



# Revolutionizing Vessel Design

## ***Designing the Future of Great Lakes and St. Lawrence Seaway Ships***

**BY RICHARD MUELLER, CEO, NETSCo**

**T**he Great Lakes-St. Lawrence Seaway represents one of the most vital maritime corridors in North America, facilitating the transportation of goods and commodities essential to both regional and global economies. As we move further into the 21st century, the design of vessels navigating this crucial waterway is undergoing a transformation driven by rapid technological advancements, aggressive environmental considerations and evolving economic needs.

### ***Technological Advancements***

The astonishing speed of technological change and the owner's expectation of the designer's ability to immediately incorporate these new technologies is revolutionizing ship design. From automated navigation systems to advanced materials, these innovations enhance operational efficiency and safety. One of the most significant new trends is the integration of digital technologies, such as the Internet of Things (IoT), into vessel management systems. These technologies enable real-time monitoring of ship performance, optimizing routes and fuel consumption while reducing operational costs.

Moreover, the adoption of autonomous and semi-autonomous vessels is on the rise. These ships are equipped with sophisticated sensors and artificial intelligence that allow them to navigate with minimal human intervention. As regulations evolve to accommodate these technologies, their potential to reduce human error and improve safety is significant. The design of ships will need to incorporate these systems seamlessly, ensuring that they enhance rather than complicate operations.

### ***Environmental Sustainability***

The urgency of addressing climate change, and the impending 2050 deadline

***Future vessels must adhere to stricter emissions regulations, which will likely drive the adoption of cleaner fuels and more efficient propulsion systems.***

to reach net-zero greenhouse gas (GHG) emissions is prompting ship designers to prioritize environmental sustainability. The shipping industry is responsible for a considerable amount of GHG emissions, and stakeholders are increasingly focused on reducing this impact. Future vessels must adhere to stricter emissions regulations, which will likely drive the adoption of cleaner fuels and more efficient propulsion systems.

One promising avenue is the exploration of alternative fuels, such as hydrogen, ammonia and biofuels. These options present opportunities for reducing carbon footprints, but they also require a reevaluation of vessel design to accommodate different fuel systems and storage needs. For instance, hydrogen-powered ships will necessitate specialized tanks and safety protocols, influencing the overall design of the vessel. Implementing these design changes on existing vessels has proven to be somewhat problematic, but designers of new vessels will have the opportunity to fully optimize their designs to take advantage of these improvements.

Additionally, designing to maximize energy efficiency will be a paramount concern. Designers will increasingly employ hull forms and advanced coating systems that will minimize drag, utilize lightweight materials and integrate renewable energy sources, such as solar panels and wind-assisted propulsion. These innovations not only help in reducing fuel

consumption but will also align with the broader goals of sustainable development.

### ***Economic Considerations***

The economic landscape of the Great Lakes-St. Lawrence Seaway is evolving, influenced by global trade dynamics and changing local industry demands (often in ways that designers can't anticipate) given the relatively long life of new assets operating in fresh water, as much as 50 percent of the time or more. The design of future vessels must reflect these changes to remain competitive. This puts additional pressure on design engineers to try to anticipate what is yet to come. Ships that are bigger, faster, more fuel efficient and more flexible in their cargo handling capabilities will create additional issues of their own. The increasing size of cargo ships, known as "smart ships," poses challenges for ports and navigation systems. Designers must ensure that ships are optimized for the specific constraints of the Seaway, including not only the obvious depth, width and lock dimensions, but also taking into consideration the port and infrastructure advances that will need to be made to accommodate these advanced vessel designs.

Moreover, the emphasis on intermodal transport is growing. Ships are now designed to work seamlessly with rail and truck transport, necessitating features that facilitate quick and efficient loading and unloading. This development will require collaboration among the stakeholders involved to create integrated systems that enhance the flow of goods.

### ***Regulatory Framework***

While always an important consideration, the regulatory environment is playing an increasingly crucial role in shaping the design of future vessels. Compliance

with international standards, such as those set by the International Maritime Organization (IMO), along with local regulations, will dictate many aspects of ship design. In many cases, new regulations are being implemented before it is clear that there are viable technologies available to meet them. So, as environmental regulations become more stringent, designers will need to incorporate features that meet or exceed these requirements.

Additionally, collaboration with regu-

latory bodies during the design process can streamline approvals and ensure that new vessels are compliant from the outset. Engaging with everyone involved early in the design phase can facilitate the development of innovative solutions that address both operational and regulatory challenges.

### ***Resilience and Adaptability***

The impacts of climate change are increasingly evident in the Great Lakes

region, with rising temperatures, altered precipitation patterns and shifting ice conditions that will affect navigation. The design of future ships must account for these changes, enhancing resilience and adaptability. Traditionally, engineers are used to designing based on historical data and proven operational parameters; but now they will be expected to create vessels that can operate effectively in variable conditions that haven't been seen before. For example, they are exploring hull forms and propulsion systems that can withstand extreme weather and ice conditions. Moreover, the inclusion of modular designs may allow for easy upgrades and modifications, ensuring that vessels remain relevant and efficient as environmental conditions evolve.

### ***Collaboration and Innovation***

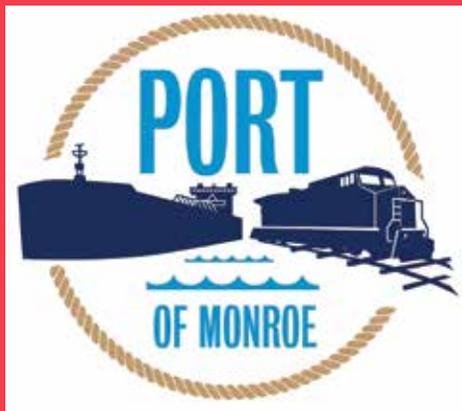
It is clear that the future of ship design will depend heavily on extensive collaboration among all of the stakeholders, including vessel designers, shipbuilders, technology providers, environmental organizations and governmental agencies. Creating a forum for dialogue and innovation that can lead to the development of holistic solutions that address the multifaceted challenges facing the maritime industry will be absolutely crucial.

Investments in research and development are essential for fostering innovation. This is important, because public-private partnerships can drive advancements in technology and sustainability, ensuring that the Great Lakes-St. Lawrence Seaway will continue to be a competitive and efficient corridor for maritime trade.

### ***Multifaceted Approach***

Envisioning the next generation of ships for the Great Lakes-St. Lawrence Seaway is an intricate process that requires a multifaceted approach. By embracing the available technological advancements, prioritizing environmental sustainability as well as considering economic factors, navigating regulatory frameworks and fostering collaboration, stakeholders can create a new generation of vessels that not only meet today's demands but also anticipate the challenges of tomorrow.

As the maritime industry evolves, the commitment to designing innovative, efficient and sustainable ships will play a critical role in ensuring the continued vitality of this essential waterway. With concerted effort and vision, the Great Lakes-St. Lawrence Seaway can remain a cornerstone of North America's economic landscape for generations to come. ■



# *Michigan's Gateway Port*

VISIT  
[PORTOFMONROE.COM](http://PORTOFMONROE.COM)