PIANC Workshop
13-14th September 2011

Part 4: Innovation

By Stephen Kwok
SLSMC, Canada

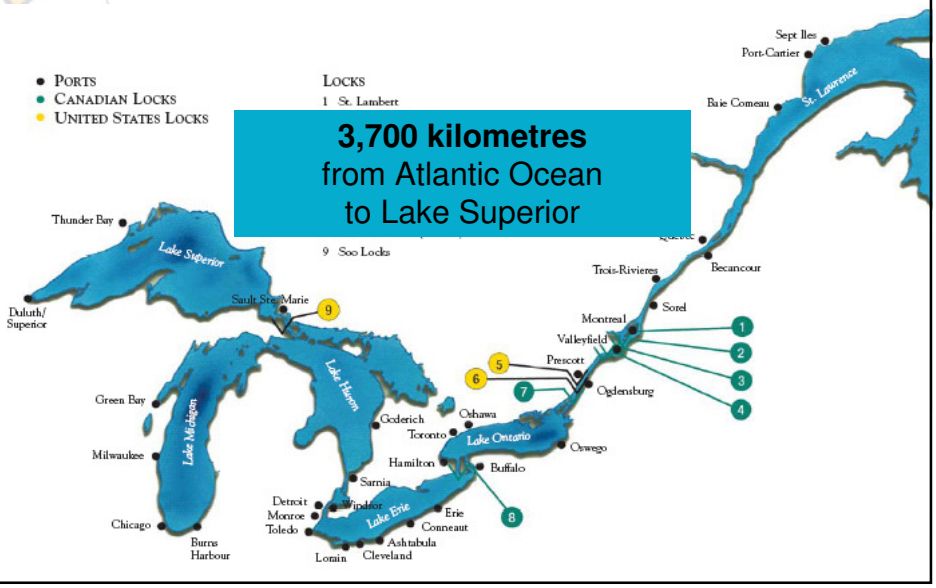
PIANC
Setting the course

Presentation Outline

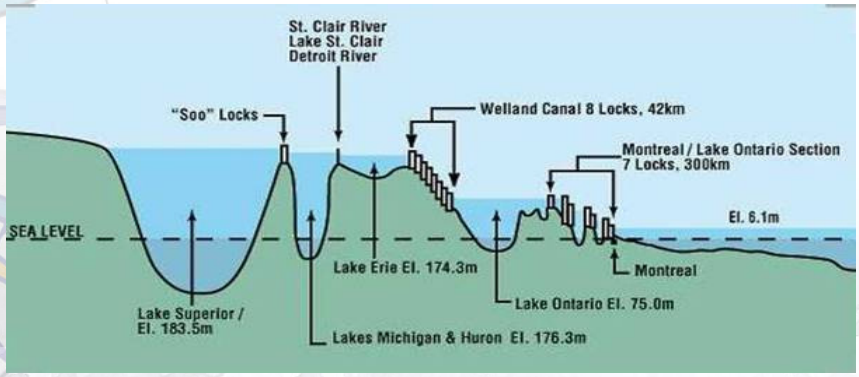
The St. Lawrence Seaway
- Overview

Innovations
- Vessel self spotting
- Hands free mooring

Great Lakes St Lawrence Seaway



The St. Lawrence Seaway includes 13 Canadian and 2 U.S. locks



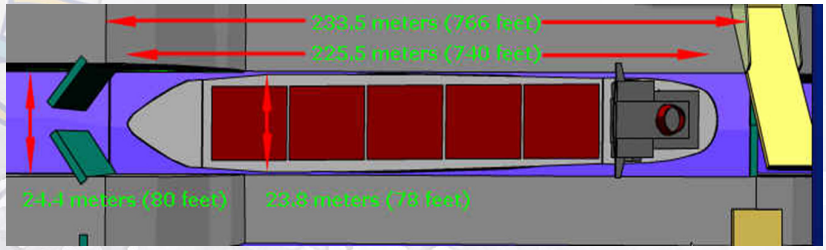
The Seaway accepts vessels up to 30,000 tonnes

Lock Dimensions

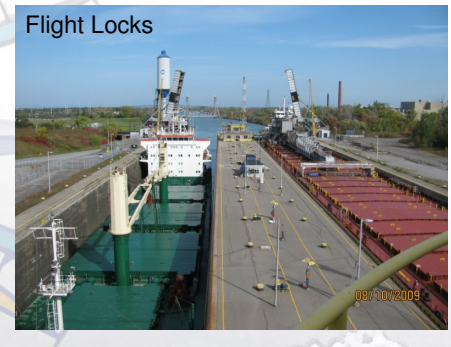
- Length = 233.5m
- Width = 24.4m
- Depth = 9.1m

Max Vessel Size

- Length = 225.5 m
- Beam = 23.7 m
- Draft = 8.08 m



Locks in Niagara & Montreal



VESSEL SELF SPOTTING

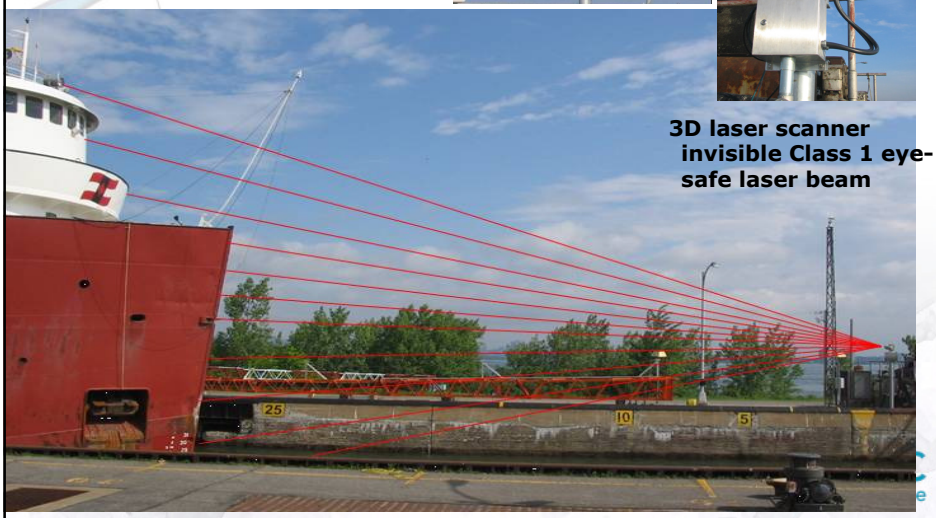
Objectives of Vessel Self Spotting

- Optimize lock cycle time by having all lock personnel available for mooring operations sooner in the process.
- Set the stage for potential automation of the lockage process.

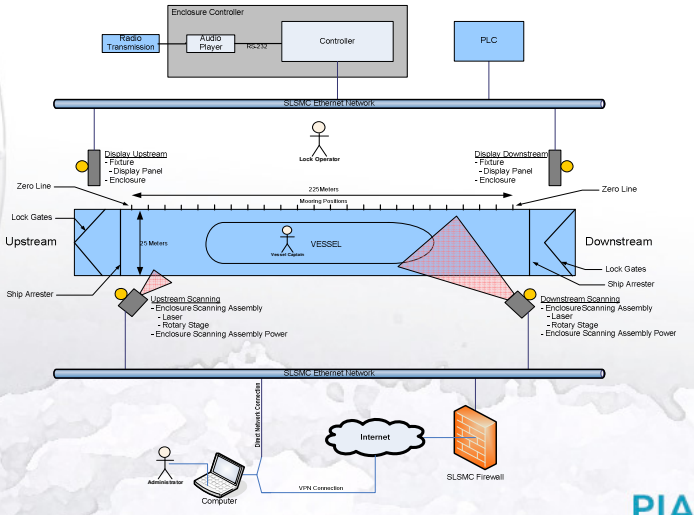
System Description

- Measures the distance from the vessel entering the lock chamber to its final mooring position
- This distance is available to the ship master via two display panels and through an automated marine radio transmission
- The system is composed of two scanner assembly (one per direction) and two display panels

VSSS



Schematic Layout



MOVIE 1 -

HANDS FREE MOORING

Objectives of Hands-Free Mooring

- Enhance operations efficiencies and reduce costs
- Remove the need to have non-standard equipment to transit the Seaway
- Enhance safety and eliminate possible mooring related injuries
- Provide customers with faster and more efficient service

Technologies Considered

- Mechanical
  - Robotic arm with mooring wires
- Electro-magnetic
  - Experimented by Delft University
- Vacuum Pads
  - Developed in New Zealand by MSL
    - Successful installations for ferries
    - Pilot installation in Dover, England for 7m tide

Why did we select vacuum mooring?

- Vacuum mooring is a proven technology
- Floating bollards are widely used in many locks around the world
- Least complicated system among the options

Timeline

2007	Prototype #1 – Proof of Concept
	One floatation unit installed at a “Low Head” Lock
2008	Prototype #2 – Pilot Test
	Two floatation units installed at a deep lock with 12m lift
2009	Prototype #3
	Two additional “winched” units installed at the deep lock
2012	Prototype #4

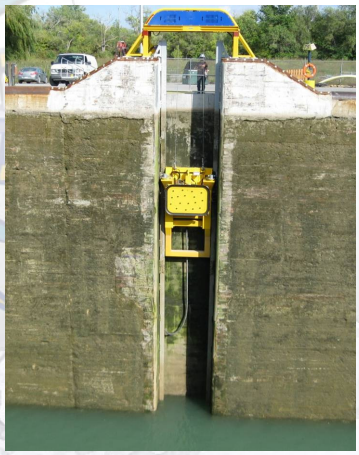
Prototype #1 confirmed that the concept is feasible

- Vacuum pad can hold 20 kN perpendicular force and 16 kN sliding force
- Rubbing bar & other obtrusions on hull can be an issue with seal
- Needs redesign of vertical travel mechanism

Prototype #2 showed that floatation units have limitations

- Generally work as per design
- Two units inadequate for large vessels
- Rubbing bar and obstructions continue to be an issue
- Ice build-up on floatation tank and track

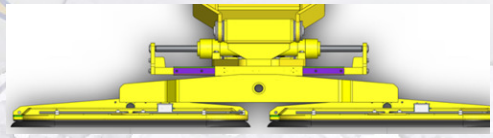
Prototype #3 exhibited major improvement in performance

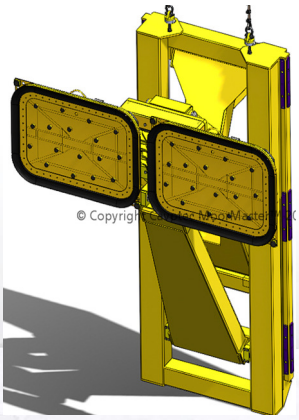


- Ability to be positioned vertically to avoid obstacles
- Can be parked at top when not in use
- More complicated operation & control system
- 4 units still inadequate for vessel induced surge forces

MOVIE 2 -

Prototype #4 will boost energy absorption capabilities





Challenges of technology innovations

- Lack of means to simulate real conditions
- Initial reliability not optimal
- Adaptation by vessel masters
- Impact on lock crews