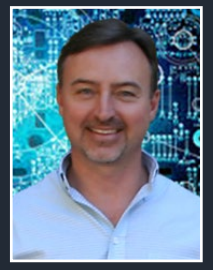
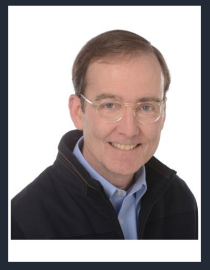
Quantum Economic Development Consortium (QED-C)

Use Case TAC

Use Case TAC Leadership



William Clark
GD Mission Systems



Jim Gable
Anametric
COMMs & Security

Yuri Lebedev
Q-Sensorix
Sensing

Mark Danchak
Quantum 1 Group
Computing

Use Case TAC – 2021 Vision & Goals

- **Vision**
  - The Use Case TAC aims to
    - Identify practical uses for quantum technology in the areas of Communications & Security, Sensing and Computing
    - Assess the readiness of these quantum technologies, and any gaps that may exist
    - Partner with other TACs to help advance & transition these technologies & applications to emerging markets
- **Goals**
  - Refine & extend QED-C Quantum Use Cases
  - Increase Use Case TAC Awareness & Participation
    - Workshops
    - Conference presentations & publications
    - Collaboration / interaction with other TACs
    - Internal (member) briefings
- **Why Join the Use Case TAC?**
  - Learn & help shape the future of Quantum Industries; don't be a spectator, get in the game!

Communications & Security Members

November 2021

- Aliro
- Amazon
- Anametric
- AT&T
- Aperio Global
- Booz Allen Hamilton
- Bright Apps
- Corning
- Deloitte
- Galois
- GE Research
- General Dynamics
- Google
- Hudson Institute
- Inside Quantum Technologies
- L3 Harris
- Lockheed Martin
- MITRE
- PQ Security
- Qrypt
- Qubitekk
- Qunnect
- Raytheon
- Safe Quantum
- Toshiba America
- Verizon
- Wells Fargo
- Young Bastile
- **Government:**
- Defense Innovation Unit
- Department of Energy
- Department of Homeland Security
- Oak Ridge National Laboratory

Sensing Use Case Members

November 2021

- Anametric
- Boeing
- General Dynamics
- Inside Quantum Technology
- Keysight Technologies
- Lockheed Martin Corporation
- L3Harris Technologies
- Mitre
- Q-Sensorix
- SRI
- Toptica

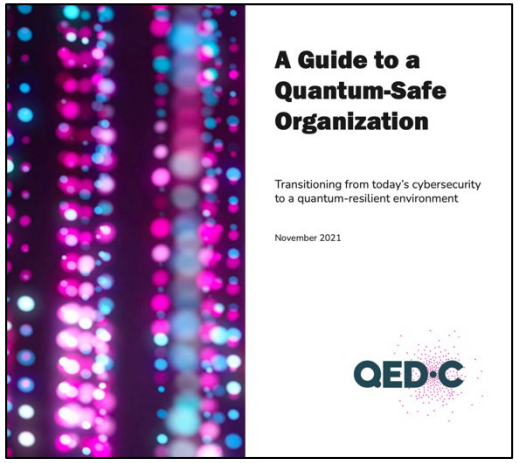
- Gov’t: DOE, MIL

Computing Use Case Members

- Dr. William Clark, General Dynamics
- Mark Danchak, Quantum1 Group
- John Zerr, DOE/DIU
- Jungsang Kim, IonQ
- Pranav Gokhale, SuperTech
- Rima Oueid, DOE
- James Goeders, Honeywell
- Bob Sorensen, Hyperion
- Sonika Johri, IonQ
- Kayla Farrow SemiCyber
- Hari Krovi, Raytheon
- Alan Ho, Google
- Carl Dukatz, Accenture
- Lawrence Gasma, Inside Quantum Technology
- Damian Watkins, Aperio Global
- Brandon Rodenburg, MITRE
- Santanu Basu, Corning
- Justin Ging, Honeywell
- Andy Hoag, SemiCyber
- Kristen L. Pudenz, Lockheed Martin
- Paul Gleichauf, ARM
- Max Mellette, Infocus Networks
- Terrell Frantz, Harrisburg Univ
- Adam Bouland, QC Ware
- Eric Ostby, Google
- Mike Lange, Harris Corp
- Tamas Terlaky, Lehigh Univ.
- Jennifer Paykin, Galois
- George Porter, Infocus Networks
- Glen S. Uehara, General Dynamics

Communications & Security Group

- **2021**
  - Conducted the workshop on “Quantum Networks” with DOE in April
    - Industry and Gov’t Labs presentations
    - Many cross introductions
  - Nearing completion of “A Guide to a Quantum-safe Organization”
    - An introduction for understanding the cryptographic threat of future quantum computers and the mitigating actions organizations can take – starting now
    - With Newry Corp
  - Supported a QKD Interest Group

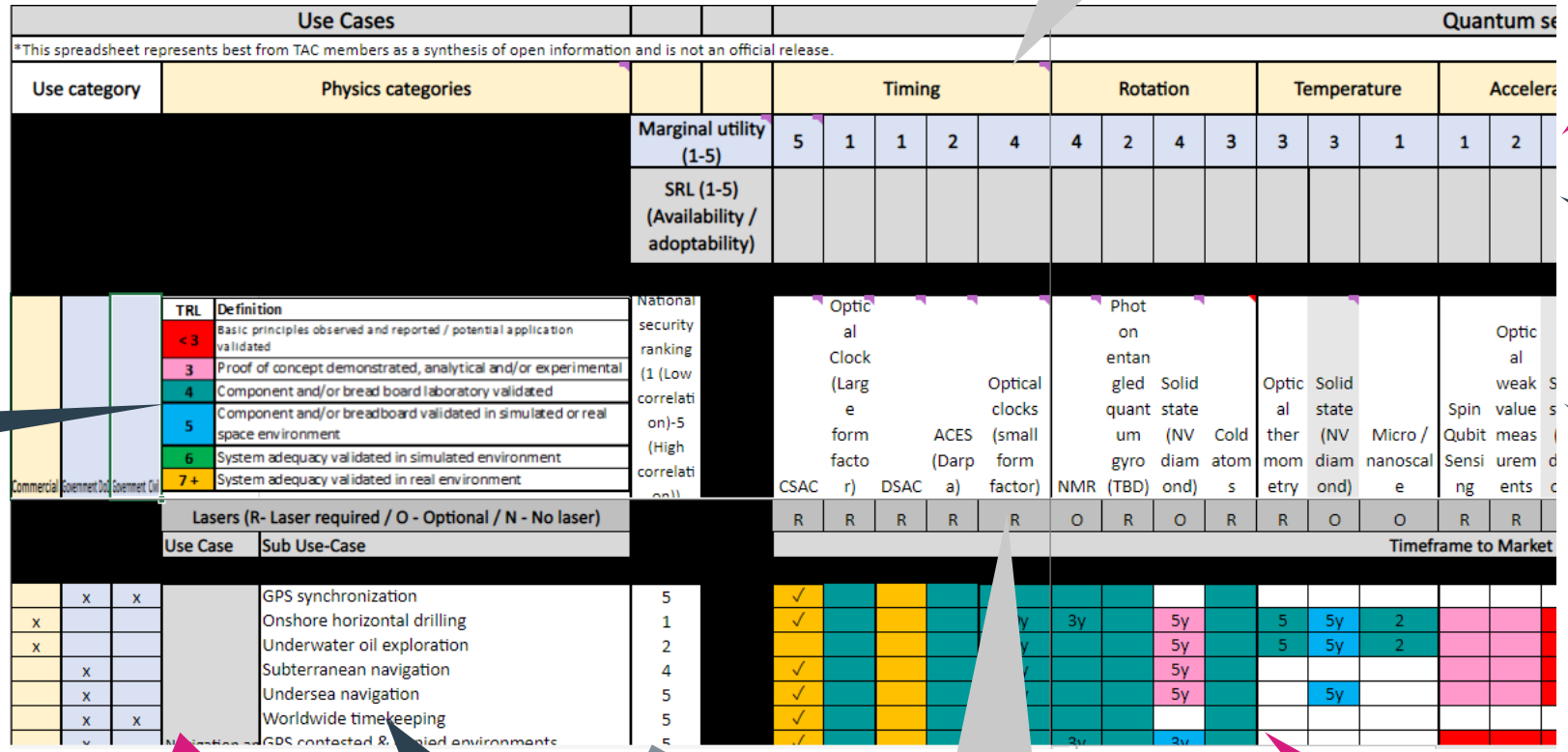


- **2022**
  - Potential new projects to support the field
    - Future of the QKD Interest Group
    - Highlight new advances
    - Update use case listings
  - Support for the “Guide” paper
    - Continuing “PR” to promote readership
    - Likely release an update to incorporate new information

Sensing Use Case Group

- **2019**
  - Nov 2019 Face to Face workshop meeting in Colorado
  - Creation of the Sensing Use Case excel spread sheet
- **2020**
  - Biweekly meeting updating spread sheet focusing on use cases & technology
- **2021**
  - Change of the focus from quantum sensing technology & use case to market-oriented updates
  - Initiated discussion to hold a second workshop & prepared workshop proposal and schedule
  - Sensing subgroup presented at the Quantum Marketplace
- **2022**
  - Hold second workshop with greater focus on marketplace
  - Establish TAC focus for 2022 with a goal to increase participation
    I. Biweekly meeting invitations to the science labs to refine use cases & tech updates
    II. Setup a process for gathering latest research on quantum sensing technology & use cases

Sensing Use Case Spread Sheet



Use Cases

*This spreadsheet represents best from TAC members as a synthesis of open information and is not an official release.

Use category				Physics categories		Timing					Rotation				Temperature			Accelera		
					Marginal utility (1-5)	5	1	1	2	4	4	2	4	3	3	3	1	1	2	
					SRL (1-5) (Availability / adoptability)														
					Lasers (R- Laser required / O - Optional / N - No laser)	R	R	R	R	R	O	R	O	R	R	O	O	R	R	
				Use Case	Sub Use-Case															
	x	x			GPS synchronization	5	✓													
x					Onshore horizontal drilling	1	✓				3y		5y		5	5y	2			
x					Underwater oil exploration	2							5y		5	5y	2			
	x				Subterranean navigation	4	✓						5y							
	x				Undersea navigation	5	✓						5y			5y				
	x	x			Worldwide timekeeping	5	✓													

TRL	Definition
< 3	Basic principles observed and reported / potential application validated
3	Proof of concept demonstrated, analytical and/or experimental
4	Component and/or bread board laboratory validated
5	Component and/or breadboard validated in simulated or real space environment
6	System adequacy validated in simulated environment
7+	System adequacy validated in real environment

National security ranking (1 (Low correlation)-5 (High correlation))

Timeframe to Market

Optical Clock (Large form factor) | Optical clocks (small form factor) | Photon entangled quantum gyro (TBD) | Solid state (NV diamond) | Cold atoms | Optical thermometry | Solid state (NV diamond) | Micro / nanoscale | Spin Qubit Sensing | Optical weak value measurements

CSAC | DSAC | ACES (Darpa) | NMR

Type of Measurement

Market Potential

Market
- Commercial
- DOD
- Dual Use

Supply Chain Readiness (SRL)

TRL Definition

Quantum Sensing Technology

Use Case Group (PNT)

Use Case Subgroup

National Security Rating

Laser Requirement

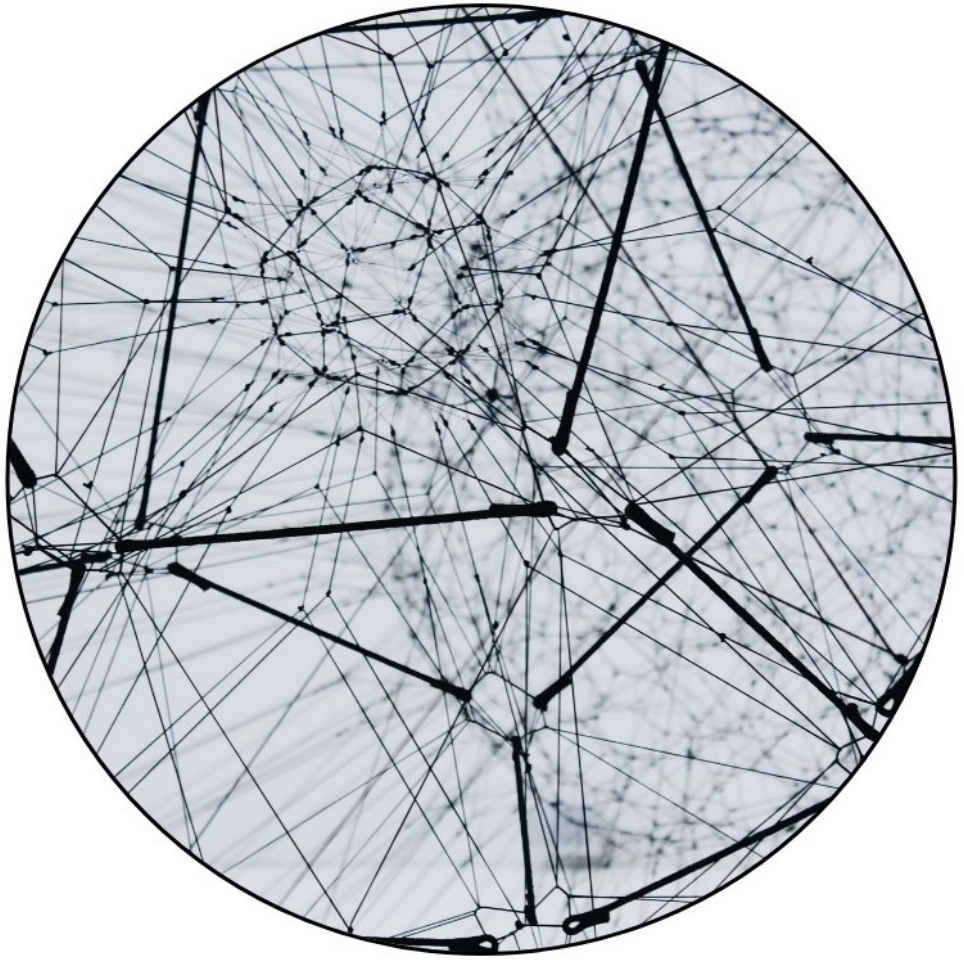
TRL

Computing Use Case Group

- **2021**
  - 8-10 interviews with key stakeholders in the QC space, interviews are ~45 minutes each with our Use Case TAC participating
  - Develop a slate of media that highlight areas of exploration in computing use cases including, short from video and blog posts with our QED-C Members.
  - Organize 1-2 workshop(s) on highlighting methodologies and collaborations focused on advancing quantum computing use cases in at least 2 industry fields, (ex: pharma or finance or logistics)
  - Refine and add depth to the Use Case Spreadsheet that was begun in 2020
- **2022**
  - Create access to the computing use case data gathered in the study.
  - Publish a paper in 2022 that gives a roadmap to industry for exploring business use cases. Ideally we would do this in conjunction with 3-4 of the quantum computing companies
  - Hold the Energy Use Case Workshop in conjunction with DOE and Accenture (February 2022)
  - Organize two new workshops with co-sponsors in two key areas of development:
    - Financial Use Cases
    - Logistic/Supply Chain Use Cases

Study: Quantum Computing Business Use Cases

- Launch: November 2021
- Partnering with TQD to launch the project in November 2021.
- This is a public and private (via interviews) analysis of the expected business use cases for quantum computing.
- The output will lead to database of use cases, a heatmap of industry activity and collaborations on computing use cases.



Workshop #1: QED-C + Pistoia Alliance + QUPHARM

- December 1, 2021
- Presentations showing specific business use cases being pursued via collaborations between the pharmaceutical industry and quantum computing companies:
  - McKinsey
  - Merck KGa
  - Jenssen
  - Daiichi Sankyo

Workshop #2: QEC-C + DOE + Accenture

- Target: February 2022
- Curated and engaged discussion led by Accenture working to explore the needs and potential use cases of the Energy Industry with important stakeholders from each major industry category:
  - US Department of Energy
  - US Energy Companies
  - US National Labs
  - Quantum Computing Companies