

U.S. Department of Homeland Security

SCIENCE AND TECHNOLOGY DIRECTORATE

The Department of Homeland Security: Developing a Quantum State of Mind



Science and
Technology

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Introduction to DHS S&T

<https://www.dhs.gov/medialibrary/assets/videos/36283>



AT SEA:

Patrols 95,000 miles
of coastline



ON LAND:

Processes
868,000 people
entering the U.S.



IN THE AIR:

Screens 2.4 million
people and 5.5
million carry-on items



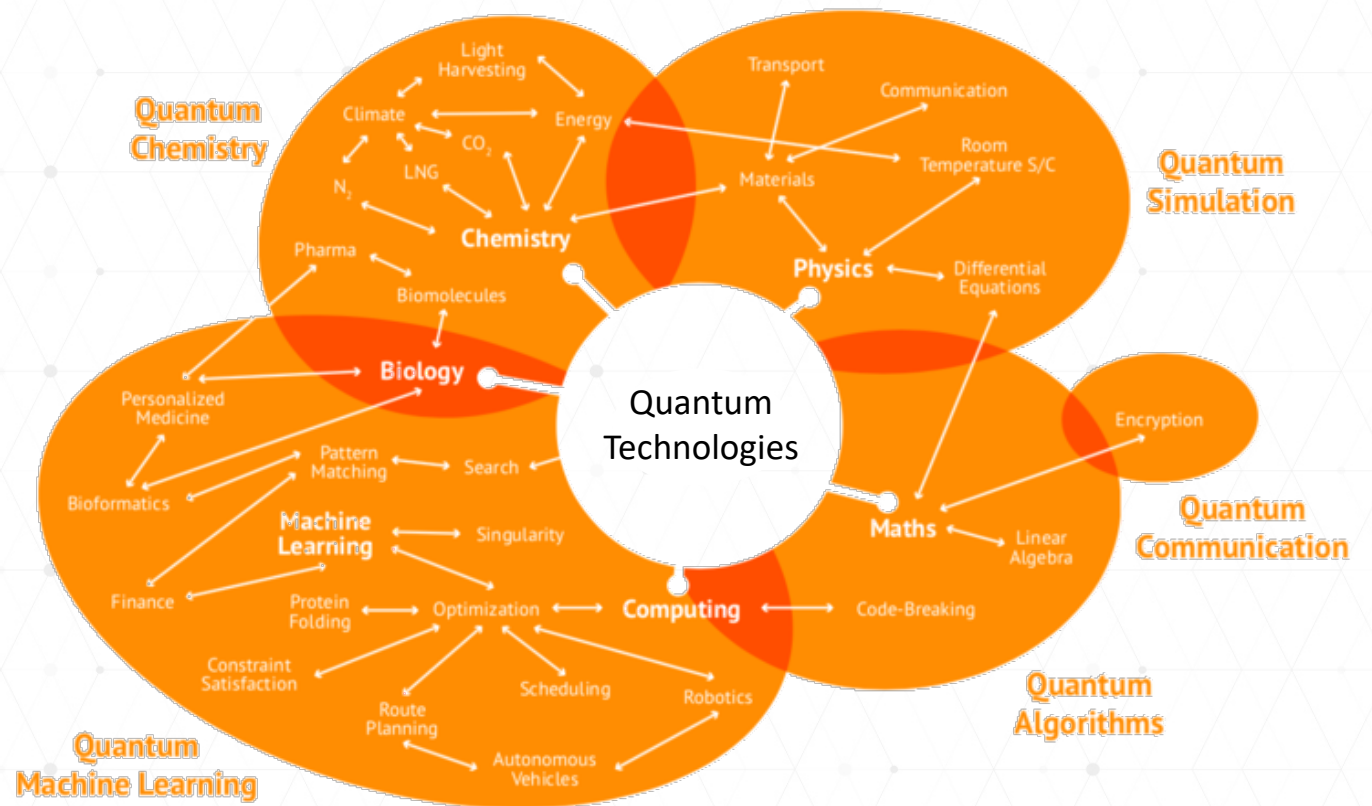
IN CYBERSPACE:

Examines
17 terabytes of
digital content

Science advisor to the Secretary and the research and development arm for DHS.

Quantum Information Sciences / Quantum Computing at DHS S&T

- Quantum Computing
 - Simulation
 - Annealing
 - Machine Learning
 - Algorithms / Search
 - Factorization
- Quantum Sensing
- Quantum Networking / Communications



<https://www.alumni.ox.ac.uk/quad/article/quantum-computing-oxford>

Credit: Pete Shadbolt & Jeremy O'Brien

Executive Infographic

Unclassified Use Cases Only

Operational Needs Categories

Maintain Cybersecurity Against Malicious Threats

Ensure Maritime Security in Polar Regions

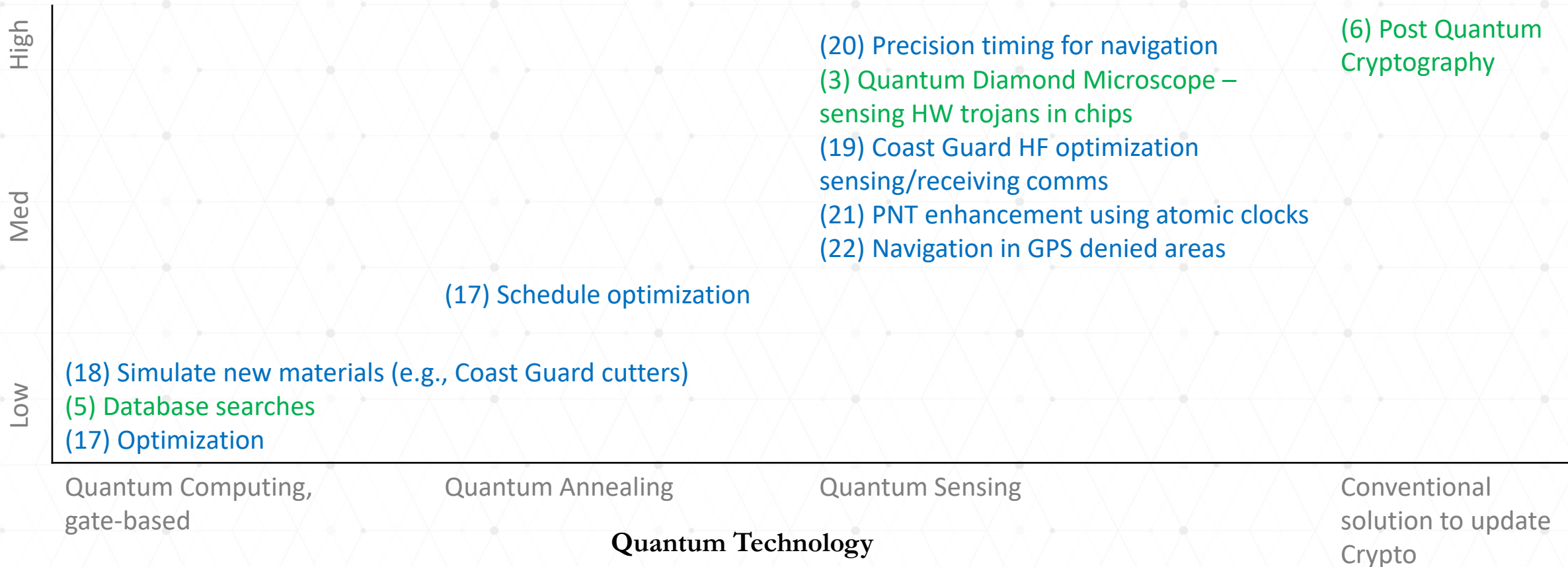
Prioritize and Investigate Child Exploitation Materials

Screen Passengers and Accessible Property at Airport Security Checkpoints

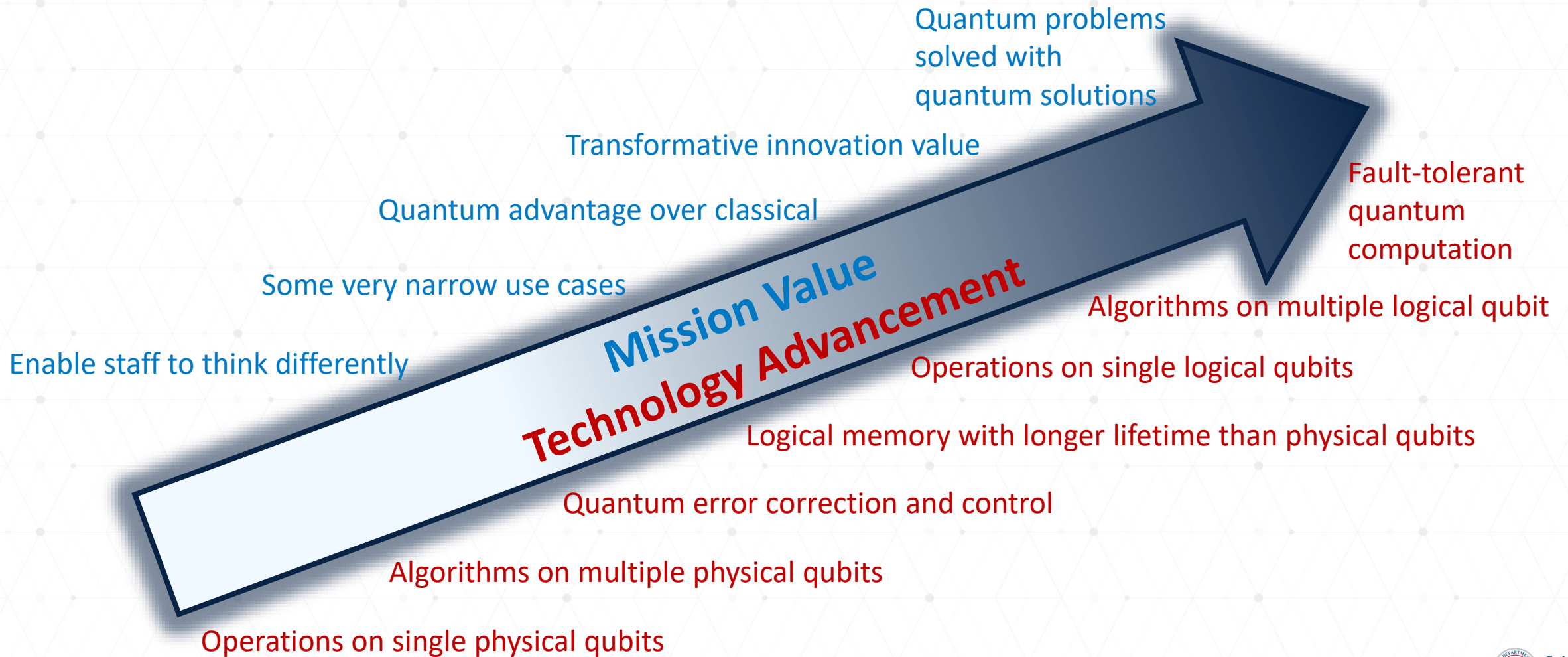
Safeguard Borders and Ports Against Intrusion

Use cases
are
FOUO/LES

Potential advantages and prospects
of technological advancements in
the next 5-10 years



Quantum Computing: Technology Advancement vs Mission Value



What We Watch

- Identifying useful problems / Problem dependent advantage – Still unclear how problem-dependent quantum speedup will be
- Reducing noise - Processors are getting larger, but noise continues to pose challenges for observing definitive quantum advantage
- Error correction
 - Processor size – Systems are currently too small to solve classically intractable problems
 - Repeatability and Stability - devices are not stable; difficult to reproduce even classically solvable results
- Scaling components - current size to power ratio is not sustainable. Improvements must be made in miniaturizing and scaling components.
- Connectivity - extra challenges, such as supercooled cable or a complex network of lasers

And look for metrics to computize these things.

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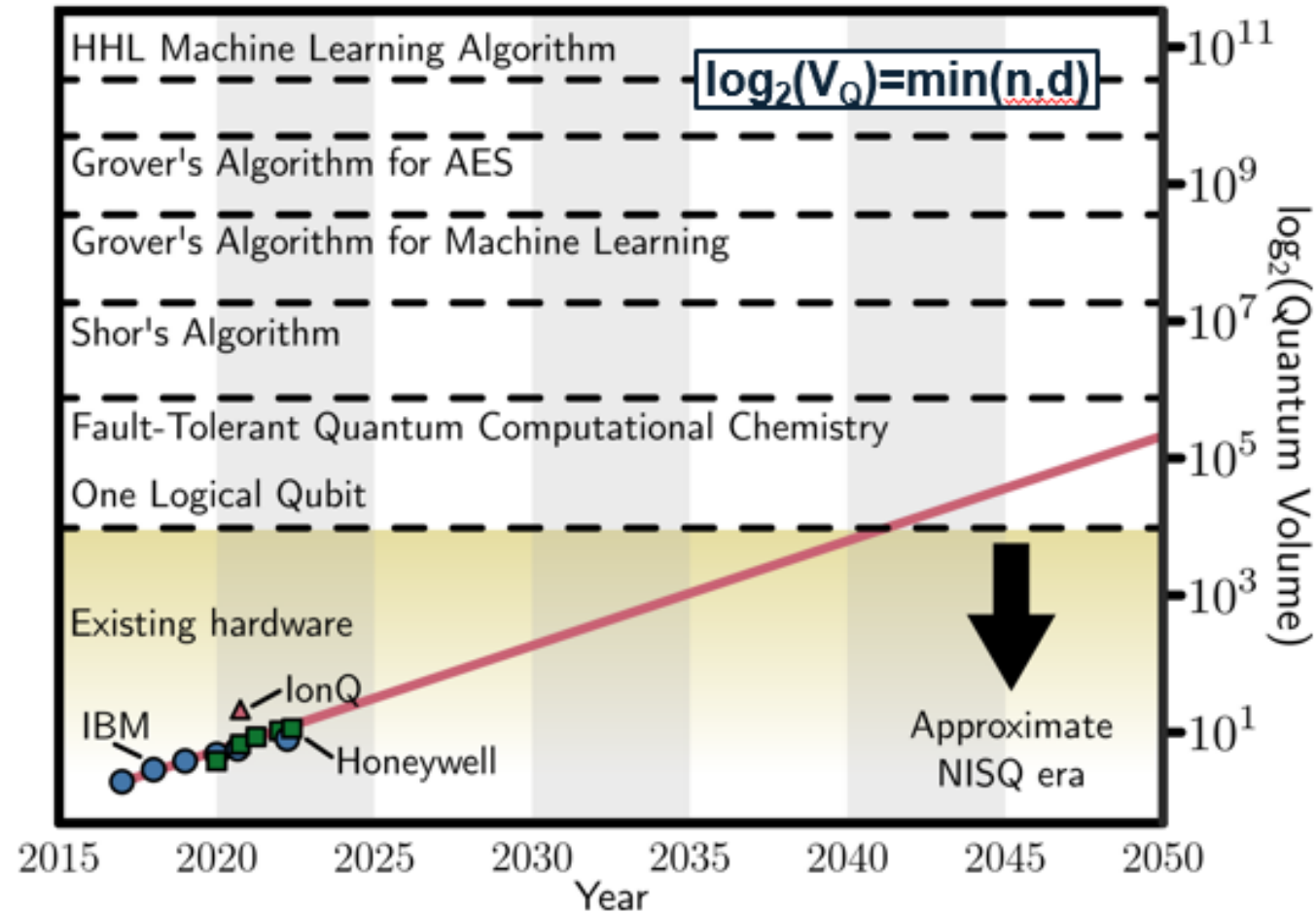
STQuantum@hq.dhs.gov



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Back Up Slides

Quantum Volume of Modern Systems vs Required Metrics for Implementation of Important Quantum Algorithms



Improvements are Needed in Both Size and Precision to Enable Useful Applications of Quantum Computers

