What industries are using quantum computing?

Our customers, collaborators, and users have built **hundreds of early quantum applications**, in areas as diverse as scheduling, logistics management, quantum chemistry simulation, financial modeling, preventative healthcare, traffic flow optimization, defense, space and so much more.

Manufacturing:

GE Research built a logistics management application that can ultimately help with preventive maintenance and scheduling repairs for equipment.

Volkswagen used a hybrid solver service to build a paint shop scheduling application which was designed to optimize the order in which cars are being painted. This pilot application showed an 80% reduction in waste.

DENSO Corporation, a leading supplier of advanced automotive technology, systems, and components developed a proof-of-concept aimed at optimizing control of automated guided vehicles on their factory floors finding 15% efficiencies.

Telecommunications:

Telecom Italia built a proof-of-concept that found quantum computing helped to optimize 4G and 5G radio planning in Italy, by finding a solution 10x faster than with classical computing alone.

British Telecom and **Accenture** have each looked at quantum computing applications to help solve some key problems facing the telecommunications industry, including cellular network optimization, faster fault detection and improved operational efficiencies.

Financial Services:

Multiverse Computing, a quantum applications company, used quantum-enhanced algorithms to spot fraud more effectively and utilized quantum computing for portfolio optimization. They found they could identity fraud around 100x faster and were able to provide significant portfolio performance improvements with quantum hybrid applications.

CaixaBank Group in Spain, has found that quantum-hybrid applications have significantly decreased compute time by up to 90% to solve complex financial problems, improving investment portfolio optimization, increasing a bond portfolio internal rate of return (IRR) by 10%, and minimizing the capital needed for hedging operations. What normally took several hours to compute was reduced to just minutes and facilitates the ability to increase modeling complexity.

A large payments provider built a proof-of-concept to look at incorporating quantum hybrid applications to innovate on feature selection, a critical step in building powerful models to fight sophisticated fraud.

Life Sciences:

GlaxoSmithKline found that its work on mRNA codon optimization problems were a good fit for quantum annealing.

University of Southern California and their research partners applied quantum annealing to ML approaches for several problems in the life and physical sciences, including TF-DNA binding, cancer classification, and solving a Higgs boson optimization problem.

Polarisqb is using quantum for drug design efforts to complete optimization calculations faster than conventional computers and therefore accelerate drug discovery. Their Quantum-Aided Drug Design (QuADD) quickly identifies a library of top candidate molecules for drug targets.

Menten AI, a protein design start-up, has been leveraging synthetic biology, machine learning and quantum computing to design proteins not found in nature for diverse applications in the pharmaceutical and chemical industries. Their work in de novo protein design have been advanced to live-virus testing for COVID therapeutics.

Infrastructure, Logistics and Supply Chain:

SavantX built a quantum application to optimize Pier 300 at The Port of Los Angeles. Their Hyper Optimization Nodal Efficiency (HONE) quantum powered AI engine increased the capacity and velocity of cargo movement at the port where it doubled cargo handling equipment productivity and produced more predictable cargo flows. With the quantum application, the port was able to see increased efficiencies of crane delivery and utilization by 60% and reduced turn times for trucks.

Groovenauts, Inc., a Japanese technology company using AI and quantum computing, has built a proof-of-concept quantum-hybrid application to optimize construction sites. By looking at GPS tracking, Groovenauts was able to analyze the truck movement, speed, and other behaviors to increase the amount of dirt used by roughly 10% and providing the ability to speed up construction projects.

Australian Department of Defence worked with D-Wave and NEC-Australia to develop a last-mile resupply quantum computing application to showcase the ability to optimize autonomous vehicles resupplying forces.

Retail & Scheduling:

Pattison Food Group, a western Canadian grocery retailer, successfully used a quantum-hybrid solver service to find solutions for complex grocery optimization problems. They reported being able to reduce time needed for one optimization task from 25 hours to just 2 minutes per week saving time and money.

Sigma-I, a Tokyo-based start-up, used quantum hybrid technologies to build a powerful personnel management tool to help address the concerns about maintaining a safely reduced in-house presence due to the pandemic while also ensuring that the relevant members of a given team are consistently present at the same time.

Groovenauts, Inc., launched a commercial service integrating quantum annealing computing technology into their technology offering because they found quantum computing to be the best way to efficiently plan staff schedules for distribution logistics companies.

D:WAVE

Energy & Environment:

Mitsubishi Estate worked with **Groovenauts, Inc.** to enable AI with D-Wave's quantum computing techniques to solve the problem of labor shortages for waste collection staff, while also lowering overall CO_2 emissions for Tokyo. This proof-of-concept optimized waste collection routes and reduced CO_2 emissions. Optimized routes and scheduling were built and showed a 57% reduction in CO_2 emissions, reduced the number of vehicles needed by 59%, and had a total work time reduction of 38%.

E.ON, a Germany utility, is looking at quantum computing for decentralized power production. Quantum computing technology could allow for real-time operation electrical grids, something which is outside the reach of today's AI capabilities. Other potential applications which E.ON hopes to address with quantum applications include the development of improved climate models to guide the deployment of renewables, materials design for batteries and grid infrastructure.

Researchers at **Artificial Brain Tech Inc.** and the **Indian Institute of Information Technology** have been looking at quantum-hybrid applications for EV charging station placement, a growing area of concern with the expanded adoption and support of electrical vehicles use.

Space and Satellite:

Researchers at the **German Aerospace Center (DLR) & Airbus** looked at image acquisition planning for earth observation satellites. The problem looked at how to acquire high value images while obeying the attitude maneuvering constraint of the satellite.

Researchers at **NASA Ames Research Center, Jet Propulsion Laboratory** at the California Institute of Technology, & the **Center for Quantum Information Science and Technology**, and Information Sciences Institute at the Univ. of Southern California showed how quantum annealing can be used to map a sampling of the hardest artificial intelligence problems in space exploration.

Researchers from **Booz Allen Hamilton, Los Alamos & USRA** concluded that for problems like this satellite optimization problem, heterogeneous quantum techniques will be required to solve the problem at larger scales.

NASA Quantum artificial Intelligence Lab (QuAIL) team is working to demonstrate that quantum computing and quantum algorithms may someday dramatically improve the agency's ability to address difficult optimization and machine learning problems arising in NASA's aeronautics, Earth and space sciences, and space exploration missions.

Artificial Brain won the myEUSpace award for its quantum-hybrid algorithm for optimizing real-time scheduling for multiple Earth Observation Satellites (EOS). Bringing groundbreaking solutions in the integration of EU space data with cutting-edge technologies like Artificial Intelligence (AI) and Quantum Computing.

➡ **Find Out More:**
www.dwavequantum.com/applications