REDUCING WASTE WHILE MAXIMIZING SPACE:
PRECISE CARGO LOADING WITH QUANTUM OPTIMIZATION

Cargo loading is a complex optimization challenge for any organization facing the task of transporting large quantities of goods across long distances by air, sea, rail, and road.

When it comes to this important function of the supply chain, shippers aim to arrange as many three-dimensional packages into a finite number of containers (or bins) as possible while adhering to a vessel's weight limit, all while preventing any package damage during transit. This challenge impacts bin packing for smaller items handled within warehousing systems too. Shippers and handlers need to consider the dimension of items and the size of the containers, ensuring that the total volume of items in each container does not exceed its capacity while minimizing the number of containers to be shipped. Additionally, multiple ways to store each item, and various constraints apply; for example, items cannot overlap, and fragile items must be stacked on top.

QUANTUM OPTIMIZATION: A POWERFUL SOLUTION

An effective quantum optimization solution for cargo loading needs to solve for the placement of each package, efficiently using the available container and bin space while addressing these complexities, keeping in mind that the time required to find an optimal solution increases exponentially with the number of packages. Not only are there a growing set of variables to consider, such as special handling requirements, but also items to be packed may arrive at various times, requiring adaptive packing strategies.

D-Wave helps logistics companies solve the 3D puzzle of optimal cargo loading and many other complex optimization problems through hybrid computing solutions that use the best of classical and quantum computing technologies. D-Wave's annealing quantum computers, boasting over 5,000 qubits, are the largest in the world. They enable organizations to leverage quantum programming to develop advanced commercial applications. Through the Leap™ quantum cloud service, customers can access hybrid solvers capable of handling problems with millions of variables and hundreds of thousands of constraints. **This secure, real-time, production-grade service offers over 99% uptime and availability.**

Specifically, a hybrid quantum algorithm identifies points within the cargo space, typically starting with corners of the container to serve as a reference for placing items. The algorithm then assigns cargo items to these points, and then simultaneously explores multiple possible configurations, quickly identifying the best-known arrangements of cargo. Since the cost of cargo transportation is generally determined by factors like weight, volume, and distance, quantum-optimized cargo loading can significantly enhance cost efficiency by decreasing the number of containers needed. For instance, a quantum-optimized approach can lead to notable reductions in freight expenses for road transportation over long distances. Similarly, quantum optimization can lower transportation costs across other modes, including sea and air, by optimizing container use. Aside from cost savings, quantum optimization can improve fill rates by approximately 15% across all transportation methods, according to internal D-Wave data. For shippers, this can lead to more efficient container usage, enabling them to transport more goods within the same space and reducing the environmental impact by minimizing the number of shipments required for the same volume of goods.

REDUCING WASTE WHILE MAXIMIZING SPACE:
PRECISE CARGO LOADING WITH QUANTUM OPTIMIZATION

BENEFITS OF QUANTUM-POWERED CARGO LOADING

- Improves weight distribution and balance
- Enhances loading speed and efficiency
- Better handles complex loading constraints simultaneously

USE CASE: QUANTUM OPTIMIZATION IN ACTION AT THE PORT OF LOS ANGELES

At the Port of Los Angeles's bustling Pier 300, logistics operations are both large-scale and intricate, encompassing everything from space utilization to the efficient packing and distribution of cargo. SavantX's Hyper-Optimized Nodal Efficiency Engine (HONE) harnessed D-Wave's quantum computing solutions to enhance core aspects of port operations. Employing a digital twin simulation, the terminal at Pier 300 **achieved a 60% boost in crane deliveries** per day and minimized average crane travel distances. These advancements streamlined operations and contributed to an **increase in the port's value from $850 million in 2018 to $2.3 billion in 2021.**

> "Not all problems are optimization problems, but for the ones that are, there's a huge opportunity to bring value into the equation. We've tasted the power of quantum, and we're very, very excited about it."
>
> **— Ed Heinbockel, CEO, SavantX**

GET STARTED NOW

Are you ready to explore how quantum optimization can meet your cargo loading needs?

With our hands-on team of experts and our Launch™ program, it's easy to reap the benefits of quantum optimization now. Our team will guide you through every step of your journey: we'll validate your use case, offer an optimized and thoroughly tested solution, and ensure a smooth path to production deployment.

Sign up for a consultation today.