Quantum Network and Sensing Applications Will Impact Spacecraft, Autonomous Vehicles, Medical Imaging, GPS, Augmented Reality and Much More; Learn About this Often Overlooked Gigantic Market Opportunity
USE CASES
The Quantum Network Will Profoundly Impact Our World

Quantum Network & Sensors
- Atomic Clocks
- Sensors
- Gyroscopes
- Accelerometers
- Gravimeters

Aircraft
GPS Satellites
Power Grids
Financial Trading Systems
Virtual / Augmented Reality; Video Games
Cell Towers
Navigation Systems
Autonomous Vehicles
Machine Health Monitoring
USE CASES
Distribution of Time Impacts Broad Applications

● All GPS satellites have an atomic clock on them that keeps very precise time

● Every GPS signal has a timestamp from that clock

● Billions of GPS sensors throughout the world receive the GPS time stamp so a system can have coordinated time
  ○ Power grids use this time to balance frequency across the grid
  ○ Financial systems use this to establish the order and priority of transactions
  ○ Cell towers use this timestamp to parse bandwidth for communications

● By using this coordinated time with GPS satellites, systems lock on an identical clock

● Power grids, communications and financials systems will fail if GPS is compromised
I hate GPS….We’ll push the performance envelope in timing and navigation technology by harnessing Nobel Prize-winning physics research that uses lasers to cool atoms.”

- Ash Carter, 25th US Secretary of Defense
USE CASES
Space Policy Directive-7 on Improving GPS Cybersecurity

U.S. Government’s 2021 Initiative Will Create Enormous Market for Quantum GPS Products

- “Space-based satellites are imperative for various technology and infrastructure, including the electrical power grid, communications, transportation, weather forecasting and emergency response”
- “Space-based positioning, navigation and timing (PNT) systems are increasingly critical to the American way of life”
- “Continuous access to U.S. PNT services provided by GPS, as well as improving the performance and cybersecurity of GPS”
- “Directs an increase of cybersecurity for the Global Positioning System (GPS) and GPS-enabled devices”
USE CASES
Precision Navigation

Today: Classical Systems
- Requires ongoing calibration with outside signals, typically a GPS or radio signal
- GPS vulnerability means navigation systems are vulnerable

Tomorrow: Quantum Systems
- Consists of quantum accelerometer, gyroscopes and clock
- Extraordinarily accurate. Does not require any ongoing calibration with outside signals
- Once starting point is established, device knows precisely how fast it travels, for how long, and in what direction

Cats & Trucks
Planes & Helicopters
Ships
Drones
Missiles
Spacecraft
USE CASES
Stealth & Precision Gains in Lidar & Radar

Today: Classical Systems
- Radar (radio waves) and Lidar (light waves) shoot sound or light at objects and measure the returned reflection to learn about the object
- The object, which might be a plane or missile, can detect that it is being observed

Tomorrow: Quantum Systems
- Quantum devices are better at detecting signals:
  - Increased accuracy
  - Hear fainter signals
- Detect signals from depths of universe
- Design systems that avoid ability of object to detect it is being observed

Military
Environment
Autonomous Vehicles
Space Exploration
● Autonomous Vehicles must gather vast amount of data, process it quickly and make real-time, nearly-instantaneous decisions

● Data includes lidar, radar, sound and imagery

● Speed of decision making means many decisions must be made within the vehicle; that is, the vehicle cannot rely on computers in the cloud

● Vehicles also must be protected from hacking

● Quantum devices, including quantum computers, will contribute to data collection & processing, decision-making and security
Today, most encryption is predicated on large prime numbers; decoding them with classical computers is basically impossible.

Shor's algorithm is the mathematical approach factoring prime numbers. Classical computers cannot process Shor's algorithm.

Quantum computers are able to rapidly solve Shor's algorithm and, thereby, will make encryption obsolete.

Quantum Communication is enabling a new form of encryption, with the result being a gigantic improvement in cyber security.
Quantum Communication Explained

- Quantum systems will create a stream of entangled photons of light using a bi-photon emitter.
- One of the entangled pairs is distributed with the message while the other remains at the origination location.
- If the message is intercepted (that is, a potential hacking occurs), the entangled QuBits will lose their coherence.
- The QuBit at the originating location will be used to instantaneously detect the potential hacking and trigger corrective action.

Implication:
Communication Networks Will Have Quantum Devices Throughout their Networks: Optronics, Repeaters, Amplifiers, Routers and End User Devices.
Quantum Signal Processing Sensors Process Real-Time Data Such as Time, Space, Temperature, Magnetic Fields, Sonar, Weight, Gravity and Frequency

- Receive a very wide range of frequencies
- Detect very weak signals
- Know precisely where signals originate
- Up to 10,000 times more sensitive than classical sensing

USE CASES
Quantum Sensors will impact countless industries and applications

Audio / Speech Processing
Robotics
Early Threat Detection
Augmented Reality
MedTech / Imaging
Space Research