

Chip Scale Atomic Clock (CSAC)

PROBLEM / OBJECTIVE

Assured Position, Navigation and Timing (PNT) is a key capability for the warfighters on the battlefield. Assured PNT systems will integrate innovative technologies such as the Chip Scale Atomic Clock (CSAC), which uses the oscillations of cesium or rubidium atoms to provide precise timekeeping in environments absent or in denial of GPS. While DARPA was able to demonstrate CSAC technology, units were hand assembled in a laboratory environment. It was not feasible to manufacture CSACs on a large-scale basis.

The objective of this joint Defense-Wide Manufacturing Science and Technology (DMS&T) and Army ManTech project was to develop high volume manufacturing processes to reduce unit cost for CSACs.

ACCOMPLISHMENTS / PAYOFF

Process Improvement: This project improved manufacturing processes of the physics package, the most important element of the CSAC. Process improvements include:

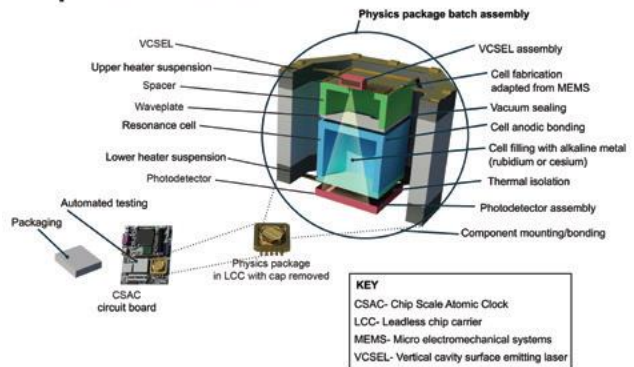
- Batch processing for atomic filling and vacuum sealing and robotic assembly of components and subassemblies
- Redesigned key processes using less expensive and 20% fewer parts while maintaining performance

Processes maturity was improved to TRL 7 and MRL 7 while fostering competitive manufacturing technologies among multiple vendors to assure more effective solutions.

Implementation and Technology Transfer:

Technology Transition occurred in 2014 with the PD PNT (Product Director for Position, Navigation and Timing). CSAC has been adopted by the oil and gas exploration industry for precision drilling operations. CSAC has been integrated with a MicroGRAM Selective Availability Anti-spoofing Module (SAASM) GPS Receiver. The PEO IEW&S is evaluating this SAASM GPS/CSAC product for military system applications.

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Expected Benefits and Warfighter Impact:

This capability supports TRADOC priorities for agile, ubiquitous networks. The technology has been incorporated into the Army PNT System of Systems Architecture (SoSA) strategy through competitive prototyping and structured testing to drive innovation as the Army shifts to assured PNT solutions. Warfighter benefit is through maintaining the integrity with the network. Specific benefits of this ManTech investment include:

- Reduction in manufacturing costs to \$200 per unit for production volumes.
- Increase production capability to over 40,000 units per year.

The Return-on-Investment (ROI) is projected at 42 to 1 for critical communications capabilities as a result of making this game-changing technology affordable.

TIME LINE / MILESTONE

Start Date	November 2010
End Date	September 2014

FUNDING

U.S. Army ManTech	\$13.2M
DMS&T	\$10.7M
Air Force GPS Wing	\$2.2M

PARTICIPANTS

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