

River Quest 2018
Great Lakes Cargo Capital
Synopsis, Resource Links & Vocabulary List

MN Standard 6.1.2.1.1
Practice of Engineering

Next Gen [WI] MS-ETS1-1
Engineering Design

Synopsis

The Port of Duluth-Superior

By far the largest tonnage port on the Great Lakes – and among the top 25 ports in the nation – the Port of Duluth-Superior handles an average of 35 million tons of cargo and nearly 900 vessel visits each year. Huge lake carriers ('lakers') and smaller oceangoing ships ('salties') carry mostly bulk cargoes of iron ore, coal, limestone, grain, cement and salt, plus general cargoes like wind components and other equipment.

Located the farthest inland at 2,342 miles from the Atlantic Ocean (less than a week's sailing time), the Port of Duluth-Superior links the heartland of North America to the rest of the world via the Great Lakes St. Lawrence Seaway System (GLSLSS). The Port sits at the mouth of the St. Louis River which means we are at the headwaters of this entire inland waterway system – a *bi-national* marine highway that is bordered by eight (8) U.S. states and two (2) Canadian provinces.

To get to the Twin Ports from the ocean, 'salties' must move through 16 locks on the GLSLSS to safely navigate a nearly 602-foot elevation change in water levels from sea level to Lake Superior – including eight locks in Buffalo, NY alone (i.e. the Welland Canal, which bypasses Niagara Falls). 'Lakers' spend their entire working lives on 4 of the 5 Great Lakes, being too large to navigate any of the locks except the Soo Locks at Sault Ste. Marie, Mich.

Ballast water is used to stabilize ships—to keep them 'trimmed' when carrying no cargo or only a partial load. Ballast keeps propellers submerged and distributes stresses so the ship doesn't break in half. On a 1,000-foot laker, nearly 14 million gallons of water will be pumped out while 70,000 tons of iron ore or coal is being loaded.

The maritime industry is committed to implementing ballast water exchange/treatment methods to eventually eliminate the potential transport of aquatic invasive species. Today, moving cargo by water remains the safest, most fuel efficient, cost effective and environmentally-friendly mode of transportation.

Did you know?

- It takes nearly 700 railcars of iron ore pellets to fully load just ONE 1,000-foot laker.
- At normal water levels, that Laker can carry nearly 70,000 tons of pellets – enough to make 45,000 tons of steel.
- Steel made from that single boatload of pellets can be used to manufacture 55,000 compact cars.
- It would take seven, 100-car trains or 3,000 huge tractor-trailers to haul that same amount of pellets.

Reference links:

Boatnerd	www.boatnerd.com
Duluth Seaway Port Authority	www.duluthport.com
Duluth Shipping News/Duluth Boats	www.duluthboats.com
Marine Traffic	www.marinetraffic.com
The Great Lakes Seaway Partnership	www.greatlakesseaway.org
Great Lakes St. Lawrence Seaway	www.greatlakes-seaway.com

Mobile Apps to track ship traffic:

Ship Finder or Marine Traffic



Vocabulary List:

Ballast water
Bi-national
Great Lakes St. Lawrence Seaway
Headwaters
Lakers
Locks
Maritime
Salties



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See page 2 for a full description of the Great lakes St. Lawrence Seaway and how locks operate →

The Great Lakes St. Lawrence Seaway System

The five Great Lakes, their connecting channels, and the St. Lawrence River form one of the longest deep draft navigation systems in the world – 2300 miles (3,700km) from the Atlantic Ocean to the Port of Duluth-Superior.

This bi-national waterway is a critical foundation of the region's economy for more than 200 years. In a time before railroads and highways, the Great Lakes and St. Lawrence River served as the primary transportation system. Many of North America's largest cities were established along the waterway as commerce flourished between their ports. Today, Great Lakes-Seaway shipping is equally important. Each year more than 160 million tons of waterborne cargo is transported within the region or to overseas destinations.

Superior, Huron, Michigan, Erie and Ontario

The five (5) Great Lakes form the heart of the waterway. These massive inland seas contain one-fifth of all surface freshwater on planet Earth. Situated between Canada and the United States, four of the five lakes are shared by the two nations. The fifth, Lake Michigan, is entirely within the U.S.

Connecting Rivers

The waterway flows from west to east. Lake Superior drains into Lake Huron via the St. Mary's River. Lake Huron drains into Lake Erie via the St. Clair and Detroit Rivers. Lake Erie drains into Lake Ontario via the Niagara River. The entire system flows to the Atlantic Ocean via the St. Lawrence River. As it flows from its westernmost point in Duluth, Minnesota to the Atlantic Ocean, the waterway drops in elevation approximately 600 feet (182 m).

Locks and Channels

While most of the waterway is naturally navigable, the St. Marys, the Niagara and the St. Lawrence rivers were not. Natural obstructions such as rocks, shallow water, dangerous rapids, and waterfalls all had to be tamed, controlled and/or bypassed to enable safe navigation. Massive public works projects have been carried out by both the United States and Canada to construct channels and locks.

A **navigation lock** is effectively a 'water staircase.' The lock chamber is gated on either end. After a ship enters a lock, water is pumped into or out of the chamber, causing the vessel to rise or fall. Once the correct elevation is achieved, the opposite gate opens and the ship exits the chamber. Utilizing lock infrastructure, vessels are able to overcome changes in waterway elevation.

- **The Soo Locks**

The St. Marys Falls Canal and Soo Locks are located at Sault Ste Marie, Michigan, and were constructed by the U.S. Army Corps of Engineers. The canal and locks enable ships to bypass rapids on the St. Marys River and safely pass between Lake Superior and Lake Huron, a 21 foot (7 m) elevation change. There are two parallel locks operating at the Soo. The MacArthur Lock is 800 feet (244 m) long, 80 feet (24 m) wide, and 29.5 feet (9 m) deep. The Poe Lock is 1200 feet (366 m) long, 110 feet (34 m) wide, and 32 feet (10 m) deep.

- **St. Lawrence Seaway – Welland Canal Section**

The Welland Canal was constructed by the Government of Canada and cuts across the Niagara Peninsula between Port Weller and Port Colborne, Ontario, a distance of 27 miles (43.4 km). The canal includes eight successive navigation locks which lift or lower ships 326.5 feet (99.5 m) from Lake Ontario to Lake Erie, bypassing Niagara Falls. Each Lock chamber is 766 feet (233.5 m) long, 80 feet (24.4 m) wide, and 30 feet (9.14 m) deep.

- **St. Lawrence Seaway – Montreal/Lake Ontario Section**

Completed in 1959 by the U.S. and Canadian governments, the canals and locks of the Montreal-Lake Ontario section of the St. Lawrence Seaway enable deep-draft navigation between Montreal and Lake Ontario. This section of the waterway features seven navigation locks – five in Canada and two in the United States. Combined, these locks lift or lower ships 243 feet (74 m). Each lock chamber measures 766 feet (233.5 m) long, 80 feet (24 m) wide, and 30 feet (9.14 m) wide.