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50 GREAT LAKES SEAWAY REVIEW

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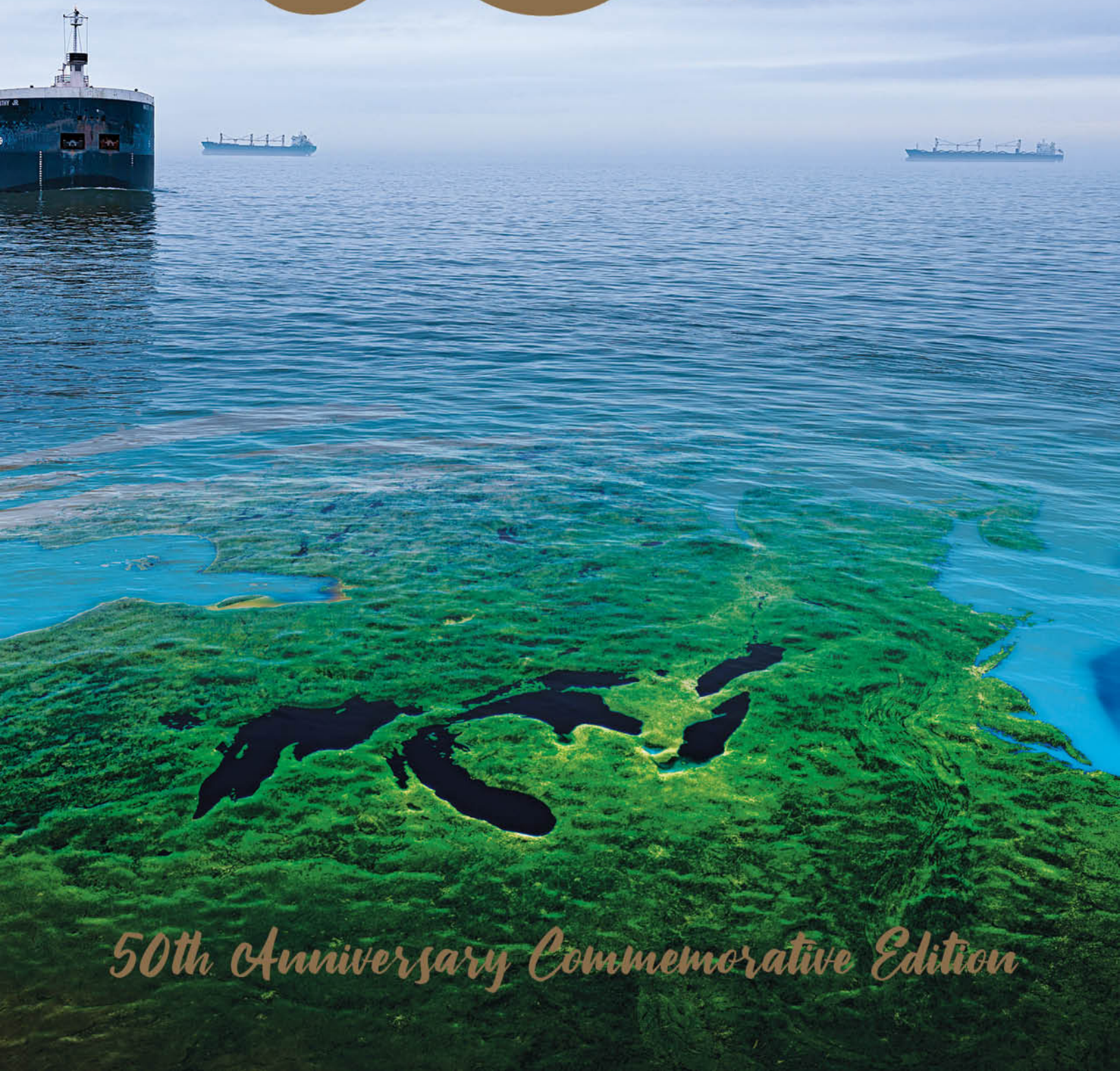

50th Anniversary Commemorative Edition

SHIPS *of the* GREAT LAKES

WHAT FUELED THEIR SUCCESS?

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The earliest record of navigation on the upper Great Lakes dates back to 1679, when shipbuilder Robert Sieur de La Salle built the 70-foot "galliot" *Griffin*, just upstream of Niagara Falls; powered by sail, fueled by wind. For almost 200 years, sail was king.

As a major trade route in an area, extremely rich with natural resources, port cities from Montreal, Quebec to Duluth, Minnesota thrived with the hustle and bustle of vessels transporting grain, lumber, iron ore, salt, coal, furs and more to markets all over the world. In terms of propulsion and fuels, a lot has changed since the earliest Great Lakes schooners, as they slowly traveled the twisted rivers and sometimes shallow harbors and rivers of the Great Lakes.

The transition from sail-powered schooners to paddlewheel steamboats was slow on the Lakes, as the amount of trade being carried at the time could not justify the high cost of the construction. After almost two centuries of sail and wind, it wasn't until a dual-purpose steamboat came onto the scene around 1825, offering both high-value cargo space and passenger rooms onboard, that shipowners were able to justify the significant investment needed to build these ships. Less valuable cargoes continued to use sailing vessels.

Encouraged by the increased speed of these steamboats, and the lure of connecting the upper four Great Lakes with Lake Ontario by finding a way around the Niagara Falls, the first Welland Canal was opened in 1829. Passengers and cargo began flowing from the head of the Lakes at Duluth all the way to the Gulf of St. Lawrence, and eventually to Europe. The Great Lakes/St. Lawrence Seaway "system" was born, and designers and shipbuilders rushed to create and construct vessels that could take advantage of this newfound opportunity.

The most common power used on these paddlewheel steamboats was the beam engine, a steam engine that used a pivoting overhead beam to apply force from a vertical steam piston to a vertical connecting rod. Firewood fueled these engines until in the mid-1800s, when plentiful (and local) coal became the primary fuel.

By 1840, there were more than 100 of these steamers in service on the Great Lakes. A large number of these steamers still had masts fitted with sails and jibs. Not recognized as such at the time, these ships were, in fact, the first true "hybrid ships," with the capability to employ either of the two power sources, depending on conditions.

Propeller steamships

With steam becoming more reliable as a power source, and coal proving its worth as a seemingly endless and economical fuel for its time, propulsion technology was adapting at a more rapid pace. By 1841, the first propeller-driven steamship for use on the Great Lakes/Seaway was built and named *Vandalia*. Fitted with an Ericsson steam-propelled screw propeller, it was found to be a less costly alternative to the paddlewheel steamer from a capital standpoint.

In addition, the machinery for the engine was easier to use, more economical to operate and much smaller, allowing for more cargo space. The ships burned less than a quarter of the fuel needed for the comparable paddlewheel steamboat. The screw-propeller steamships, fueled with coal, literally transformed trade on the Great Lakes and hundreds were built over a 10-year span between 1841 and 1851.

Lake freighters

Lake freighters, ships that were purpose built and sized for service on the Great Lakes, became even more numerous in the 1880s and 1890s. Many of the older ships built in the boom of 1841 were scrapped or converted into barges

SOURCE: ROBERT WELTON

for the lumber trade. But the primary power for these vessels until about the 1940s continued to be provided by steam, fueled by coal.

Then came World War II and, along with it, a new reason for a shipbuilding boom.

During World War II, L-Type Great Lakes dry-bulk cargo ships were built to supply iron ore to the steel mills and foundries cranking out munitions to fight the Germans on the European Front and the Japanese on the Pacific Front. There were two types of L-ships: the L6-S-B1, powered by three-cylinder triple expansion steam engines, and the L6-S-A1, which used a Lentz four-cylinder compound engine.

Both L6 ships, more commonly known as Maritime ships, started out burning coal to fuel the engines. Over the years, they were converted to burn oil.

Currently, only two Maritimers remain active on the Great Lakes: *J. Burton Ayers*, renamed *Cuyahoga*, was repowered with a 3,084 bhp diesel engine in 1999; and, the *Hill Annex* (*George A. Sloan*), renamed *Mississagi* was converted in 1984 with a 4,500 bhp 12-cylinder diesel engine running on intermediate grade 320 diesel fuel, one of the first medium-speed diesels to use this fuel.

Larger vessels on the Lakes

In the late 1970s and early 1980s, a building surge of sorts resulted in many of the current series of Great Lakes vessels, including a class of 13 lakers known colloquially as the 1,000-footers.

Lakers are typically limited in size due to the locks, shallow connecting channels and harbors. But innovative designers, including Cleveland's renowned naval architect George Plude, were instrumental in pushing the boundaries of propulsion and maneuverability in designing these behemoth vessels.

The first of these vessels, the *Stewart J. Cort*, won its designers, including Plude, the prestigious Elmer A. Sperry Award for innovation in the transportation engineering field. The largest vessels on the Great Lakes/Seaway, these 1,000-footers were constructed between 1976 and 1981. All of them remain in service today.

The last of the 1,000-footer class was built for Interlake Steamship Company. Originally named the *William J. Delancey*, and now sailing as the *MV Paul R. Tregurtha*, she holds the title of "Queen of the Lakes" as the longest vessel on the Great Lakes, at 1,013 feet, and 6 inches.

Commissioned in 1981, she was powered by two Colt-Pielstick model 16PC2-

3V-400 V-16-cylinder, four stroke, single acting diesel engines each rated at 8,560 bhp. She was equipped with five holds, capable of carrying 68,000 long tons of iron ore or a cubic capacity for 71,250 net tons of coal.

Going green

After six decades of various grades of diesel oil being the fuel of choice, its reign has a few cracks in its armor. With imminent environmental regulation deadlines approaching, regulating the discharges of SO_x, NO_x, particulates and CO_2, many shipowners operating on the Great Lakes are looking for ways to comply with the guidelines and protect the freshwaters of the Lakes.

Other sources of fuel are currently being investigated and experimented with, just as owners did when steam came along, and then diesel oil after that. Around the world, innovative approaches utilizing hybrid electric systems, LNG, methane and even hydrogen are being considered.

Of these, hybrid electric and LNG show the most promise. But neither fuel is without its problems to be overcome and, oftentimes, the technology needs to catch up with the needs of the market. While these technologies show great promise, the capital costs to implement them are far in excess of the returns that they will generate. But, just as changing from wind to wood to coal to heavy oil to marine diesel fuel had its challenges—and required significant engineering and creative thinking—the change to ultra-low sulfur diesel fuel to hybrid electric or LNG or methane or hydrogen will take place when creative, innovative minds develop the technology that today is only dream. But those great minds are out there; maybe one of our children or grandchildren will unlock the secrets, just as other great inventors have done over the centuries.

While the task ahead to develop new fuels and new propulsion systems to take shipping to the next level is a daunting one, we can and must prevail. The region, indeed, all the North American continent, relies on the economic power the Great Lakes transportation system supports.

As the owner of NETSCo, a naval architect and marine engineering firm, I often reflect on the impact our design services have had on the ships trading on the Great Lakes. I feel honored that, along with my employees, we have had even a small part to play in the rich history of the Great Lakes. I look forward to seeing what those next innovators can and will do in the future. ■