

SmartTug

Right Tug, Right Vessel, Right Time



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How Leading Ports Are Turning Tugboat Scheduling into a Strategic Advantage

Executive Summary

In today's high-stakes maritime environment, port efficiency is no longer optional; it's a competitive advantage. Tug scheduling, once seen as an operational detail, is now under scrutiny for its impact on fuel cost, berth delays, and emissions. Smart-Tug, Solverminds' AI-powered scheduling engine, helps tug operators shift from reactive planning to proactive orchestration. This paper outlines the real-world challenges in tug operations, how Smart-Tug addresses them, and the measurable gains achieved through intelligent, data-driven dispatch.

Tug Operations Under Pressure: The Cost of Ineffective Scheduling

Tug scheduling at many ports remains a manually driven process, dependent on experience-based guesswork and reactive planning. As a result:

- Tug delays ripple into berth scheduling disruptions
- High fuel consumption arises from excessive repositioning
- Idle tug time is frequent, yet asset utilization remains suboptimal
- Carbon emissions and operational costs rise unnecessarily

Tug scheduling is further complicated by the need to coordinate with pilot availability and adhere to port-specific safety regulations, which often dictate the number of tugs required based on vessel class, engine condition, and draft depth. Manual processes make it harder to comply with these evolving standards, resulting in inconsistent decisions that impact both safety and efficiency.

The Visibility & Control Gap

Despite modern vessel tech, tug operations remain:

01. Disconnected: Tug availability and berth priority are tracked in silos

02. Unpredictable: Delays are rarely factored in real time

03. Potential Compliance Gaps: Port safety rules are sometimes overlooked, risking operational or regulatory non-compliance.

With global port activity increasing and regulations tightening, tug owners /operators must modernize their scheduling approach to remain competitive and sustainable.

Background / Context

Tugs are critical enablers of safe and efficient port operations. Yet, despite advancements in vessel technology, tug operations often lag behind in digital transformation. Industry research reveals:

- Tugs account for up to **50% of a port's marine fuel consumption** (Source: Port of Rotterdam study).
- Globally Ports are being challenged to reduce emissions under the **IMO 2030 carbon intensity goals**.
- Tug scheduling-related berthing delays **contribute to \$25,000+ daily in average costs**, depending on vessel type and port size, with larger and busier ports experiencing even greater cost impacts.
- Manual scheduling leads to **inconsistent dispatch decisions**, often aligned with neither cost-efficiency nor emissions-conscious priorities.
- Tug scheduling is closely linked to **pilot availability** and coordination with marine control.
- The **number of required tugs** is also dictated by port-specific safety regulations.

Given these realities, tug optimization stands out as a high-impact opportunity within port operations.

Proposed Solution

Smart-Tug addresses these inefficiencies by offering a fully integrated, AI-powered tug scheduling engine that:

- Assigns the **right tug, at the right time**, based on real-time priorities and constraints.
- Optimizes for **fuel consumption, tug availability, and vessel priority**.

- Empowers operators with an **interactive UI** that allows on-demand reruns and adjustments.
- Supports **scenario modeling** and **emissions forecasting** for strategic planning.
- Factors in the regulatory requirements alongside real-time port constraints to **ensure compliance and safe scheduling**.
- Enables tug owners/operators to **simulate and evaluate optimal fleet sizing** over time.
- Aligns with **IMO standards** and internal ESG goals for sustainability reporting.

Smart-Tug in Action: An AI-Powered Tug Management System

01. Core Capabilities

- Real-time tug assignment based on job type, berth timing, and availability
- Optimization engine minimizes fuel, delays, and idle repositioning
- Port safety guidelines, tug rest cycles, and delay thresholds built-in
- Seamless rescheduling on demand

02. Platform Features

- 6-hour rolling schedule planning window
- Operator-controlled delay buffers
- Partial job execution support
- Smart rerun logic for updated data inputs
- Prioritizes high-value jobs to boost revenue and cut costs

03. Sustainability & ESG Alignment

- Emissions tracking by job and tug
- Forecasting impact of carbon tax scenarios
- Supports IMO 2030 and custom ESG frameworks

Opportunities and Potential Impact

AI-based tug scheduling presents strong potential to unlock significant operational and environmental efficiencies in tug operations. Based on industry trends and simulation models, Smart-Tug offers the following benefits:

- **Reduction in tug fuel consumption** through optimized routing and fewer repositioning runs
- **Improved tug utilization** by minimizing idle time and better aligning tug capacity with job requirements
- **Reduced vessel turnaround delays**, particularly in high-traffic ports
- **Lower emissions per operation**, supporting environmental compliance and sustainability objectives

Smart-Tug is designed to integrate seamlessly with existing port infrastructure and does not require changes to hardware assets, making it a scalable and cost-effective solution for modern operators seeking smarter operations.

Why It Matters for Tug Owners/Operators Today

Tug Owners/Operators face a dual challenge: Smart-Tug enables both by:

- Stay compliant with global emission norms
- Remain cost-efficient and agile in daily operations
- Eliminating manual guesswork
- Delivering visibility across scheduling, constraints, and job outcomes
- Providing operators with a tool that supports both planning and reaction

Conclusion

Smart-Tug represents a leap forward in tug scheduling optimization, addressing long-standing inefficiencies in tug scheduling through AI and real-time data integration. By reducing fuel use, emissions, and operational delays while boosting asset utilization, Smart-Tug empowers tug owners/operators to meet both commercial and sustainability goals. As ports brace for rising traffic, stricter ESG mandates, and growing economic pressure, those without intelligent tug scheduling will be left behind.