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IBM

Leading bulk tanker transportation company

Driving innovation in bulk tanker transportation with advanced analytics and optimization

Bulk tanker logistics is such a complex problem that many trucking companies can't offer a comprehensive service: they have to specialize in only a small set of products. Optimization software from IBM is helping this leading tanker carrier to buck that trend by finding efficient routes in near-real time—enabling huge cost savings and supporting growth.

Business challenge

To transport bulk products safely and profitably, this carrier needs to manage hundreds of constraints on tankers, drivers and cargos. How can it help its planners make optimal routing decisions?

Transformation

This leading bulk carrier embedded IBM optimization software into its operational systems and developed a sophisticated solution that provides insight to optimize driver and route planning every 10 minutes.

Results

Millions	Millions	Million-dollar
of dollars saved annually by eliminating miles of unnecessary driving	more dollars saved annually by improving driver retention	revenue boost achieved by increasing driver productivity

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Business challenge story

Mastering complexity

The US trucking industry finds itself at a crossroads. The physical structure of the supply chain is changing and rapidly digitizing.

As it seeks to continue to outperform competitors and expand its business, this leading bulk carrier has two key advantages: many years of experience in every aspect of truckload and intermodal logistics, and a rich tradition of operations research and advanced analytics.

A spokesperson for this leading bulk carrier explains: "Success in logistics isn't just about having the most trucks or the best drivers. It's also about making the smartest decisions. In many cases, you can define the optimal decision mathematically: it's the one that maximizes certain factors, such as the utilization of trucks, trailers and drivers, while minimizing others, such as the number of empty miles driven, the amount of fuel used, and the total delivery time.

"Operations research helps us model problems in terms of the constraints on our network, and use powerful solvers to find optimal solutions. The more complex problems we can solve, the bigger the advantage we have over our competitors."

In the case of bulk transportation, there are a number of additional constraints that add extra layers of complexity to an already difficult optimization problem. For example, as well as finding the optimal combination of drivers, trucks and trailers, route planners must also factor in the need to wash out the tank trailer between loads. Instead of just cycling between pick-up and drop-off destinations, planners also need to locate a convenient washing facility after each delivery.

> "We've reduced our annual bulk transportation mileage by more than a million miles, saving millions of dollars per year."
>
> — Spokesperson, leading bulk carrier

The spokesperson adds: "Prior load is also important. If you have used a tanker to ship a certain product, you may not be allowed to use that tanker to ship another type of product until it has gone through up to three wash cycles. On top of that, we have more than 100 different configurations of tanker, with different tank-linings that are only suitable for certain types of cargo, or valves that are designed for specific loading modalities.

"The bulk tanker problem is so difficult that many logistics companies simply sidestep it altogether. Instead of offering a comprehensive bulk shipping service, they specialize in shipping just a small range of products, so they don't have to worry about all the possible combinations of products and tankers.

"That's especially bad for larger shippers, because they have to engage many small logistics providers to cover all of their transportation needs. That raises their supplier management costs, and means they miss out on the efficiencies of having a larger fleet at their disposal."

The company realized there was potential to provide a more efficient and cost-effective, single-vendor service for customers.

Transformation story

Harnessing advanced analytics

This bulk tanker carrier has been a long-time user of IBM advanced analytics and optimization software—in particular, IBM® ILOG® CPLEX® Optimization Studio.

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The spokesperson explains: "We used to run IBM ILOG CPLEX Optimization Studio head-to-head with optimization software from another vendor, but today it's the only optimization product we use. From a pure speed perspective, it's a very capable solver—but more importantly, it's easy to integrate with our operational systems to provide near real-time decision support.

"The other advantage of working with IBM in the optimization space is the engagement with scientists from IBM Research. That level of operations research expertise just doesn't exist at other companies. There's also a rich ecosystem of IBM Business Partners for CPLEX, who made a key contribution to our bulk optimization project."

Using IBM ILOG CPLEX Optimization Studio, the company was able to split the problem up into a number of sub-problems that could be solved separately, and then combine the results into a single solver that recommends the optimal combination of drivers, trailers and tank-washes for each load across the whole logistics network. The resulting model can find solutions for 1,500 orders, 800 tankers and 500 drivers with a five-day rolling horizon in less than 10 minutes—a problem space that contains more than 1 billion feasible assignment scenarios.

"The underlying techniques we used to solve the individual problems were not new, but the application of four different optimization models in sequence was innovative—we haven't seen anything similar in problems of this type," says the spokesperson.

After validating the model, the bulk tanker embedded this solver into its operational planning systems, integrating it with its Oracle Transportation Management and Siebel CRM applications. The solver runs continuously during the working day, updating as new orders arrive from customers and operational data comes in from drivers and tank wash stations. The results are presented as recommendations in the planning interface used by the company's regional planners.

"Our planners can override the recommendations if something unexpected happens, such as a truck breaking down, or a customer re-routing an order at the last minute," says the spokesperson. "There will always be factors that are outside the knowledge of the model, so human input is still important for exception management. But generally, the model knows best: it shows our planners the cost impact of making changes, and 80 to 90 percent of its recommendations are accepted straight away."

The bulk carrier has also begun using IBM SPSS® Modeler, together with open-source Python libraries, as part of a sophisticated demand forecasting model to predict incoming orders and pickup locations. This helps the company select tank-wash stations that are likely to be near the location of the next pick up the tanker can handle—reducing the total empty miles that need to be driven between jobs.

Results story

Scaling up the bulk shipping business

The solution has already begun to transform the company's bulk shipping division, which is one of its fastest-growing.

"Many people in the industry believed the routing problem for bulk shipping was too complex to be automated, and that the bulk sector was destined to remain a niche, specialist market," says the spokesperson.

"Our senior leadership team knew we could prove them wrong, and helped us push the project through. As a result, we offer a much more comprehensive bulk logistics service than our competitors—reducing their shipping costs and improving delivery times significantly."

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In numbers, the results of the project are impressive: “We’ve reduced our annual bulk transportation mileage by more than a million miles, saving millions of dollars per year,” says the spokesperson. “And we’re getting thousands of additional days of utilization out of our tanker fleet.

“We’ve seen savings of over a million dollars per year by reducing unused hours for drivers and improving driver retention. And the bulk division has seen a multi-million-dollar uplift in annual revenues by increasing driver productivity.”

For the planning team, the model simplifies decision-making, allowing planners to focus on dealing with exceptional circumstances instead of basic routing decisions. As a result, productivity in the planning department has increased substantially, error rates have fallen, and two full-time planners have been redeployed in other roles.

The company is now in a strong position to scale its bulk division to take advantage of new opportunities as the logistics sector continues to evolve. The spokesperson concludes: “This project isn’t just an interesting example of solving an operations research problem—it’s a real business success story.

“Our bulk division is able to serve more customers more cost-effectively, deliver their products faster, and improve the overall quality of service. We’re excited about working with IBM data, analytics and optimization services to drive similar improvements in bulk and other divisions in the future.”