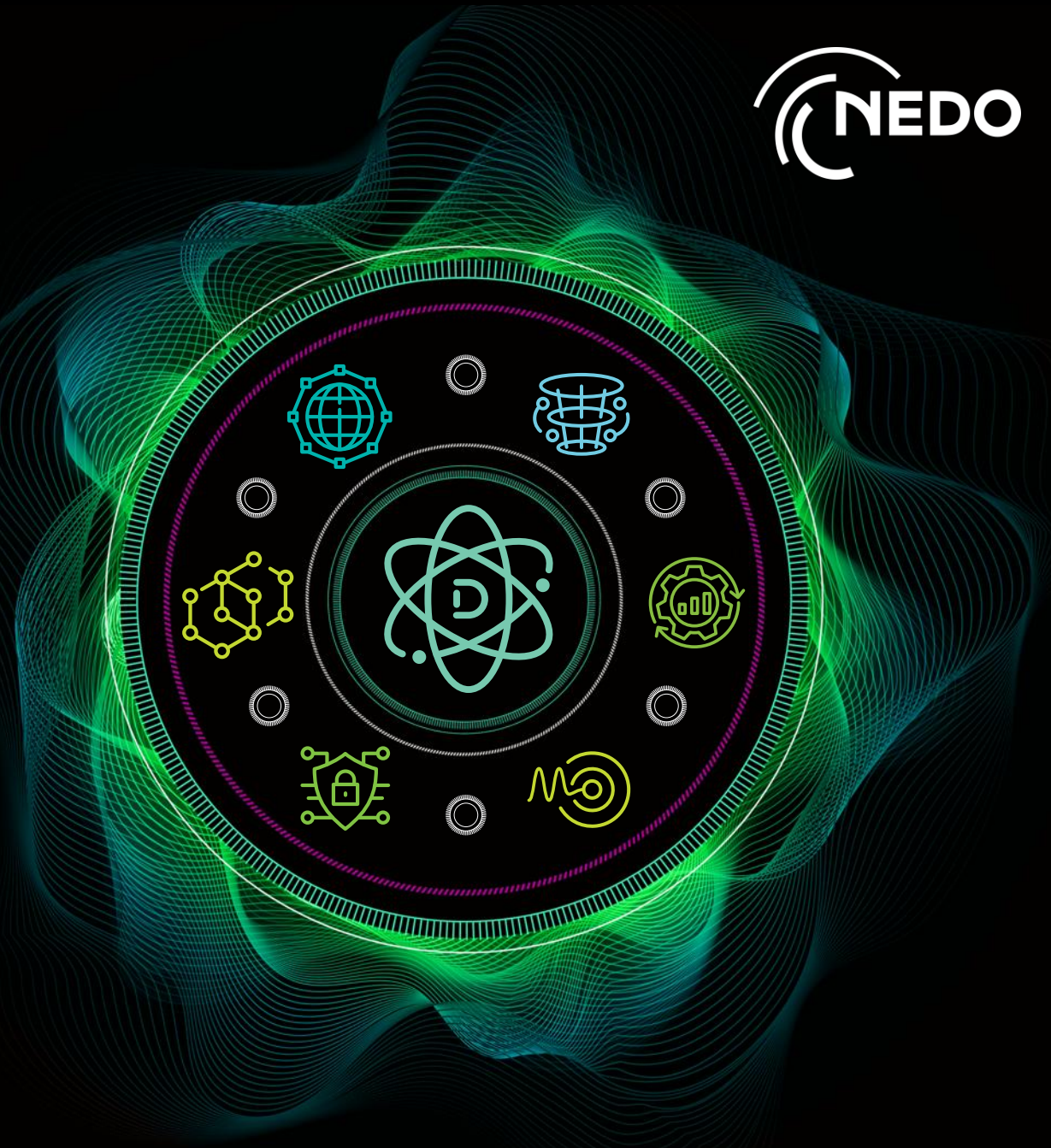
Quantum Computing Use Cases

Traffic control for flying cars (air mobility)

OneSky, Tohoku University, Sumitomo Corporation (QX PJ)



New Energy and Industrial Technology Development Organization (NEDO)

OneSky, Tohoku University, Sumitomo Corporation (QX PJ): Traffic control for flying cars (air mobility) [2021/10] 1/2

Validation

Industry	Transportation
Means	air transportation of people
Method	combinatorial optimization
Category	Ising*

Background

- **Air mobility is a next-generation means of transportation that is expected to reduce travel time in urban areas, improve the convenience of transportation on remote islands and in mountainous areas, and speed up emergency transportation and cargo transportation.**
- When the air mobility society is realized, it is assumed that many unmanned aerial vehicles (UAVs) will fly around, and **a system for real-time three-dimensional traffic control including UAVs will be necessary.**

Problem setting as a quantum computer

- **Comparison of conventional methods and quantum technologies regarding the number of air mobility devices that can be controlled in real time** was conducted.
- The machine uses **quantum annealing**

Issues and motivation to be solved

- In order to ensure the safety and security of air traffic in the era of air mobility, it is necessary to **determine the most appropriate flight operation in light of ever-changing weather conditions, radio wave conditions, and other air mobility conditions.**
- But finding answers in real time from an exponentially growing pool of combinations can be **difficult with conventional computers.**
- For this reason, **OneSky, Tohoku University and Sumitomo Corporation (QX Project) have started a quantum technology demonstration to control a large number of air mobility in real time.**



Reference: PR TIMES"Quantum computer improves traffic control for flying cars" (https://prtimes.jp/main/html/rd/p/000000005.000080581.html)
*Ising: A computing approach, mainly associated with quantum annealers and simulators specialized for the Ising model, in which a problem is first formulated as an Ising model and then solved computationally. It is particularly well suited to problems that involve finding the optimal combination from a vast number of possibilities.

OneSky, Tohoku University, Sumitomo Corporation (QX PJ): Traffic control for flying cars (air mobility) [2021/10] 2/2

Validation

Industry	Transportation
Means	air transportation of people
Method	combinatorial optimization
Category	Ising*

Expected business benefits

- The number of air mobility devices that can be controlled was **improved by approximately 70% over the conventional method.**
  - ✓ Up to now, the number was around 40, but increased to around 70 due to the use of quantum technology
- For one particular optimization problem, they achieved a **10 x speedup over a classical computer**



conventional method



use of quantum technology

Reference: PR TIMES"Quantum computer improves traffic control for flying cars" (https://prtimes.jp/main/html/rd/p/000000005.000080581.html)
*Ising: A computing approach, mainly associated with quantum annealers and simulators specialized for the Ising model, in which a problem is first formulated as an Ising model and then solved computationally. It is particularly well suited to problems that involve finding the optimal combination from a vast number of possibilities.

More use cases are available on our website. We invite you to explore them.
https://www.quantum-computing-use-cases.nedo.go.jp/english/

More Use Cases

New Energy and Industrial Technology Development Organization (NEDO)
AI and Robotics Department (e-mail: quantum_ai@ml.nedo.go.jp)

This collection of use cases was obtained as a result of the work commissioned by the New Energy and Industrial Technology Development Organization (NEDO) "Cyber-Physical Development Business of Quantum/Classical Hybrid Technology/Study of Use Case of Quantum Technology" and the “Post-5G Information and Communications System Infrastructure Reinforcement R & D Project (Quantum Industrialization)/Comprehensive Study for Promoting the Industrialization of Quantum Computers”.