# Evaluating Quantum Technologies for Mission Use

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# What mistakes do we want to prevent?

1

### Buying too early

A device that works in the lab but not in the field.

*Cost: money, credibility, a soured customer.*

2

### Buying the wrong thing

Technology that addresses a different problem.

*Cost: solves nothing, consumes budget.*

3

### Missing the window

Deployable technology that didn’t make it into the program.

*Cost: capability gap that takes years to close.*

# Five axes to evaluate technology/vendors on

| | | |
|---|---|---|
| 1 | **Classical baseline delta** | How does this compare against the best classical alternative at comparable SWaP and cost? |
| 2 | **Lab vs. field performance** | Ask for field or environmental test data, parameter drift, duty cycle, etc. |
| 3 | **Integration and logistics burden** | Cryogenics, laser alignment, calibration, facility needs. |
| 4 | **Deployment readiness** | L1 lab demo → L2 prototype → L3 ruggedized → L4 field trial → L5 sustained operational use. |
| 5 | **Vendor and supply-chain viability** | Runway, revenue mix, single-source components, foreign ownership. |

# Quantum sensing

## Factors to consider:

**Bias stability and drift over mission duration**

Recalibration isn't always possible during the mission.

**Environmental hardening**

Device sensitivity to platform effects: vibration, magnetic fields, thermal gradients.

**Data products vs. just sensors**

Data processing algorithms are often the key step in getting useful information.

## Selected vendors

Vector Atomic

Infleqtion

Q-CTRL

AOSense · Exail

SandboxAQ

DEPLOYMENT READINESS

| L1 Lab demo | **L2 Prototype** | **L3 Ruggedized** | L4 Field trial | L5 Operational |
|---|---|---|---|---|

# Quantum networking

| | | |
|---|---|---|
| **PQC migration** | Standards published and mandated | **Real work** |
| **QKD** | Not endorsed for national security systems | **Requires extraordinary justification** |
| **Entanglement distribution, repeaters, memories, transduction** | Research | **Monitor; selective testbed engagement** |

## Physical constraints:

- Fiber loss caps repeaterless links to roughly 100–200 km.
- Without working repeaters and memories, a "quantum network"requires trusted nodes, which are inherently less secure.
- Quantum channels generally cannot traverse amplified and switched telecom fiber; dark fiber is required.

DEPLOYMENT READINESS

**L1 Lab demo** | **L2 Prototype** | L3 Ruggedized | L4 Field trial | L5 Operational

# Quantum computing hardware

## Access, don't acquire

### Metrics hygiene

- Two-qubit gate fidelity, with the benchmarking methodology stated
- Logical qubit count vs. roadmap
- Error-correction trajectory: distance to threshold, demonstrated below-threshold scaling
- Benchmarks against the best classical (HPC) method

### Hardware-related costs

Dilution refrigeration · helium supply chain · power, vibration, EMI, floor loading · specialist operators · calibration cadence.

### What to spend money on instead

Workforce development · algorithm and use-case readiness · benchmarking discipline · cryptographic inventory.

DEPLOYMENT READINESS

**L1 Lab demo** | L2 Prototype | L3 Ruggedized | L4 Field trial | L5 Operational

# Final recommendation result

Acquire | Pilot | Access | Monitor | **Pass**

*"Pass on QKD for this enclave. Revisit if federal guidance changes, or if a repeater-based architecture removes the trusted-node assumption."*

## Additional questions before recommendation is actionable:

- Acquisition path
- Accreditation
- Facility and SCIF constraints
- Maintenance
- Supply chain
- Budget cycles
- Workforce