LARGE OIL AND GAS REFINERY AND DISTRIBUTION COMPANY
SHORT SEA INVENTORY - ROUTING OPTIMIZATION

Background

A large **oil and gas company** ships crude and refined oil products **from its refineries to several central distribution facilities** along the coast, from which these products will then be **distributed to their final destinations.**

The company **leases ships of different capacities** for this purpose, with different **speeds and operating costs.** These ships are **assigned voyages** where they **load products at certain refineries** and **unload** them at **distribution points.** In some cases, ships are also required to load products at distribution points, to be transferred to other **distribution facilities.**

The company needed to **minimize the total transportation cost** involved in the operation. This includes the **cost of operating the fleet of ships,** as well as minimizing the **overall number of ships** necessary.

The Challenge

There are *infinite possible ways of shipping* the products.

To begin with, there are all the *possible paths* that a *ship can take.*
Let's assume – *for simplicity* – that the *transportation network* consists of *2 refineries* and *3 distribution facilities.*

The figure below shows this *reduced transportation network* with two refineries, **R1** and **R2,** and three distribution facilities, **D1, D2** and **D3.** The *figure shows* just *two of the many possible ways* to get from Refinery 1 (**R1**) to Distribution Point 3 **(D3)** —— the solid blue path **(R1 → D1 → D2 → D3)**, and the dotted red path **(R1 → R2 → D2 → D1 → D3)**. If we assume that a voyage must *start at a refinery* and must include *at least one distribution point,* the number of possible, *unique paths* is 132.
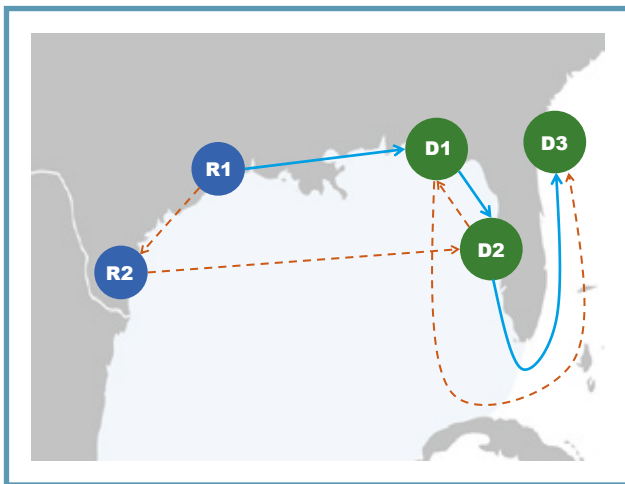
If we have *three ships available,* then the number of possible *assignments of ships to paths* is **3 x 132 = 396.** If we have a *single product to transport,* and we can *load any number of barrels* of the product on a ship – *up to the ship's capacity* – then the number of *possible ways* to transport the product *is infinite!*

The actual *size of the company's transportation network* is *much larger,* consisting of *several refineries, multiple distribution facilities,* more than a *dozen ships,* and *several products.* The *current scheduling* of *product loading* on ships and *assigning ships to paths* is done *manually* by a team of planners using very *complex spreadsheets.* Obviously, *manually generated transportation solutions* are *not optimal,* leading to *unnecessarily high costs* and *large amounts of wasted capacity* on ships.

OptPro Solution

OptPro combines *advanced analytics methods,* such as *mathematical optimization* and *artificial intelligence,* with a *digital twin representation* of the actual process.

In this case, the **OptPro** was implemented to simultaneously *minimize the number of ships* necessary to *fulfill shipment requirements* and the *total cost of transporting products,* while meeting *product demand* at all *distribution points.*

The *system assigns ships to paths,* and *schedules daily ship activities,* from port *departures and arrivals* to *loading and unloading specific products.* The schedule is then *validated by a digital twin representation* of the transportation network, certain adjustments are made to *resolve conflicts* (e.g., staggering arrivals when *two ships* scheduled to arrive at a port at exactly the *same time)* and forwarded to *maritime operations planners* to put into operation.

Results

The *solution* approach is an *example of the wide applicability* of **OptPro,** from *optimizing production schedules* at a manufacturing plant to *optimizing transportation schedules* in maritime operations.

By using **OptPro,** the *company will achieve a savings of over 4% per barrel* of refined products it delivers to distribution facilities across its network, a *total savings of more than $2MM per month.*

The solution also provides the *ability to anticipate* when a *ship can be repurposed* for certain periods, such that *additional savings* can be *achieved.*

2241 17th Street
Boulder, CO 80302

303.447.3255

www.OptTek.com