Mars Architecture Definition Document, accurate and timely position, navigation, and timing (PNT) services are critical in the architecture, identifying a need to expand a PNT capability to the full lunar proximity service volume. This is echoed in the White House Office of Science, Technology, and Policy Cislunar Science and Technology Strategy, which pinpoints the fundamental need for PNT infrastructure to enable and sustain a vibrant cislunar ecosystem. While the Human Lunar Return segment seeks commercial services to provide a PNT service over a South Pole service volume for a limited period per Earth day, meeting the Sustained Lunar Evolution segment requires a Lunar Navigation System (LNS) focused on delivery of precise and resilient PNT services across the lunar globe and near-Moon space. This presentation describes the pre-Phase A system concept for an orbital constellation, the requisite lunar surface-based in-situ monitor and control segment, and an Earth control segment to provide lunar PNT services out to 200km altitude above the surface. The LNS leverages the foundational efforts on lunar reference system components such as the Lunar Geodetic System, Lunar Time System, and lunar ephemeris and orientation critical to safe, accurate, and seamless navigation.

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