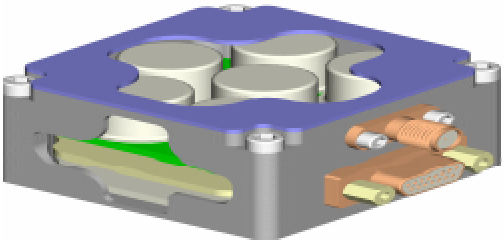
Navy Topic No: N01-054



Syntonics

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Syntonics develops custom radio frequency and precision frequency and timing electronic devices for land, sea, and space applications. It is dedicated to providing specialty products that deliver best-in-industry quality, precision, and reliability. It work has included radio frequency and optical communication systems and components; state-of-the-art antennas; precision space-qualified oscillators, and highly reliable, robust global positioning system (GPS) holdover clocks for both the U.S. military and commercial customers.

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SBIR Investment: $908K

Precise Time and Frequency for Navy Applications: The PICO Advanced Clock

About the Technology

Syntonics has developed a precision time and frequency source with excellent intermediate-term timing stability, long life, and high reliability. The company demonstrated that it is feasible to provide good frequency control and intermediate-term holdover timekeeping using an ensemble of quartz oscillators and an adaptive Kalman filter controller. "Holdover" timekeeping is the ability of a timekeeping source to maintain precision time for hours after an external precision time reference is removed, such as if the GPS system were jammed by the enemy. Syntonics' precise intermediate-term computer-controlled oscillators (PICO) control electronics monitor an oscillator ensemble and an external time reference such as GPS, when available, and maintains time that is "better" – i.e., more stable – than the external time reference. PICO's architecture includes two modules that comprise the control electronics, the time measurement unit and the central processor unit, and three additional modules, the oscillator ensemble unit, the signal generation unit, and an input-output module, that can be customized for specific applications.

Benefit to PEO C4I&Space and Other DOD Programs

The innovative PICO concept provides SPAWAR and other DOD programs with an inexpensive, highly reliable, and long-lived holdover time source with the signal purity and short-term (up to twenty minutes) stability of a good quartz oscillator and with intermediate-term (20 minutes to several hours) stability approaching a rubidium atomic standard. Reliable sub-microsecond timekeeping for hot-starting precision-guided munitions (PGMs) can now be achieved without atomic clocks. The PICO system will provide programs with a low cost of ownership device, and precise holdover timekeeping during GPS, and outages.

Why PICO Improves the Technology

- Uses robust "fail safe" architecture, enabling long mean-time-between-failures by avoiding single-point failures
- Can use any external time reference, for example GPS or the Joint Tactical Information Distribution System network time reference
- Can ensemble available atomic clocks with a PICO unit, enhancing stability and monitoring the atomic clock
- Provides superior short-term stability and phase noise performance versus cesium or rubidium based frequency sources

Military and Commercial Significance

- PEO C4I&Space has already identified operational requirements for improved holdover timekeeping in both its navigation system sensor interface and JTIDS/Link-16 systems for hot starting PGMs and enabling "organic" navigation without GPS.
- A Memorandum of Agreement was signed between Syntonics and Lockheed-Martin to incorporate PICO technology into its unmanned launcher systems.
- Other DoD components have a GPS holdover timekeeping requirement that can be addressed by PICO.
- In a space application, the PICO concept can be applied to the Block III version of GPS satellites.
- A PICO-like product directly addresses telecommunication network synchronization with an approach that competes favorably on price and reliability with existing products based on rubidium clocks.