

Precision Time Protocol-Based Trilateration for Planetary Navigation

Non-GPS innovation offers bidirectional position information over communications channels

Progeny Systems Corporation has developed a high-fidelity, field-scalable, non-Global Positioning System (GPS) navigation system that offers precision localization over communications channels. The system is bidirectional, providing position information to both base and mobile units. It is the first-ever wireless use of the Institute of Electrical and Electronics Engineers (IEEE) Precision Time Protocol (PTP) in a bidirectional trilateration navigation system. The innovation provides a precise and reliable navigation capability to support traverse-path planning systems and other mapping applications, and it establishes a core infrastructure for long-term lunar and planetary occupation. Mature technologies are integrated to provide navigation capability and to support data and voice communications on the same network.

On Earth, the innovation is particularly well suited for use in unmanned aerial vehicles (UAVs), as it offers a non-GPS precision navigation and location service for use in GPS-denied environments. Its bidirectional capability provides real-time location data to the UAV operator and to the UAV. This approach optimizes assisted GPS techniques and can be used to determine the presence of GPS degradation, spoofing, or jamming.

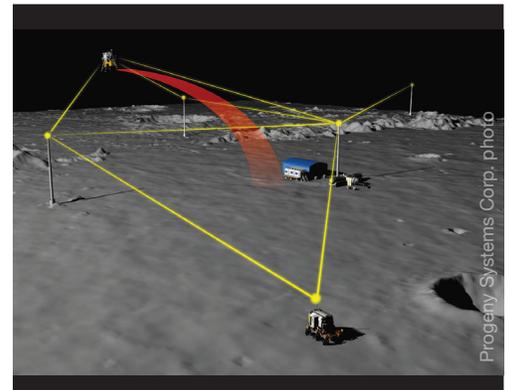
Applications

NASA

- ▶ Lunar and planetary habitation, exploration, and mining
- ▶ Manned and unmanned mobile systems
- ▶ Landing systems for lunar and planetary reentry

Commercial

- ▶ Identification of GPS jamming and spoofing affecting combatant aircraft and ground assets
- ▶ Navigation in urban environments where GPS is spotty or nonexistent
- ▶ Vehicle tracking in urban environments
- ▶ Emergency responder localization in multilevel buildings
- ▶ Near-port marine tracking in severe weather conditions
- ▶ Air traffic control and precision runway monitoring



Phase II Objectives

- ▶ Establish key performance requirements
- ▶ Prototype multimode wireless network, employing PTP for demonstration
- ▶ Complete electronics design and identification of components
- ▶ Complete design of radio frequency (RF) transmitter, receiver, and antenna components
- ▶ Develop link models for the lunar environment
- ▶ Complete tower design with finite element analysis and fabricate a scale model
- ▶ Demonstrate trilateration processing in prototype wireless network
- ▶ Deliver prototype hardware and firmware

Benefits

- ▶ Offers a lightweight and compact package
- ▶ Uses low power
- ▶ Operates reliably and precisely
- ▶ Uses existing and planned communications infrastructure

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