Navigating Success

Validating Throughput Capacity in a Novel Marine Fuel Operation Through Discrete Event Simulation

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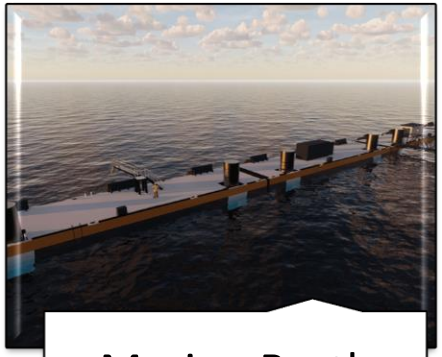
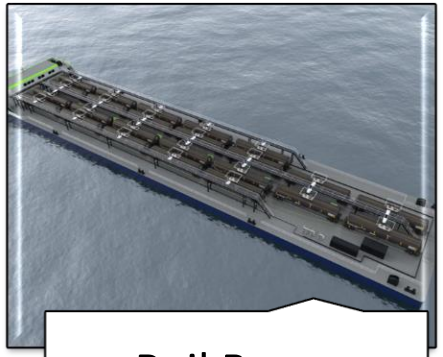
Wolverine Terminals

- Wolverine Terminals is a Calgary, Alberta based company that specializes in providing marine fuel solutions in Prince Rupert on Canada's West Coast.
- Prince Rupert is currently the largest port in North America without marine fuel service.
- Patented barge technology to allow for rail offloading and marine fuel blending on a floating barge.
- Commercial Operations expected to commence 3Q24



Marine Berth

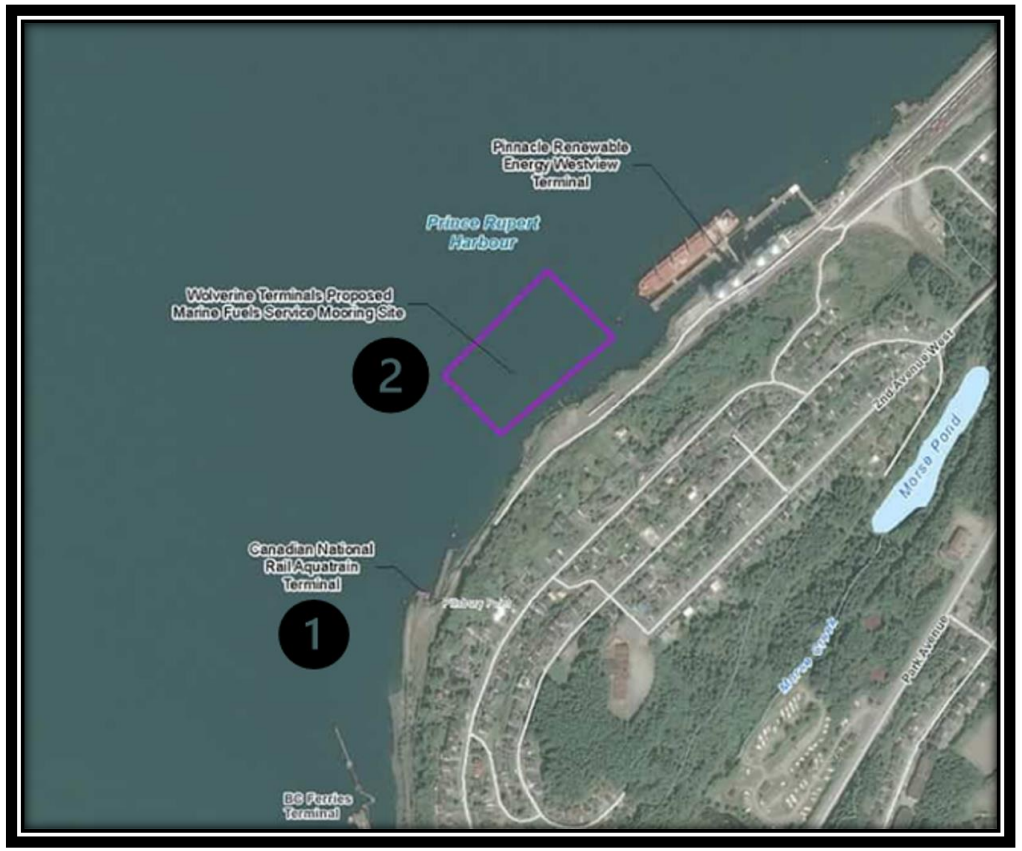


Rail Barge

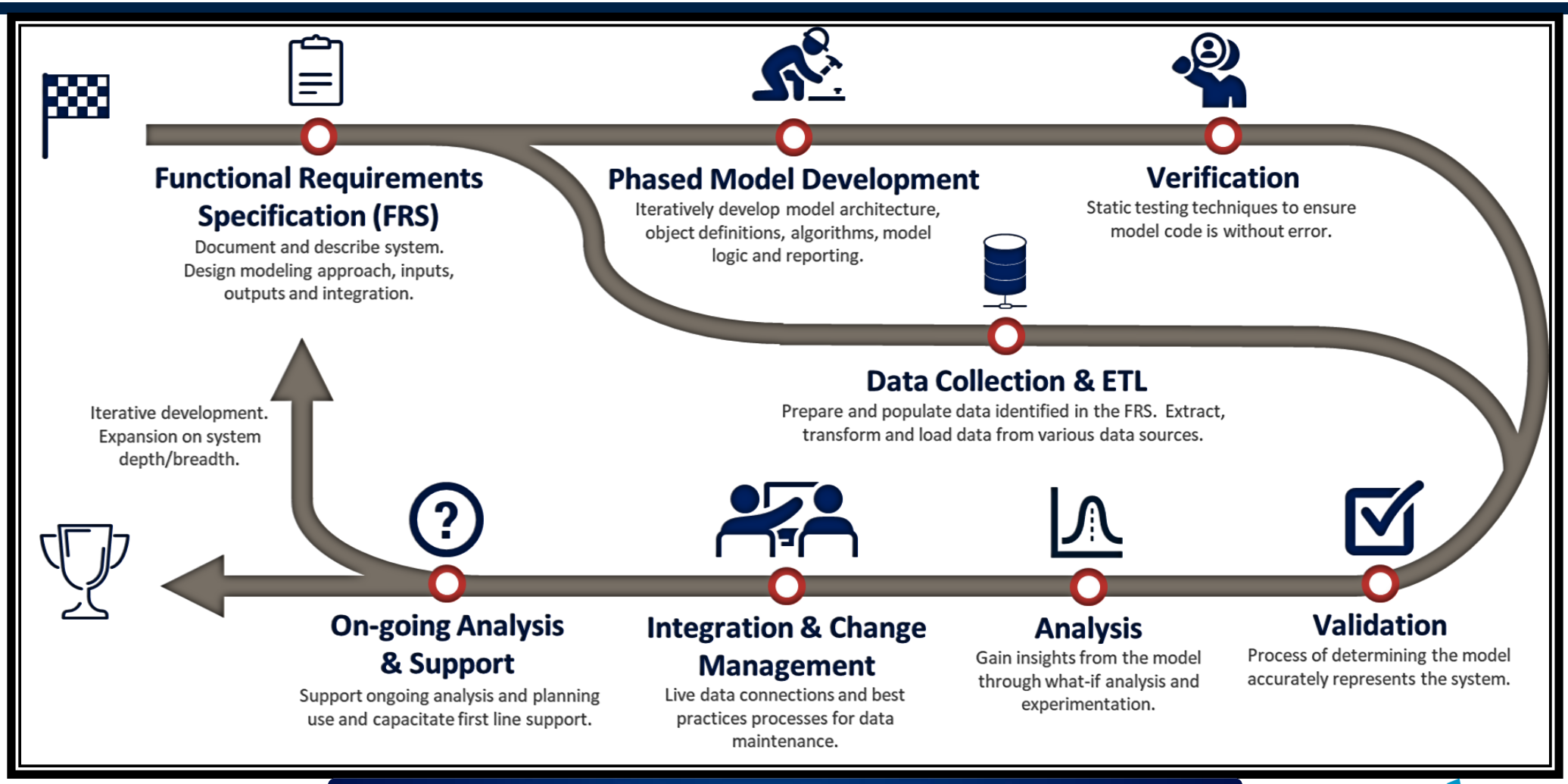
Fuel Distribution

Background Overview

- MOSIMTEC partnered with Wolverine Terminals to develop a discrete event dynamic simulation to study the throughput capacity of their new, complex marine fuel business.
- Wolverine Terminals wanted to evaluate and test assumptions for the system given different demand, supply, processing, and environmental variables.
  - The primary objective for the modeling exercise was to stress test the maximum volume throughput capability of the entire system.
  - Secondary objectives included understanding system constraints, capture bottlenecks, and identify optimization opportunities.



Navigating Success with Simulation



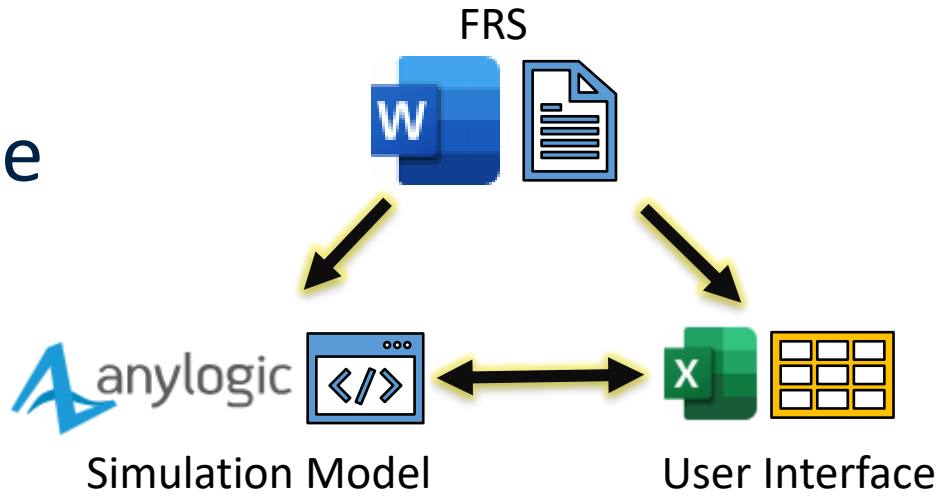
System Overview

Simulation Challenges

- Confirming the throughput capacity of the marine operations system was complex for the following reasons:
  - New operation with no historical data.
  - Patented and purpose-built infrastructure and equipment.
  - Demand, supply, and capacity constraints within the system.
  - Blending requirements to produce a finished marine fuel product.
  - Tide cycles, seasonality, daylight hours, and weather patterns that impact operating parameters.
  - The interarrival variability of vessels and limited berth durations.
- The simulation model and results all needed to be completed within 2-3 weeks

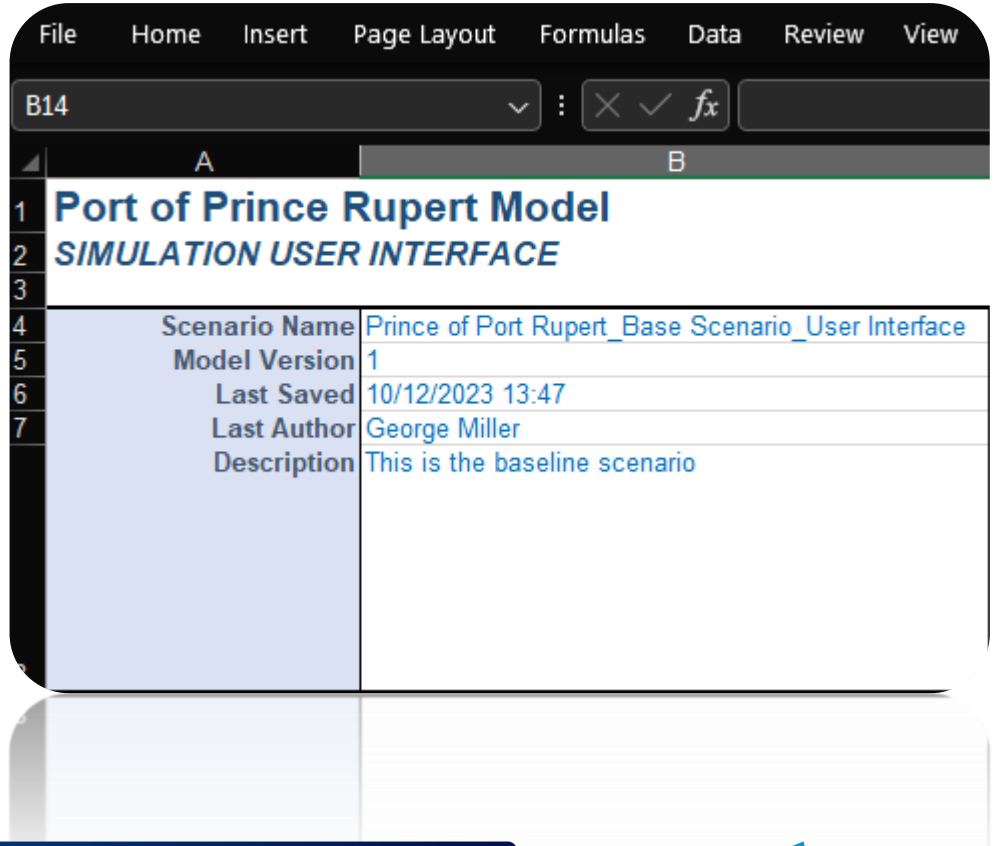
Simulation Components

- Simulation Specification
  - Developed in during a Workshop with Wolverine Terminals
- Simulation Model
  - Developed in AnyLogic
- Simulation Front End User Interface
  - Developed in Excel

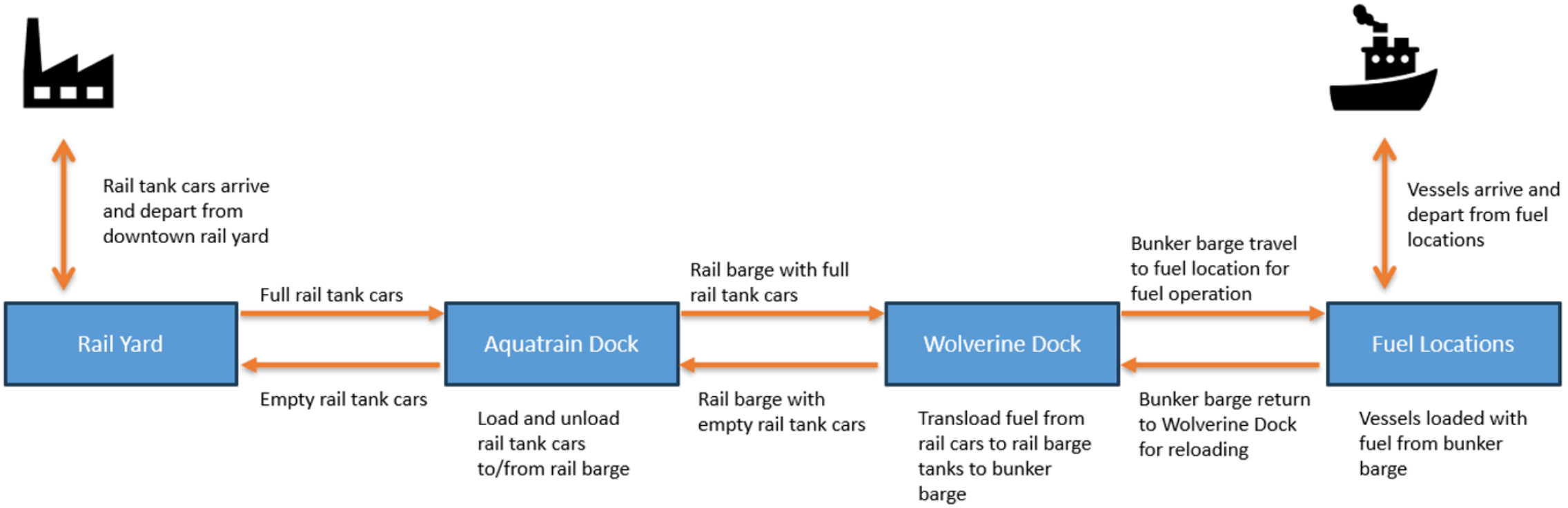


Simulation Inputs

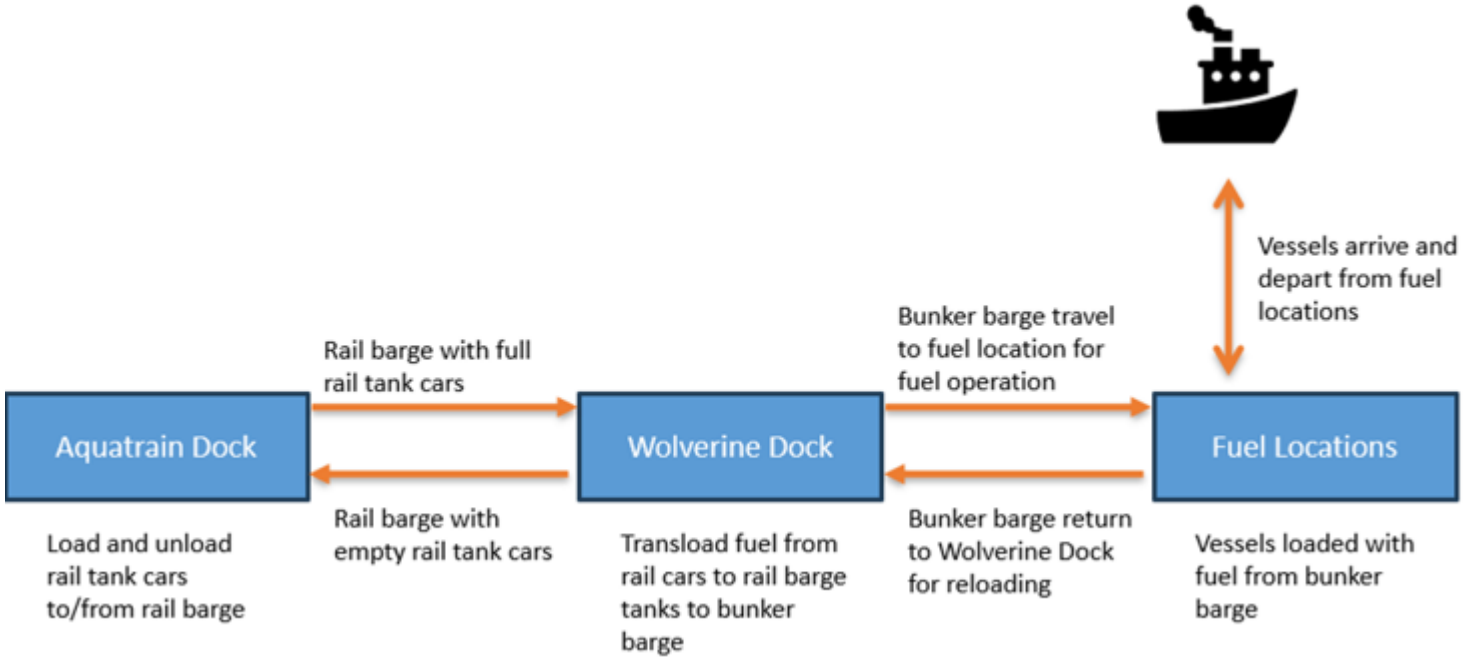
- 154 Configurable Input Fields
  - Barge Attributes
  - Product Attributes
  - Customer Demand
  - External Factors (Weather, Tides, etc.)
  - Rail Service Capability
- 21 Unique Time Distributions
  - Customer Berth Duration
  - Customer Stem Size
  - Weather Disruptions
  - Seasonal Operating Hours
- Additional benefit as a Model Executable



Simulation Model Overview

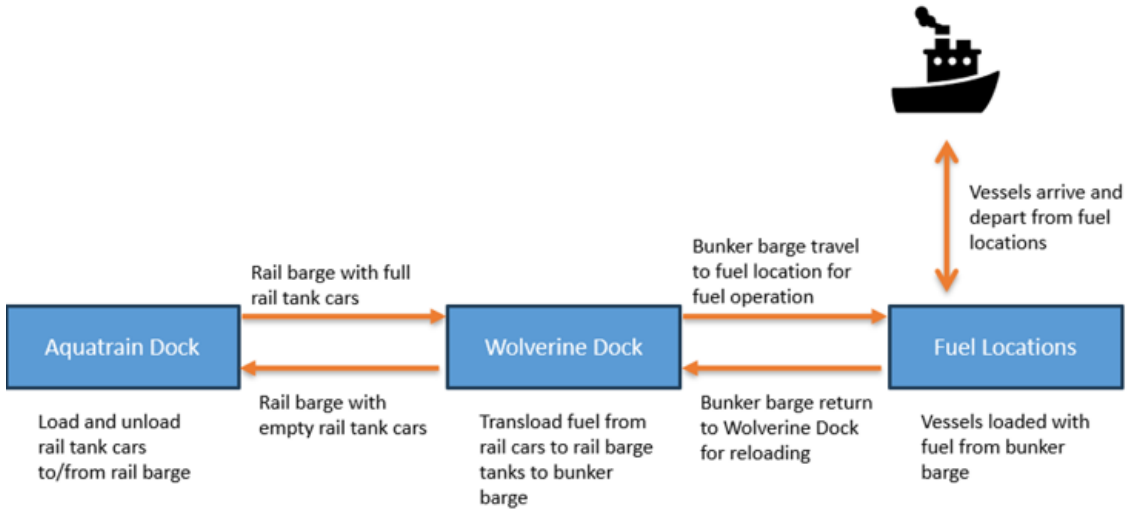


Simulation Model Overview

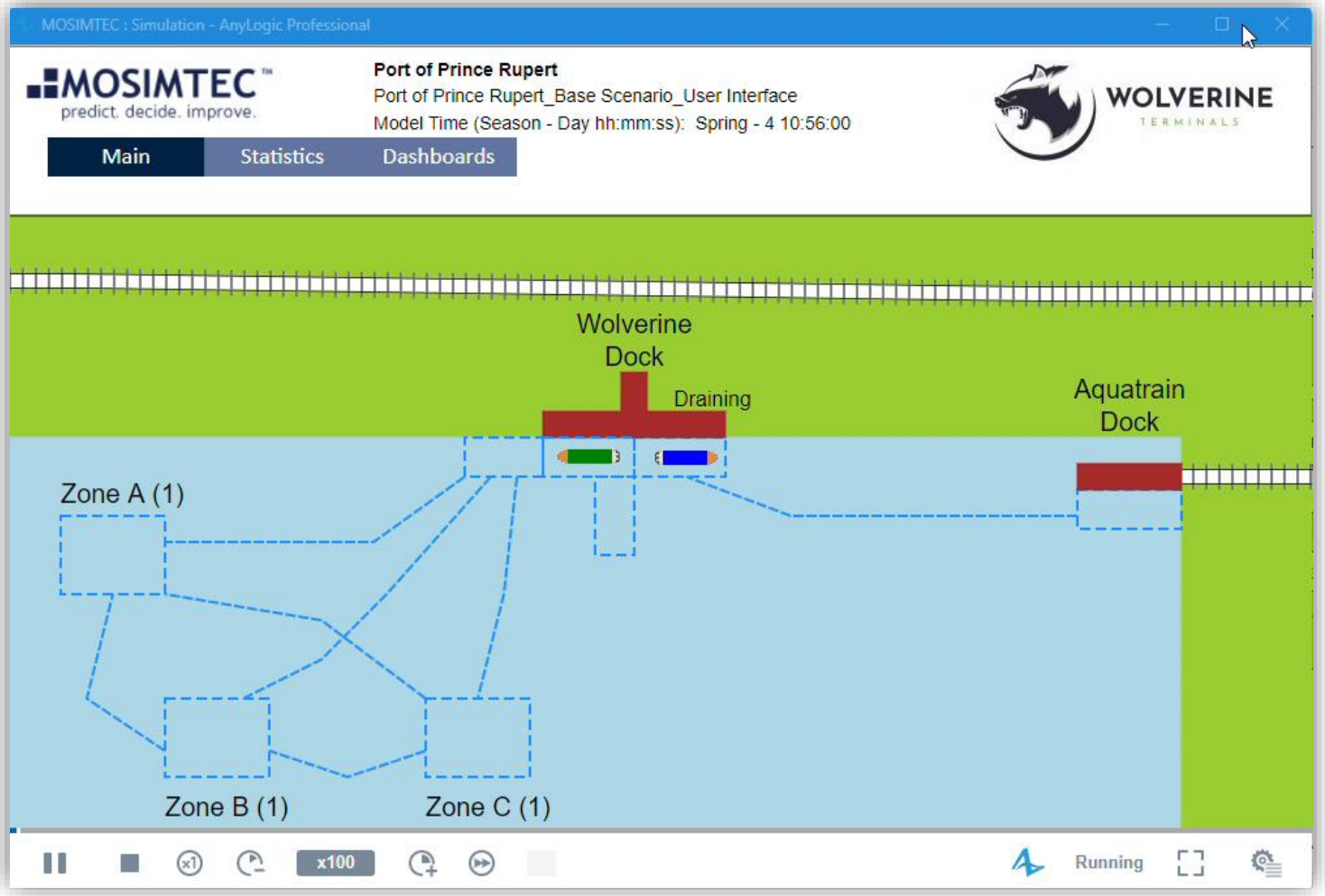


Key Modeling Assumptions

- Removed the rail car logic from the scope
- Assumed rail cars are always available during a rail switch
- Rail barge tanks tracked total capacity
- Calculated discrete times for fuel transfer
- Zones represented approximate location of customers
- Demand (customers) will be generated by an arrival rate
- Disruptions will impact delivery
- Animation would be minimal

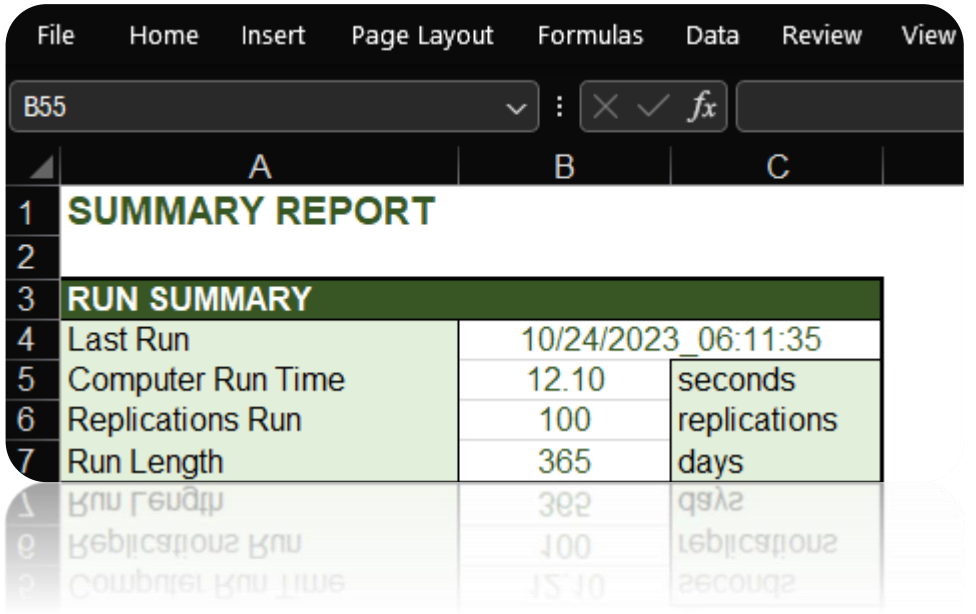


Running the Model



Simulation Outputs

- 36 Customer Requested Outputs
- Key KPI's
  - Total Throughput of Marine Fuel
  - Customer Service Levels
  - Asset Utilization
- Scenario
  - 100 Replications
  - Minimum/Average/Maximum
  - Tested how each input affected outputs in different scenarios
  - Helped identify optimization opportunities in the future



Simulation Success

- ***Validated the throughput capacity assumptions*** for Wolverine Terminals
- The model provided additional benefits as it became a tool for the team to:
  - Understand system constraints and identify bottlenecks.
  - Test potential what if scenarios and impacts to various KPIs.
  - Assess ROI on incremental investments.
  - Prioritize operation efforts on efficiency gains.

Q & A