SOLVERMINDS
SOLUTIONS AND TECHNOLOGIES

TANKER
OPTIMIZER
WHITEPAPER 2021

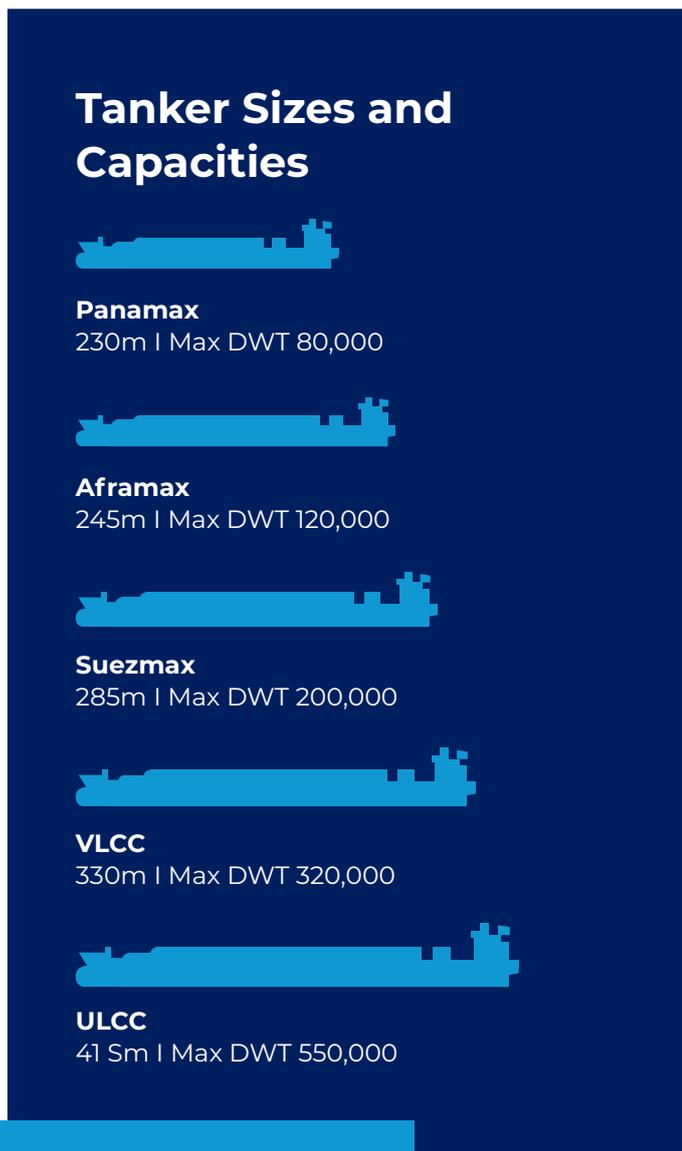## How AI Solves the Challenges of Scheduling Oil Tanker Vessels to Minimize Costs

www.fleetoptimizer.ai

Many oil majors face several hurdles when it comes to the effective scheduling of tanker vessels to supply oil from dispersed load ports to discharge ports.

Crude oil plays a significant role in global industry, energy, and consumer activities. It has been a powerhouse that has spurred the growth of nations and commerce for some time and will likely do so for some years to come. For oil majors, the primary challenge is to ensure supply and demand are met, all the while minimizing costs.

Today approximately 60% of the world's oil is transported by tankers. Oil tanker vessels' sizes depend on the area or canal they need to traverse.

With over 3,500 oil tankers – 800 of which are very large crude carriers (VLCCs) – worldwide, oil tankers, or petroleum tankers, play an active and crucial part in the transport of oil from their extraction site to refineries or distribution centers further on.

Tanker Sizes and Capacities

Panamax
230m I Max DWT 80,000

Aframax
245m I Max DWT 120,000

Suezmax
285m I Max DWT 200,000

VLCC
330m I Max DWT 320,000

ULCC
41 Sm I Max DWT 550,000

Challenges to Creating Oil Tanker Schedules

When it comes to reducing the operational costs of deployment of oil tanker vessels, tanker operation teams are faced with the daunting task of manually scheduling vessels while taking the following into account:

1. **Charter**
   Whether the vessel is time chartered or voyage chartered

   Running cost
   The costs incurred while the vessel is deployed within the service

   Class
   Such as SuezMax, VLCC, ULCC

   Dimensions and capacity
   The gross tonnage (GRT), NRT, Summer DWT, LOA, Beam, Summer Draft, WL to Manifold the tanker has

   Fuel consumption and speed
   The total fuel used at sea plus at port

   Charter hire and dry docking
   Costs per day, plus dry dock duration

   Port limitations
   Such as day light arrival only, minimum depth, port window, allowed LOA, WL to manifold, allowed beam, length of wharf, hours for maneuvering in and out, load or discharge rate (T/hr), plus congestion delays.

Now, consider that all this needs to be accounted for each vessel, across multiple ports, while keeping demand of various oil grades satisfied at various discharge ports, so that the tanks do not run dry or a minimum safety stock is always maintained. The demands at the discharge ports can be volatile, which may be influenced due to holidays, seasonal demands, weather influenced demands.

Typically, this is a manual, time-consuming activity and errors can creep in when scheduling manually, which can be costly.

1. **Manual scheduling is expensive.** Manually creating a schedule that spans a 90-day period that considers multiple vessels, multi grade oil cargo, multiple load ports and discharge ports is time-consuming and expensive.

2. **Meeting demand at discharge ports.** The schedule must meet the demand of the consumption of oil cargo at discharge ports and ensure stocks do not dip below minimum safety stock levels.

3. **Dealing with uncertainties.** The schedule must ensure the reliable delivery of cargo at discharge ports, while navigating uncertainties such as congestion, vessel breakdown, berth maintenance, planned off-hires, and arriving at specific port windows.

4. **Demand volatility.** The daily consumption for each grade at each discharge port is volatile, and the scheduling team must factor this in.

5. **Pressure to maximize utilization of time charter vessels.** The planners need to ensure they maximize the utilization of time charter vessels while dealing with restrictions such Draft, Air draft, LOA, Beam, Vessel age, Vessel flag, Dry docking etc.

6. **Incompatible oil grade loading.** Factoring in oil grade loading that is com patible with the loaded grade from the previous voyage, as well as tank cleaning time if the grades are incompatible.

7. **Finding vessels to spot charter** from the market when the available fleet is fully deployed to ensure supply is not interrupted.

8. **Dealing with further port constraints** such as single berth availability, day time arrivals, draft limitations, tidal ranges, and waiting time at ports, flags of certain countries not allowed vessels beyond certain age restriction, and port maintenance.

9. **Dealing with disruptions in the schedule** which could be those that are unplanned and arise due to multiple factors such as adverse weather, strikes, blocked canals, accidents, and unrest within a country, to name a few.

10. **Pressure from management** to ensure that vessels are maximally utilized, with zero waiting time, with maximize berth utilization, all at the lowest possible cost.

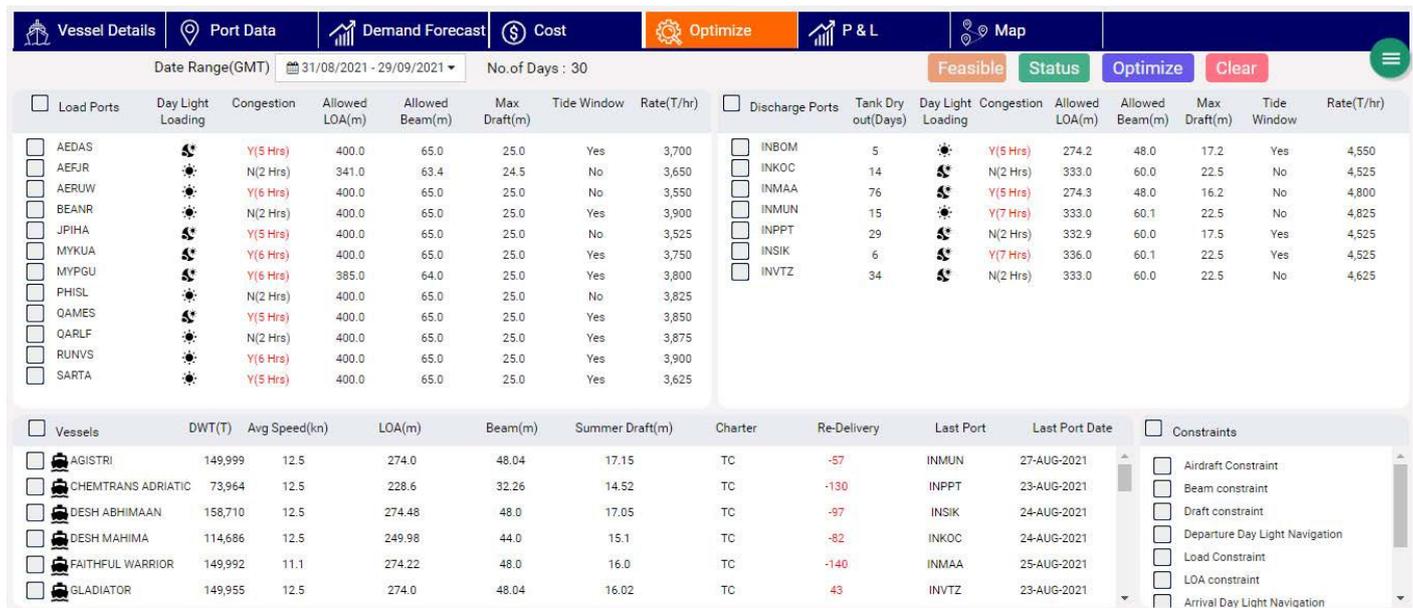# Generating a Reliable Schedule for Tanker Vessels with AI

With so many dynamic variables and factors to consider, tanker operation teams cannot be expected to schedule vessels, optimize port pairs and comply with constraints manually, plus make accurate decisions that keeps costs down.

Many organizations perform this manually. However, the cost of operational inefficiency is seldom or never computed or discussed, nor is the question asked whether the schedule generated could have been done in a better way.

This is where Solverminds' Tanker Fleet and Service optimizer comes to the rescue. The optimizer's primary objectives is to minimize cost, satisfy demand at the discharge port, and maximize the utilization of time-chartered vessels.

The Tanker Fleet and Service Optimizer uses optimization engine and machine learning (ML) to generate the demand forecast at the discharge port. The Optimizer engine generates an accurate scheduling of tanker vessels, while considering every factor, limitation, variation, and cost optimization possible. Practical and easy to use, fleet scheduling is done within a matter of minutes. The optimizer includes these factors when creating a schedule for tanker vessels.

	Vessel Details	Port Data	Demand Forecast	Cost	Optimize	P & L	Map		

Date Range(GMT): 31/08/2021 - 29/09/2021 ▾ No.of Days : 30 [Feasible] [Status] [Optimize] [Clear]

Load Ports	Day Light Loading	Congestion	Allowed LOA(m)	Allowed Beam(m)	Max Draft(m)	Tide Window	Rate(T/hr)
AEDAS	🌙	Y(5 Hrs)	400.0	65.0	25.0	Yes	3,700
AEFJR	☀	N(2 Hrs)	341.0	63.4	24.5	No	3,650
AERUW	☀	Y(6 Hrs)	400.0	65.0	25.0	No	3,550
BEANR	☀	N(2 Hrs)	400.0	65.0	25.0	Yes	3,900
JPIHA	🌙	Y(5 Hrs)	400.0	65.0	25.0	No	3,525
MYKUA	🌙	Y(6 Hrs)	400.0	65.0	25.0	Yes	3,750
MYPGU	🌙	Y(6 Hrs)	385.0	64.0	25.0	Yes	3,800
PHISL	☀	N(2 Hrs)	400.0	65.0	25.0	No	3,825
QAMES	🌙	Y(5 Hrs)	400.0	65.0	25.0	Yes	3,850
QARLF	☀	N(2 Hrs)	400.0	65.0	25.0	Yes	3,875
RUNVS	☀	Y(6 Hrs)	400.0	65.0	25.0	Yes	3,900
SARTA	☀	Y(5 Hrs)	400.0	65.0	25.0	Yes	3,625

Discharge Ports	Tank Dry out(Days)	Day Light Loading	Congestion	Allowed LOA(m)	Allowed Beam(m)	Max Draft(m)	Tide Window	Rate(T/hr)
INBOM	5	☀	Y(5 Hrs)	274.2	48.0	17.2	Yes	4,550
INKOC	14	🌙	N(2 Hrs)	333.0	60.0	22.5	No	4,525
INMAA	76	🌙	Y(5 Hrs)	274.3	48.0	16.2	No	4,800
INMUN	15	☀	Y(7 Hrs)	333.0	60.1	22.5	No	4,825
INPPT	29	🌙	N(2 Hrs)	332.9	60.0	17.5	Yes	4,525
INSIK	6	🌙	Y(7 Hrs)	336.0	60.1	22.5	Yes	4,525
INVTZ	34	🌙	N(2 Hrs)	333.0	60.0	22.5	No	4,625

Vessels	DWT(T)	Avg Speed(kn)	LOA(m)	Beam(m)	Summer Draft(m)	Charter	Re-Delivery	Last Port	Last Port Date
🚢 AGISTRI	149,999	12.5	274.0	48.04	17.15	TC	-57	INMUN	27-AUG-2021
🚢 CHEMTRANS ADRIATIC	73,964	12.5	228.6	32.26	14.52	TC	-130	INPPT	23-AUG-2021
🚢 DESH ABHIMAAN	158,710	12.5	274.48	48.0	17.05	TC	-97	INSIK	24-AUG-2021
🚢 DESH MAHIMA	114,686	12.5	249.98	44.0	15.1	TC	-82	INKOC	24-AUG-2021
🚢 FAITHFUL WARRIOR	149,992	11.1	274.22	48.0	16.0	TC	-140	INMAA	25-AUG-2021
🚢 GLADIATOR	149,955	12.5	274.0	48.04	16.02	TC	43	INVTZ	23-AUG-2021

Constraints:
☐ Airdraft Constraint
☐ Beam constraint
☐ Draft constraint
☐ Departure Day Light Navigation
☐ Load Constraint
☐ LOA constraint
☐ Arrival Day Light Navigation

Optimizer window showing the list of load ports and discharge ports, with key parameters, and the list of Time chartered vessel in fleet and spot charter vessels available for hiring. List of constraints that is applied to optimizer.

1. 30/60/90 Days
The Tanker Fleet Schedule Optimizer can create a schedule that spans a 90-day period in a matter of minutes, that drills down to weeks or days, per vessel.

2. Multiple Grades
The optimized schedule caters to multiple vessels to deliver multi grade oil cargo from multiple load ports to multiple discharge ports.

3. Stock Management

The schedule ensures satisfaction for the demand of the consumption of oil cargo at discharge ports, ensuring stocks do not dip below minimum safety stock levels, while mitigating changes in demand.

4. Reliability

The optimizer achieves the reliable delivery of cargo at discharge ports, while navigating scenarios such as congestion, vessel breakdown, berth maintenance, planned off-hires, and arrival at specific port windows.
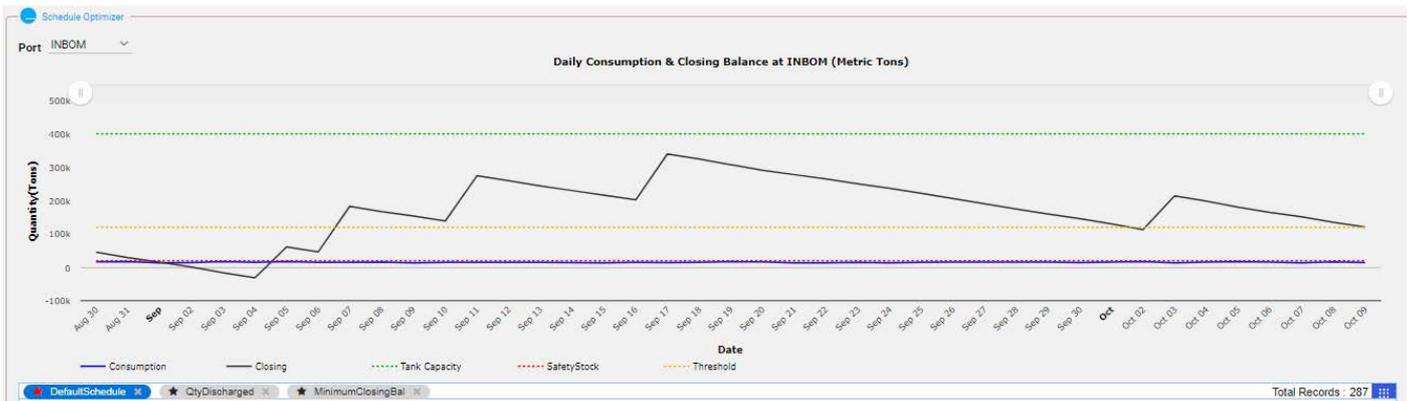
A daily closing balance of tanks in port, showing the optimizer trying to maintain the close balance between minimum threshold (orange dotted line) and the maximum tank capacity (green dotted line).

5. Data-driven Forecast and Clarity

Daily forecasting for each grade, at each dis charge port is provided, using AI and ML predictions.

6. Time Charter Optimization

The optimizer identifies the ideal number of vessels of mixed sizes used for time charter for maximum utilization. This also ensures compliance with restrictions such as Draft, Air draft, LOA, Beam, Vessel age, Vessel flag, Dry docking etc.

7. Charter Hire

The optimizer highlights charter vessels from the market when the deployed time chartered vessels are fully utilized, and demand cannot be met by them alone.

8. Grade Load Optimization

The optimizer ensures vessels load oil grade that is compatible with the loaded grade from the previous voyage. It also adds tank cleaning periods into the schedule if the grades are incompatible.
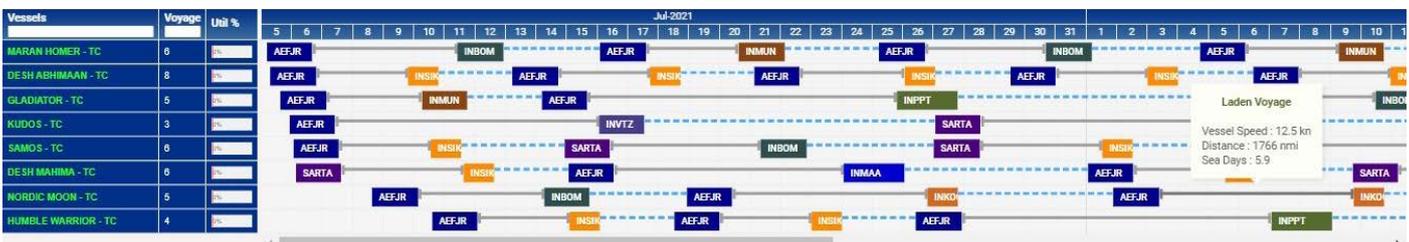
A 60 day schedule generated by the optimizer for Time and Spot chartered vessel. All demand surges (seasonal) satisfied by Spot and regular demand satisfied by Time Chartered.

SOLVERMINDS
SOLUTIONS AND TECHNOLOGIES

9. **Port Constraints**
The optimizer automatically factors in further complexity added by other port constraints such as day time arrival, draft limitations, tidal range, and minimum waiting time at port.

10. **Agile Planning**
The optimizer can easily be adjusted to handle disruptions that are required to satisfy demands.

11. **Reduced Costs**
The optimizer can compare costs between ships to know which is the most affordable selection and can generate revenue per ton mile for comparing costs for each vessel.

12. **Disruption Planning**
The optimizer gives planners the ability to plan the revised schedule based on disruptions reported by vessel or at the port. This is a major value, as the majority of the cost saving is reported when rescheduling vessels, with the new scenario.

Value Generation

1. The primary objective of the optimizer is to minimize the cost of operations.
2. It ensures that demand is satisfied, and does not run dry.
3. The optimizer maximizes vessel utilization.
4. Waiting times at port due to tide, congestion, maintenance and dry docking is minimized.
5. The optimizer allows for replanning following any disruption at discharge port or in transit.
6. The optimizer facilitates the selection and allocation of all available time or spot-chartered vessels at the load region.
7. It ensures that all technical port and vessel constraints are met.

For more media information, please contact:

Solverminds Solutions and Technologies:

enquiry@solverminds.com

ABOUT SOLVERMINDS

Established in 2003, Solverminds is a leading next-gen global technology company with a vision to empower businesses with innovations reimagined. Our exceptional domain expertise and cutting-edge technology solutions offer a complete range of best-in-class products for liner operations management, ship management, agency management, and advanced analytics.

While our technological focus is on delivering reliable, resilient, and robust solutions that embrace Artificial Intelligence (AI), Machine Learning (ML), Predictive Analytics, and Big Data, our strategic focus remains on quality and customer-centric approach, research and developments, and thought leadership.

Solverminds is a smart and sophisticated technology provider of a wide range of solutions and services that enfolds integrated and bespoke ERP, global consulting, cloud system, and advanced analytics. We help you ascend the ridges of the extremely competitive current world by automating your business processes while offering actionable insights, predictive outcomes, and optimized solutions to make in- formed decisions.