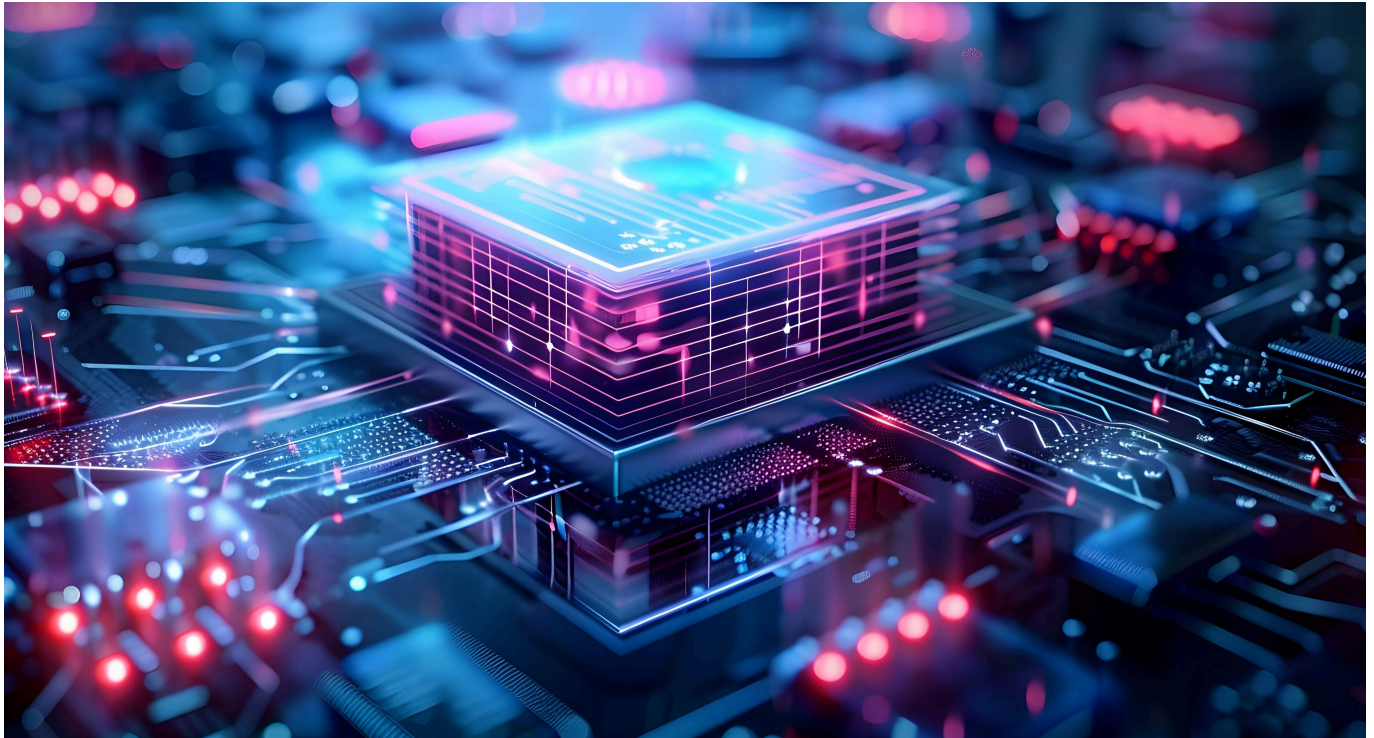


## TECH OFFER

### High-Speed Combinatorial Optimisation Platform with Quantum-Like Performance



#### KEY INFORMATION

TECHNOLOGY CATEGORY:

Infocomm - Quantum Computing

Infocomm - High Performance Computing

TECHNOLOGY READINESS LEVEL (TRL): **TRL9**

COUNTRY: **JAPAN**

ID NUMBER: **TO175374**

#### OVERVIEW

Conventional computing environments often struggle with solving complex, computationally intensive problems, particularly in the realm of combinatorial optimisation. Quantum computing was developed to address these challenges by enabling the simultaneous exploration of multiple solution paths. However, full-scale quantum computing remains prohibitively expensive and technically challenging to implement.

This technology presents a quantum-inspired alternative that leverages high-speed computing based on FPGA (Field-Programmable Gate Array) architecture. It enables parallel exploration of multiple potential solutions—without relying on the principles of quantum mechanics. By integrating an FPGA board preloaded with a custom optimisation algorithm (implemented in firmware and/or software) into a standard desktop PC, users can efficiently tackle complex optimisation problems using conventional IT infrastructure.

Combinatorial optimisation involves identifying the optimal combination of variables that maximises or minimises a particular

objective function under a set of constraints. This platform enables practical and scalable solutions across a wide range of applications, offering quantum-like performance without the operational burdens of quantum computing.

The technology provider's ideal collaboration partners include systems integrators to co-develop solutions and Institutes of Higher Learning (IHLs) to advance research in key application areas such as logistics and shipping, transportation operations, smart city initiatives, and industrial automation and operations research.

## TECHNOLOGY FEATURES & SPECIFICATIONS

The technology combined hardware (FPGA board) with embedded firmware and host software—that implements quantum inspired optimisation using classical algorithms. It occupies a niche between specialised hardware and middleware/software, enabling fast combinatorial optimisation without requiring full-scale quantum computers.

The technology offers several key advantages:

- Operates on general-purpose desktop PCs—eliminating the need for specialized environments or significant capital investment.
- Performs all computations/ calculations locally, without requiring a network connection—removing concerns about network load, latency, or data privacy.
- Utilises the QUBO (Quadratic Unconstrained Binary Optimization) format, allowing reuse of existing design assets and optimization models

Achieves high-speed performance comparable to quantum-like solution searches, enabled by FPGA-based hardware acceleration.

## POTENTIAL APPLICATIONS

The platform is ideal for solving combinatorial optimization problems, where the number of potential combinations grows exponentially and quickly becomes intractable for traditional algorithms. Real-world applications include:

- **Traffic Congestion Management (Vehicle Routing Problem – VRP)** Optimizes delivery routes and scheduling for logistics operations—reducing travel time and operational costs while meeting maintenance, labor, and routing constraints.
- **Optimized Cargo Loading and Sequencing (Logistic):** Determines the most efficient method to load goods of varying sizes, weights, and destinations—maximizing vehicle utilization and minimizing fleet requirements.
- **Optimized Visiting Order for Time and Cost Savings (Travelling):** Finds the shortest route to visit multiple locations and return to the starting point—reducing travel distance, time, and fuel consumption.
- **Personnel Assignment Optimization (Shift Scheduling):** Optimizes staff schedules in sectors such as retail and healthcare—ensuring adequate staffing while accommodating employee preferences and complying with labor regulations.
- **Aircraft or Crew Scheduling (Airlines and Transport):** Determines optimal aircraft or crew assignments while adhering to constraints such as maintenance windows, labor regulations, and flight coverage—reducing costs and improving

operational reliability.

- **Operating Room and Equipment Scheduling (Healthcare):** Coordinates operating room use, equipment, and personnel to maximize efficiency, reduce patient wait times, and avoid scheduling conflicts.

Other applications span telecom and IT, energy and smart grids, port logistics, car sharing, and more—enhancing operational efficiency and productivity.

## UNIQUE VALUE PROPOSITION

In the current landscape, while gate-model quantum computers remain focused on achieving technological breakthroughs for fundamental research and large-scale problem-solving, this high-speed combinatorial optimisation platform offers a significant advantage as a realistic and practical solution—efficiently and reliably addressing specific optimisation problems using classical computing infrastructure.