Making a Great Lake Superior

Great Lakes Maritime Commerce and Global Warming: Dredging Impacts

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Superior
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Great Lakes Maritime Research Institute

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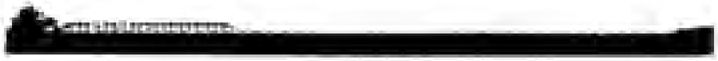
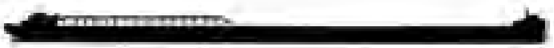
Areas of Operation: The Current Eight Great Lakes Shipping Patterns With Examples

- **Seaway traffic – Foreign**
  - Antwerp to Hamilton, Cleveland, Windsor and Burns Harbor
- **Seaway traffic – US/Canada to US/Canada**
  - Sept Isles to Hamilton
  - Portland, Maine to Buffalo, NY
- **Connecting inland waterway routes:**
  - Milwaukee to Dubuque, IA via the Illinois waterway
- **Interlake – US / Canada**
  - Superior, WI to Nanticoke
- **Interlake – US / US**
  - Superior, WI to Detroit
- **Interlake – Canada / Canada**
  - Thunder Bay to Hamilton
- **Intralake – Canada / Canada**
  - Sarnia, Ontario to Sault St. Marie, Ontario
- **Intralake – US / US**
  - Muskegon to Milwaukee

Global Warming Predictions for Great Lakes: Impacting Shipping

- **Predicted drop in lake levels** (Millard, F 2005) (Lindberg, J.D. and G.M. Albercook, 2000)
  - **Reduced draft in navigation channels = reduced vessel carrying capacity**
  - **Reduced draft in navigation channels = reduced access to docks**
  - **Reduced draft will impact not only large 1000 foot vessels but small 40 foot vessels.**

Vessel Carrying Capacity Per Trip

Great Lakes Bulk Carriers	Vessel Length (feet)	Per-Trip Carrying Capacity	Capacity Per Inch Of Draft*
	1,000	69,664	267
	806	34,720	146
	767	28,336	127
	635	22,064	107
	501	13,776	71

*Capacity per inch of draft reflects the incremental tonnage carried at normal loaded draft.

Major Great lakes U.S. flag vessel classes

Great Lakes Maritime Task Force

Lost Inches, Lost Efficiencies

Commercial vessels working the Great Lakes are leaving behind cargo virtually every time they load because of inadequate dredging of deep-draft ports and waterways. The map above uses select Great Lakes ports to illustrate how many inches of loaded draft the dredging crisis is costing the industry.

Graphic courtesy U.S. Maritime Administration

One Maritime Plaza-3rd Floor • Toledo, Ohio 43604 • Phone (419) 255-3940 • Fax (419) 255-2350

Options to Address Channel Depth Issues

1) Increased Dredging
2) Move Cargoes to other Modes
3) Change Vessel Designs and build new vessels

1. Issues in Increased Dredging

- **Physical limits** –
  - Rock Cut in St. Marys' River and other rock bottoms
- **Increased Costs** –
  - Adverse sedimentation occurs faster with shallow water calling for increased dredging frequency
- **Disposal limits** –
  - May lack adequate disposal sites for dredge especially if material has contaminants
- **Public Navigation Channels and Private Docks** –
  - Great Lakes' Ports are composed mostly private docks.
- **Undermining Dock Pilings** –
  - Older docks may not have pilings driven deep enough to support dredging deeper

Options for increased Great Lakes dredging are limited.

Lake Vessels will carry less cargo per trip.

2. Move Cargoes to other Modes

- Trade will double in next 10 years
- Truck and Rail will lack adequate capacity
- Energy costs will continue to rise impacting other modes first
- Highway congestion will continue to grow
- Environmental concerns will increasingly shape transportation decisions

Vessel Draft / Capacity

Vessel Length	Capacity Per Inch of Draft	Tonnage loss w/ 6" decrease	Tonnage loss w/ 12" decrease	Tonnage loss w/ 18" decrease	18" = Trucks @ 35 tons cargo
1,000	267	1602	3204	4806	137
806	146	876	1752	2628	76
767	127	762	1524	2286	65
635	107	642	1284	1926	55
501	71	426	852	1278	37

Capacity in Modal Shifts

- **It would take 2,800 25-ton trucks to carry as much cargo as one loading of a a1,000-foot-long US-flag Laker**
- **It would take seven 100 car unit trains to carry the cargo of one voyage of a 1000 foot Laker**

Infrastructure Changes

RAIL MILES

- 1960 – 207.334
- 1980 – 164,822
- 1990 - 119,758
- 2000 – 99,250

Net loss 108,084 miles

51%

HIGHWAY MILES

- 1960 – 3,545,693
- 1980 – 3,859,837
- 1990 - 3,866, 926
- 2000 – 3,936,229

Net Gain 390,536 miles

11%

Bureau of Transportation Statistics -2004

2020 Highway Congestion

Increased cost due to Congestion Costs and accident costs

Truck-Rail-Ship Emissions Reduction Model

Scenario: Move 15,000 tons of salt cargo from Detroit to Duluth, a distance of approximately 755 miles.

Mode	Commodity	Origin	Destination	No. of Loads	Loaded Weight (tons)*	Total Estimated Miles**	Gross Tons	Gross Ton-Miles	Estimated Gallons of Fuel***	Est. Tons HC Emissions	Est. Tons CO Emissions	Est. Tons NOx Emissions	Est. Tons PM Emissions	Est. Tons CO_2 Emissions
TRUCK	Salt	Detroit, MI	Duluth, MN	429	35	755	15,000	11,325,000	43,488	0.39	1.56	5.32	0.26	482.74
RAIL	Salt	Detroit, MI	Duluth, MN	150	100	755	15,000	11,325,000	14,496	0.16	0.44	2.96	0.10	160.91
SHIP	Salt	Detroit, MI	Duluth, MN	1	15,975	755	15,000	11,325,000	7,928	0.12	0.25	3.25	0.25	88.00

	Less Gallons of Fuel Used	Less Tons of HC Emissions	Less Tons of CO Emissions	Less Tons of NOx Emissions	Less Tons of PM Emissions	Less Tons of CO_2 Emissions
Reduction of emissions by switching from truck to rail	28,992	0.23	1.12	2.35	0.15	321.84
	Estimated overall emissions reduction =				326	tons
...by switching from rail to ship:	6,569	0.04	0.19	-0.28	-0.15	72.91
	Estimated overall emissions reduction =				73	tons
...from truck to ship:	35,561	0.27	1.31	2.07	0.01	394.75
	Estimated overall emissions reduction =				398	tons

Assumptions:

* *Estimated total weight of loaded rail car, loaded semi-truck, or loaded vessel.*

** *Estimated mileage; highway mileage used for comparative purposes*

*** *Rail fuel consumption estimated at 1.28 gallons consumed per 1000 Gross Ton-Miles.*

Truck fuel consumption estimated as three times less efficient than rail on a ton-mile basis.

Ship fuel consumption estimated at 0.70 gallons consumed per 1000 Gross Ton-Miles.

Vessel data is representative of the Canadian self-unloading bulk vessel Cuyahoga, which employs a 3,084 HP Caterpillar 3608 engine (EPA Category 2).

Excerpt from paper for SNAME 2007 additional study done by Great Lakes Commission Study – October Seaway Review

2. Change Vessel Designs

- Requires new building in US shipyards due to Jones Act
- Canada has similar law – Coastal Trading Act.
- New vessels with wider beams could carry more cargo at shallower drafts
- New vessels could be more cost effective
- New vessels could have even lower environmental footprint.

Great Lakes/River Vessels

- Bridge Forward design
- Z Drive for Maneuverability
- Removable Gen-Sets
- Modular design – bulk - RO/RO- passenger - container
- Bulk, Break bulk or Container designs
- Low air draft

SECU Vessels. Terminals, Rail

Tailor made SECU-Carrier STORAENSO

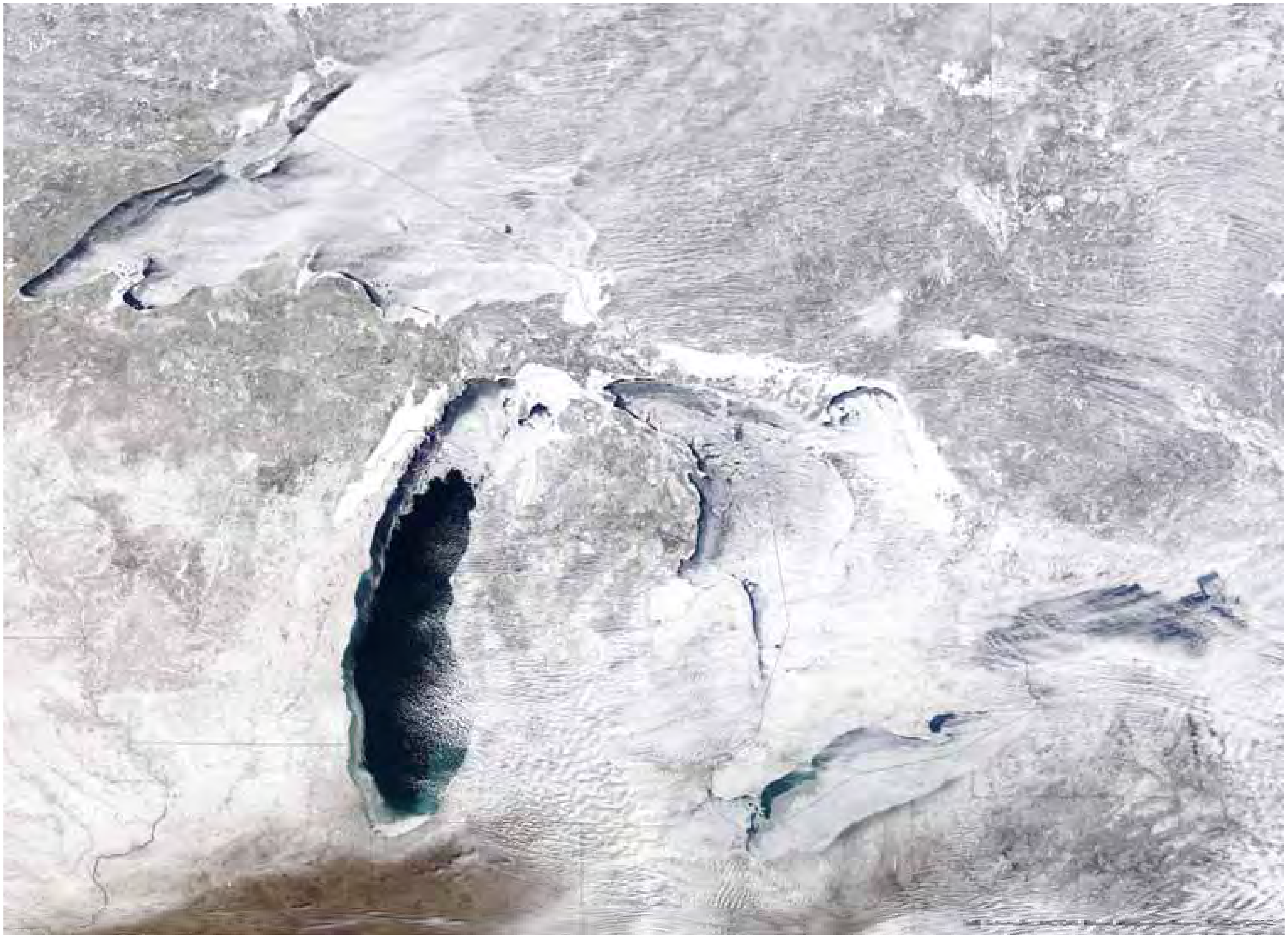
Swedish cargo ship, *Tor Selandia*, made her maiden call into the new paper handling facility

The hub in Gothenburg STORAENSO

The Future (10-30 years) Great Lakes Fleet

- Maximize cargo capacity in shallow channels
  - Length/beam/draft
- Reduced crew size
  - Multi-skilled crew and shoreside repair of units
- Efficient cargo systems
  - Reduce port time for all cargoes
- Reduced environmental footprint – Green Ships
  - Low emission engines
  - Bio-diesel capable engines
  - Ballast treatment systems
  - Highly accurate navigation systems
  - Zero Discharges to water:
  - Cargo hold cleaning, spills, sewage

Questions?



Thank you!