QUANTUM COMPANIES — GUIDE

Quantum sensing use cases

Real-world applications of quantum magnetometers, gravimeters, atomic clocks and inertial sensors in defense, healthcare, navigation and resource exploration.

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Quantum sensors exploit superposition, entanglement and quantum interference to measure magnetic fields, gravity, time, rotation and acceleration with sensitivity beyond classical limits.

Sensor types and commercial maturity

Sensor type	Physical principle	Leading vendors	Maturity	Typical sensitivity
NV-diamond magnetometer	Nitrogen-vacancy center spin	QZabre, Quantum Diamonds, SBQuantum	Commercial	~pT/√Hz (room temp)
SERF/OPM magnetometer	Spin-exchange relaxation-free alkali vapor	QuSpin, FieldLine, Cerca Magnetics	Commercial	~fT/√Hz (body temp)
SQUID magnetometer	Superconducting quantum interference	Tristan Technologies, STAR Cryoelectronics	Commercial (cryogenic)	~fT/√Hz (4 K)
Cold-atom gravimeter	Atom interferometry (Rb/Cs)	Muquans (iXblue), AOSense, ColdQuanta (Infleqtion)	Pilot/early commercial	~1–10 nm/s² (;Äv Â’ ÂMEMS gravimeter	Silicon MEMS + quantum readout	Silicon Microgravity, Glasgow Univ. spinout	Emerging	~10–100 ;Äv Â ÂChip-scale atomic clock (CSAC)	Coherent population trapping (Cs/Rb)	Microchip (Microsemi), AccuBeat, IQD	Commercial (volume)	1e-11 to 1e-12 / day
Cold-atom clock	Ramsey/Rabi interrogation (Sr/Yb)	VREMYA, NICT, NIST spinouts	Research/defense	< 1e-15 / day
Cold-atom inertial (accel/gyro)	Atom interferometry	AOSense, ColdQuanta, M Squared, iXblue	Pilot (defense/space)	~1–10 ng/√Hz, ~0.001 °/hr
Quantum RNG	Photon shot noise, vacuum fluctuations	ID Quantique, QuintessenceLabs, Quantum Dice, Quside	Commercial	Gbps rates, NIST SP 800-90B validated

Key use cases by sector

Defense & national security

- **Submarine detection**: NV and SERF magnetometers for magnetic anomaly detection (MAD) without cryogenics.
- **GPS-denied navigation**: Cold-atom accelerometers/gyros for inertial navigation on aircraft, ships, satellites.
- **Secure communications**: Quantum RNGs for key generation; QKD for link encryption.
- **Underground facility mapping**: Quantum gravimeters detect density anomalies (tunnels, bunkers).

Healthcare & life sciences

- **Magnetoencephalography (MEG)**: OPM/SERF sensors enable wearable, room-temp MEG helmets for epilepsy and brain research (FieldLine, Cerca Magnetics).
- **Magnetocardiography (MCG)**: Fetal and adult cardiac magnetic field mapping without

shielding.
- **Drug discovery**: NV-diamond nanoscale NMR for single-protein structure determination.

Energy & resources

- **Mineral exploration**: Quantum gravimeters and magnetometers on drones/aircraft for ore body detection. Ask vendors for named reference deployments.
- **Oil & gas reservoir monitoring**: Time-lapse gravity for fluid movement tracking.
- **Carbon capture verification**: Gravimetric monitoring of CO , plume migration.
- **Pipeline inspection**: NV magnetometers for corrosion and defect mapping.

Navigation & timing

- **Autonomous vehicles**: CSAC for holdover when GNSS denied; cold-atom IMU for long-duration dead reckoning.
- **Telecom & financial networks**: CSAC and quantum clocks for 5G synchronization, high-frequency trading timestamping.
- **Space**: Cold-atom clocks (ACES/PHARAO on ISS) and interferometers for geodesy, fundamental physics.

Industrial & manufacturing

- **Non-destructive testing**: NV magnetometry for current imaging in batteries, semiconductors, composites.
- **Quality control**: Quantum gravimeters for density variation detection in additively manufactured parts.

Procurement considerations

- **SWaP-C**: Size, weight, power and cost. CSACs are chip-scale (< 20 cm³, < 120 mW). Cold-atom systems are rack-mount (19", 100–500 W).
- **Environmental**: Vibration, magnetic shielding, temperature stability. SERF/OPM needs ;Å@-level shielding. Cold-atom needs vibration isolation.
- **Export controls**: High-performance magnetometers (ECCN 6A006), gravimeters and gradiometers (ECCN 6A007) and inertial navigation systems (EAR Category 7) may be controlled; some items can fall under ITAR. Confirm the classification with BIS or counsel before export.
- **Integration**: Digital output (UART, SPI, Ethernet), SDKs (Python, C++, ROS), time synchronization (PTP, NTP).
- **Support**: Calibration services, MTBF, warranty, US/EU manufacturing for defense supply chain.

Sources

- FieldLine OPM-MEG — fetched 2026-11-01.
- Cerca Magnetics — fetched 2026-11-01.
- Muquans (iXblue) quantum gravimeters — fetched 2026-11-01.
- AOSense cold-atom sensors — fetched 2026-11-01.

- Infleqtion (ColdQuanta) quantum sensors — fetched 2026-11-01.
- Microchip CSAC — fetched 2026-11-01.
- ID Quantique QRNG — fetched 2026-11-01.
- SBQuantum NV magnetometers — fetched 2026-11-01.
- QZabre NV diamond sensors — fetched 2026-11-01.
- DARPA AMIIMO / ROAMS programs — fetched 2026-11-01.

Frequently asked questions

Are quantum sensors commercially available today?

Yes. NV-diamond magnetometers, chip-scale atomic clocks (CSAC), MEMS gravimeters and quantum RNGs are shipping. Neutral-atom gravimeters and cold-atom inertial sensors are in late-stage pilots with defense and energy customers.

What is the price range?

Prices are quoted per order and vary with volume and options — chip-scale atomic clocks are the cheapest class and cold-atom inertial systems the most expensive. Ask each vendor for a current quote.

Do quantum sensors need cryogenics?

Most commercial quantum sensors operate at room temperature or with compact thermoelectric cooling. Only the highest-sensitivity research systems (SQUIDs, some NV centers) require liquid helium or dilution refrigeration.