Quantum Atomic Inertial Sensor (QuAIS)

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THE CHALLENGE

For missions in which GPS is either unavailable or actively denied, inertial navigation systems (INSs) are a key DoD asset because they are continuous sources of position, velocity, and attitude information. The INSs on defense platforms such as surface ships, submarines, unmanned underwater vehicles (UUVs), ballistic missiles, aircraft, and spacecraft all rely critically on inertial measurement units (IMUs) to maintain accuracy during GPS outages. Conventional IMUs lack the long-term performance required to accurately navigate in GPS-denied environments.

THE INNOVATION

AOSense is leveraging the intrinsic stability of atomic spectroscopy as well as the latest advances in quantum-atomic inertial sensing to develop an IMU for marine platforms with performance superior to conventional inertial devices. Novel techniques employed in this project will enable this IMU to overcome previous limitations of atomic inertial sensors for fielded military systems.

THE NAVY BENEFIT

Inertial sensor errors degrade the performance of an INS over time, which limits the duration over which the INS can maintain a mission's required position accuracy without GPS. Inertial sensors with lower noise and better stability will thus enable longer-duration missions without reliance on GPS, as well as higher accuracy inertial navigation for shorter missions.

Quantum-atomic inertial sensors have already demonstrated laboratory performance superior to conventional inertial devices. This emerging technology has the potential for significant further improvement.

THE FUTURE

The Phase II effort will culminate in a shipboard prototype demonstration, which will validate the technology's capability of achieving superior inertial navigation performance in a shipboard environment with size, weight, and power (SWaP) compatible with shipboard deployment. Subsequent development will focus on improving manufacturability, reducing sensitivity to environmental effects, and reducing system SWaP. In addition, parallel efforts will adapt this technology for other platforms.

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