



Embracing AI-Powered Collaborative Intelligence

IAPH Sustainability Award Submission 2024

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May 2024



Port of Montréal and GSTS Collaboration

4+ years of successful collaboration and partnership

Multiple industry initiatives resulting in several capabilities

Results from Digitization Projects

- **ETA Prediction** – accurately predict ETA of all vessels arriving at port up to 28 days in advance
- **Intelligent Geofences** – automatically receive alerts and updated ETA predictions when ships cross pre-defined checkpoints
- **Ice Management** – predict harsh ice conditions up to 7 days in advance
- **GHG Emissions Calculator** – calculate carbon footprint within port boundaries
- **Digitized Trade Routes** – tabulate emissions for all vessels globally; report on vessel voyages between two or more ports where Green Shipping Corridors are established
- **PMIS System Integration** – integrate ETA Predictions

Current Digitization Initiatives and Innovation Opportunities

- **World's First AI-Powered Predictive Collaborative Berth Scheduler**
 - **Supporting Port Operations**
 - Daily operations
 - Monthly planning
 - Long term planning
 - **Supporting collaboration with stakeholders**
 - Pilotage
 - Tug Companies
 - Terminal Operators
 - Shipping Lines
 - Government Agencies



OCIANA Platform

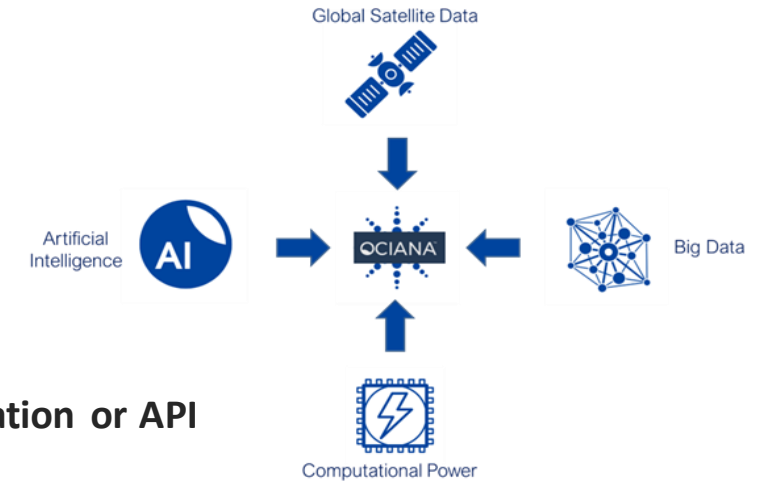
OCIANA™ incorporates the latest developments in **Artificial Intelligence** and **Big Data Analytics** to improve maritime situational awareness and provide real-time decision-making intelligence.

Multi-Source Data Analytics

- Designed to ingest a **wide range of data sources** including global AIS data, an array of satellite data, and weather data; OCIANA also ingests IoT data
- OCIANA spatially and temporally correlates the data and employs **AI algorithms**
- Output from the AI/ML trained models can be accessed through the **web-based application or API**
-- Integration with existing systems (e.g., PMIS, shore-based coordination platforms)

Partner Communication

- An embedded communications channel enables **multiple users to share information** in real time
- Advanced **chat and collaboration tools** to facilitate coordinated response -- adherence to digitization standards



OCIANA Collaborative Berth Scheduler

Enabling Digital Planning and Operational Optimization

To allow ports, pilotage, and shipping lines **real-time data exchange**

Facilitating JIT Arrivals aimed at:

- minimizing time at anchorage and therefore **reducing congestion** in the port area
- enabling ships to **optimise steaming speed**, thereby lowering fuel consumption, and reducing emissions



Key Development Objectives

Connect all stakeholder involved in the port call process via a common platform, OCIANA to:

- receive more accurate information **in real-time** on vessel movements and vessel berthing delays
- enhance planning and coordination as it pertains to the **maritime supply chain**
- provide **decision-making intelligence** for dynamic environments
- support **route optimization** for shipping lines





Incoming Vessels Screen

Leveraging OCIANA's ETA Prediction and Intelligent Geofences

OCIANA™ v0.25.0.0 INCOMING VESSELS MAP BERTH SCHEDULE DASHBOARDS REPORTS KRISTA.FOSTER@GSTS.CA

TODAY Month

◀ ▶ MAY 01 - MAY 29, 2024

Apply Date Filter To:

Checkpoint 1

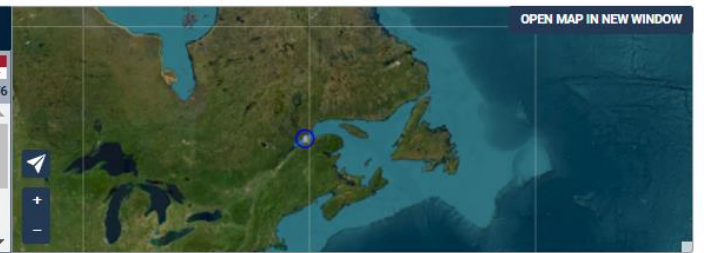
ADVANCED FILTER

REFRESH AIS/IHS

AIS/IHS Last Updated 14:23 2024-04

22 General Cargo		0 Bulk Cargo		0 Passenger	
22 Container	0 Break Bulk	0 Liquid Bulk	0 Solid Bulk	0 Cruise	0 Ferry

Vessel Information	Port History	ETA
MSC DON GIOVANNI		
IMO: 9102746	MMSI: 356579000	Call sign: 3FIV6
Ship type: Cargo ships		
Ship subtype: Container Ship (Fully Cellular)		
Country of Registry: Panama(PAN)		
Port of Registry: Panama(1010)		
Gross tonnage: 29181		
Draught: 9.0		



COLUMN SETTINGS				CHECK POINT 1				CHECK POINT 2				CHECK POINT 3			
Vessel	Terminal	Berth	Vessel Type	Name	ETA/ATA	Distance to Destination	Time to Arrival	Name	ETA/ATA	Distance to Destination	Time to Arrival	Name	ETA/ATA	Distance to Destination	Time to Arrival
MSC HANNAH	Maisonneuve	66 - Berth 1	Container Ship (Fully Cellular)	Beau-harnois Lock	2024-05-16 22:14		17d:04h:44m	Ste. Catherine Lock	2024-05-16 23:54		17d:06h:23m	St Lambert Lock	2024-05-16 23:54		17d:06h:24m
MSC ALYSSA	Maisonneuve	67 - Berth 3	Container Ship (Fully Cellular)	Beau-harnois Lock	2024-05-11 07:58		11d:14h:28m	Ste. Catherine Lock	2024-05-11 07:59		11d:14h:28m	St Lambert Lock	2024-05-11 07:59		11d:14h:29m
MSC DON GIOVANNI	Maisonneuve	66 - Berth 1	Container Ship (Fully Cellular)	Cape Ray	2024-04-28 14:51	✓		66W	2024-04-29 12:02	✓		Les Escoumins	2024-04-30 07:16		0d:13h:46m
MSC MEDITERRANEAN	Maisonneuve	67 - Berth 3	Container Ship (Fully Cellular)	Beau-harnois Lock	2024-05-17 06:55		17d:13h:24m	Ste. Catherine Lock	2024-05-17 06:55		17d:13h:25m	St Lambert Lock	2024-05-17 06:56		17d:13h:25m
MSC CANBERRA	Maisonneuve	67 - Berth 3	Container Ship (Fully Cellular)	Cape Ray	2024-05-23 01:17		23d:07h:46m	66W	2024-05-23 08:59		23d:15h:29m	Les Escoumins	2024-05-23 14:02		23d:20h:31m
MSC CELINE	Maisonneuve	66 - Berth 1	Container Ship (Fully Cellular)	Cape Ray	2024-05-07 08:17		7d:14h:47m	66W	2024-05-08 08:32		8d:15h:01m	Les Escoumins	2024-05-08 11:47		8d:18h:16m
MSC PORTO III	Maisonneuve	66 - Berth 1	Container Ship (Fully Cellular)	Cape Ray	2024-05-13 00:07		13d:06h:37m	66W	2024-05-14 06:56		14d:13h:26m	Les Escoumins	2024-05-15 02:43		15d:09h:12m
MSC MALENA	Maisonneuve	67 - Berth 3	Container Ship (Fully Cellular)	Cape Ray	2024-05-09 19:25		10d:01h:54m	66W	2024-05-11 02:03		11d:08h:33m	Les Escoumins	2024-05-11 06:43		11d:13h:12m
MSC NISHA V	Maisonneuve	66 - Berth 1	Container Ship (Fully Cellular)	Beau-harnois Lock	2024-05-18 20:34		19d:03h:04m	Ste. Catherine Lock	2024-05-18 20:35		19d:03h:04m	St Lambert Lock	2024-05-18 20:35		19d:03h:05m
VOLGA MAERSK	Racine	58-59 - Berth 1	Container Ship (Fully Cellular)	Cape Ray	2024-05-12 14:42		12d:21h:12m	66W	2024-05-13 04:09		13d:10h:39m	Les Escoumins	2024-05-13 12:04		13d:18h:33m
CMA CGM PARANAGUA	Racine	58-59 - Berth 1	Container Ship (Fully Cellular)	Cape Ray	2024-05-05 21:15		6d:03h:44m	66W	2024-05-06 11:55		6d:18h:25m	Les Escoumins	2024-05-07 08:56		7d:15h:25m
EM KEA	Racine	58-59 - Berth 1	Container Ship (Fully Cellular)	Cape Ray	2024-05-02 06:29		2d:12h:58m	66W	2024-05-02 21:54		3d:04h:23m	Les Escoumins	2024-04-25 06:20	✓	
MSC LEANDRA V	Viau	50 - Berth 2	Container Ship (Fully Cellular)	Cape Ray	2024-05-15 18:13		16d:00h:43m	66W	2024-05-16 06:52		16d:13h:22m	Les Escoumins	2024-05-17 04:16		17d:10h:46m



In the Harbour Screen

Leveraging OCIANA's Port Analytics

OCIANA™ v0.26.0.0 IN THE HARBOUR

 MAP BERTH SCHEDULE ▾ DASHBOARDS ▾ REPORTS ▾ KRISTA.FOSTER@GSTS.CA ▾

TODAY Month ▾

◀ ▶ APR 01 - APR 29, 2024

Apply Date Filter To:

Actual Arrival Time ▾

ADVANCED FILTER

REFRESH AIS/IHS

AIS/IHS Last Updated 14:50 2024-04

2 General Cargo	0 Bulk Cargo	0 Passenger
2 Container	0 Break Bulk	0 Liquid Bulk
0 Solid Bulk	0 Cruise	0 Ferry

Vessel Information	Port History	ETA
VISTULA MAERSK		
IMO: 9775737	MMSI: 219678000	Call sign: OWYC2
Ship type	Cargo ships	
Ship subtype	Container Ship (Fully Cellular)	
Country of Registry	Denmark (Dis)(DNK)	
Port of Registry	Copenhagen(276)	
Gross tonnage	34882	
Draught	11.3	

OPEN MAP IN NEW WINDOW

COLUMN SETTINGS ▲

SERVICE	TERMINAL	BERTH	VESSEL	TEU	AUDITS	COMMENTS
Service Name	Racine	58-59 - Berth 1	EM Kea	35824		
Service Name	Racine	60-61 - Berth 2	Vistula Maersk	34882		

ACTUAL	CONFIRMED	NOTE	ACTIONS
Time of Arrival ▾	Time of Departure ▾		
2024-04-23 9:26:00 AM	2024-05-23 7:00:00 AM	Note for EM Kea April Schedule	
2024-04-29 10:40:00 AM	2024-06-05 1:00:00 PM	Notes for Vistula Maersk May Schedule	

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Schedule Entries Screen

Leveraging OCIANA's Liner Service Automation

OCIANA 03.03.00 SCHEDULE ENTRIES MAP BERTH SCHEDULE DASHBOARDS REPORTS KIRSTA.FOSTER@GSTS.CA

PUBLISHED **DRAFT**

TODAY Month

MAY 01 - MAY 29, 2024

Apply Date Filter To:
Proforma Arrival

ADVANCED FILTER

REFRESH AIS/HS

AIS/HS Last Updated 10:34 2024-04

SPAN: -----

IMO: 9234351 MMSI: 636015646 Call sign: -----

Commodities: -- none selected --

Master name: -----

Country of Registry: -- none selected --

Port of Registry: -----

Length: -----

Beam: -----

Moulded breadth: -----

Maximum summer draught (salt water): -----

Vessel information

IMO: 9234351 MMSI: 636015646 Call sign: -----

Ship type: Cargo ship

Ship subtype: Container Ship (Fully Cellular)

Country of Registry: Liberia (LR)

Port of Registry: Monrovia(4028)

Gross tonnage: 33620

Draught: 10.2

ETA

OPEN MAP IN NEW WINDOW

Service	Berth	Vessel	TEU	Aids	PROFORMA SCHEDULE			INITIAL REQUEST			CHANGE REQUESTED			CONFIRMED			ACTUAL			ACTIONS
					Arrival	Departure	Source	Arrival	Departure	Source	Arrival	Departure	Source	Arrival	Departure	Source	Arrival	Departure	Source	
MED-CANADA (ST LAWRENCE) SERVICE (CANADA 66 - Berth 1		MSC Porto II	3018		2024-05-03 8:00:00 AM	2024-05-04 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MED-CANADA (ST LAWRENCE) SERVICE (CANADA 66 - Berth 1		MSC Naha V	4296		2024-05-10 8:00:00 AM	2024-05-11 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MED-CANADA (ST LAWRENCE) SERVICE (CANADA 66 - Berth 1		MSC Haman	2732		2024-05-17 8:00:00 AM	2024-05-28 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MED-CANADA (ST LAWRENCE) SERVICE (CANADA 66 - Berth 1		MSC Nuria	5016		2024-05-24 8:00:00 AM	2024-05-25 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - CANADA GULF BRIDGE SERVICE	67 - Berth 3	MSC Mediteranwan	2604		2024-05-07 8:00:00 AM	2024-05-08 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - CANADA GULF BRIDGE SERVICE	67 - Berth 3	MSC Malena	2200		2024-05-14 8:00:00 AM	2024-05-15 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - CANADA GULF BRIDGE SERVICE	67 - Berth 3	MSC Corbeno	2604		2024-05-21 8:00:00 AM	2024-05-22 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - CANADA GULF BRIDGE SERVICE	66 - Berth 1	MSC Ouliva	2732		2024-05-28 8:00:00 AM	2024-05-29 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - ADDITIONAL SERVICE	50 - Berth 2	MSC Sao Paulo	3832		2024-05-02 8:00:00 AM	2024-05-04 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - ADDITIONAL SERVICE	48 - Berth 1	MSC Roberto	2732		2024-05-09 8:00:00 AM	2024-05-10 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - ADDITIONAL SERVICE	48 - Berth 1	MSC Tamara	2604		2024-05-16 8:00:00 AM	2024-05-17 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
MSC - ADDITIONAL SERVICE	50 - Berth 2	MSC Leandra V	3836		2024-05-23 8:00:00 AM	2024-05-24 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
ST LAWRENCE SERVICE	60-61 - Berth 2	Virtus Meerak	3091		2024-05-06 8:00:00 AM	2024-05-08 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
ST LAWRENCE SERVICE	58-59 - Berth 1	EM Kea	3600		2024-05-13 8:00:00 AM	2024-05-15 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
ST LAWRENCE SERVICE	58-59 - Berth 1	CMA CGM Paranaqua	3091		2024-05-20 8:00:00 AM	2024-05-22 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
ST LAWRENCE SERVICE	58-59 - Berth 1	Volga Merak	3600		2024-05-27 8:00:00 AM	2024-05-28 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
HAPAG-LLOYD - MED-CANADA SERVICE	60-61 - Berth 2	Genoa Express	3832		2024-05-07 8:00:00 AM	2024-05-09 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
HAPAG-LLOYD - MED-CANADA SERVICE	58-59 - Berth 1	Barcelona Express	3826		2024-05-14 8:00:00 AM	2024-05-16 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
HAPAG-LLOYD - MED-CANADA SERVICE	60-61 - Berth 2	Livorno Express	3836		2024-05-21 8:00:00 AM	2024-05-24 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>
HAPAG-LLOYD - MED-CANADA SERVICE	60-61 - Berth 2	Glasgow Express	4115		2024-05-28 8:00:00 AM	2024-06-01 8:00:00 AM	Port Arrival Proforma Schedule	-----	-----	-----	-----	-----	-----	-----	-----	Port of MONTREAL	-----	-----	Port of MONTREAL	<input checked="" type="checkbox"/>

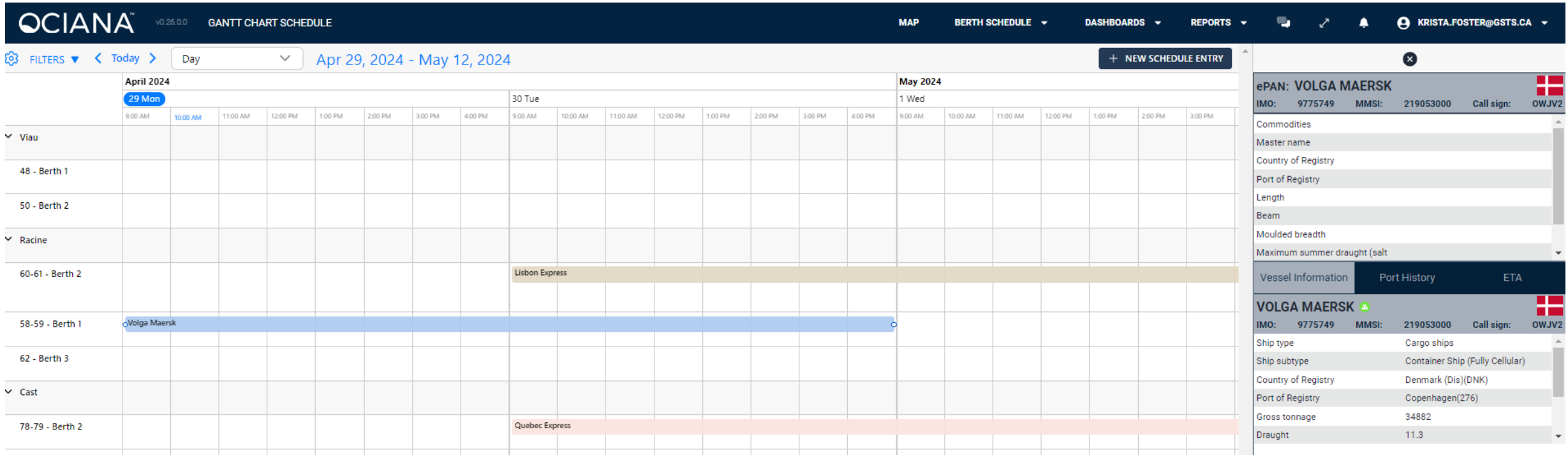
+ NEW SCHEDULE ENTRY + NEW VESSEL ⚙️ SETTINGS ⚙️ MANAGE LISTS



Gantt Chart View of the Collaborative Berth Schedule

Leveraging OCIANA's Predictive Analytics

- Display Pre-Arrival Notification (ePAN) and ship ETA
- Allow shipping lines to submit initial requests and port to confirm berth availability
- Enable collaboration with terminal operators, pilotages and tug operators
- Streamline communications for change requests and confirmation for revised BTW – eliminate calls and emails





OCIANA: Select Use Case Analysis



Lock Scheduling First In First Out

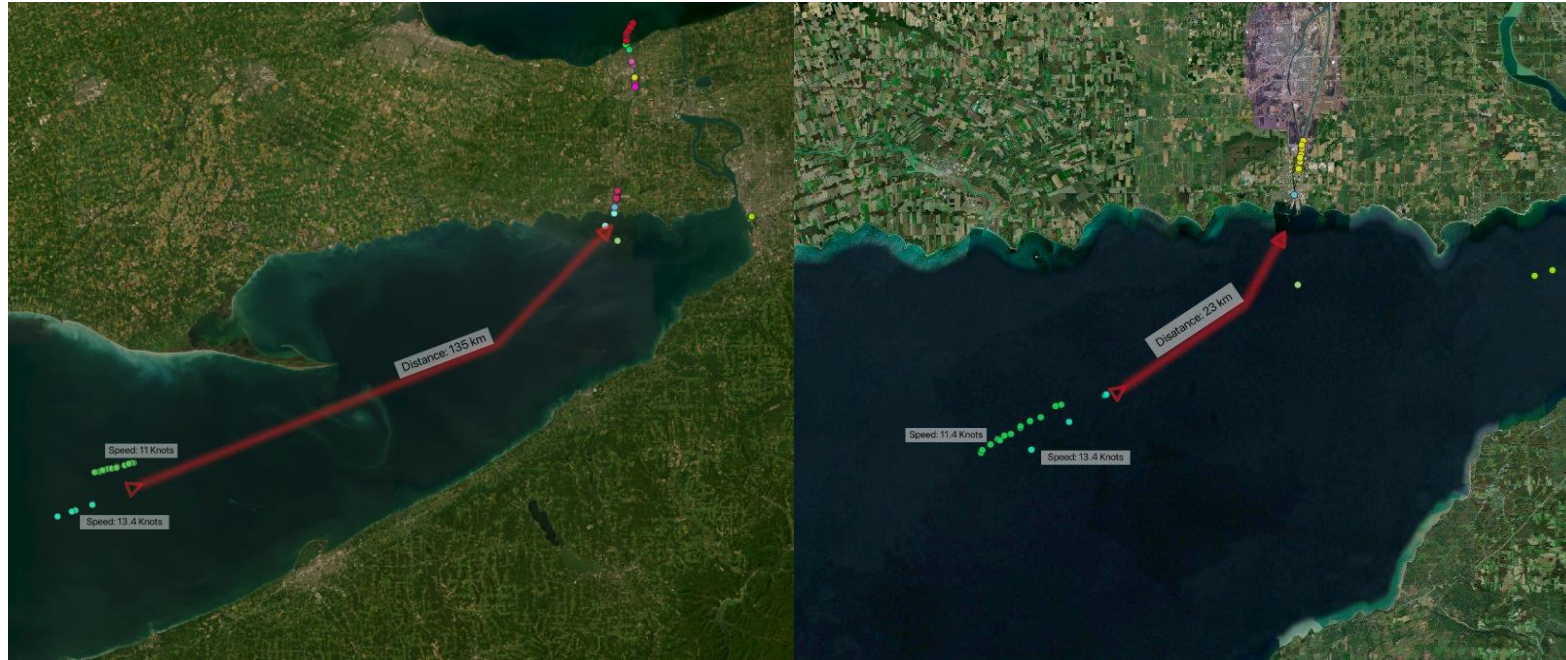


Image 1: Two ships on route to Wellend Canal

Image 2: Two ships on route to Wellend Canal (5 hours later)

- Two vessels are travelling towards Wellend Canal where FIFO is used
- FIFO causes the incentive for vessels to "race" which burns more fuel
- This case shows Vessel 2 travelling 13.4 knots overtaking Vessel 1 to get to the lock first. Vessel 1 still had to wait 1 hour to go through.



Lock Scheduling Analysis

	Lock Scheduling FIFO	Lock Scheduling with OCIANA
Speed	13.4 Knots	11 Knots
Duration	5.4 hours	6.6 hours
Time Difference		1.2 hours
Total Fuel Consumption	5.65 MT	4.79 MT
Cost of Fuel	\$7,346	\$6,227
	Net Profit*	\$1,119



Image 1: Vessel travel through seaway



Image 2: Vessel wait time at anchorage

- With no confirmed Berthing Time Window, a vessel may rush to anchor to make sure they get the next available slot.
- This cases shows wait time at anchor for this vessel was over 28 hrs with the current berth occupied.



Berth Scheduling Analysis: St. Lawrence Seaway

	Berth Scheduling FIFO		Berth Scheduling with OCIANA
Speed	10.6 Knots		9 Knots
Duration	33 hours		38 hours
Anchorage Time	28 hours		25 hours
Demurrage Fees	\$15,166		\$13,541
Total Fuel Consumption	34.5 MT	-\$1,625	28.5 MT
Cost of Fuel	\$44,850	\$7,800	\$37,050
	Net Profit*	\$6,175	

*Net Profit can extend if speed is reduced prior to entry to the St. Lawrence Seaway .

Net Profit if extended to JIT for Trans-Atlantic Voyage **\$38,000**

Berth Scheduling First In First Out: Trans-Atlantic Voyage

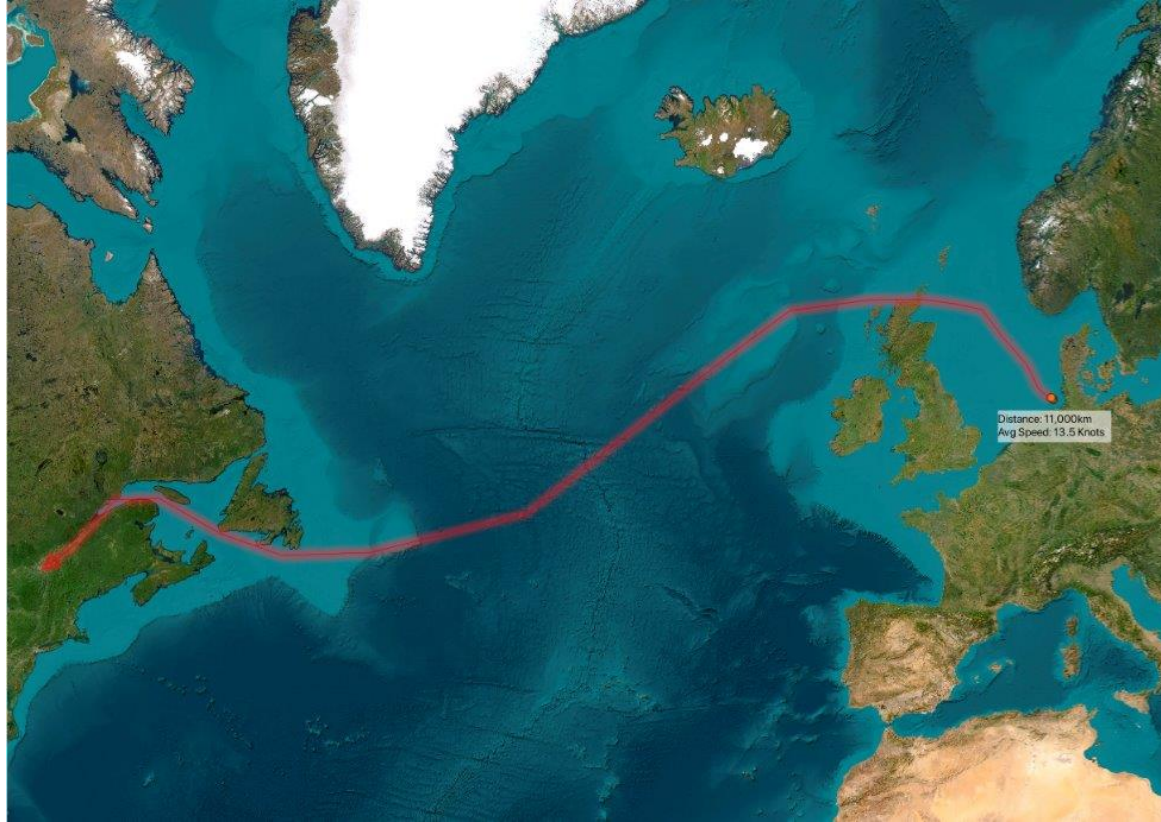


Image 1: Vessel travel cross Atlantic

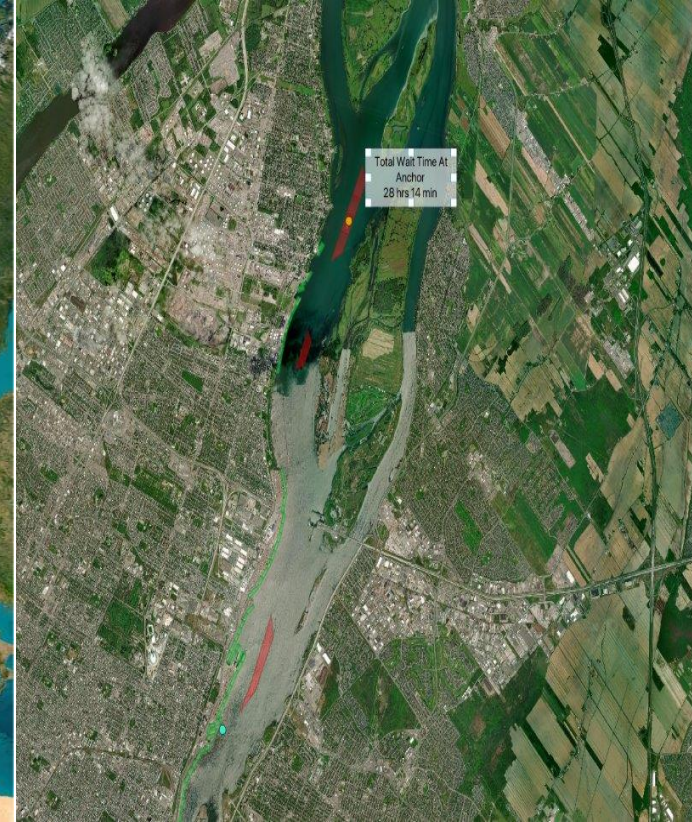


Image 2: Vessel wait time at anchorage

- With no confirmed Berthing Time Window, a vessel may rush to anchor to make sure they get the next available slot
- This cases shows wait time at anchor for this vessel was over 28 hrs with the current berth occupied.



Berth Scheduling Analysis: Trans-Atlantic Voyage

	Berth Scheduling FIFO		Berth Scheduling with OCIANA
Speed	13.5 Knots		12.7 Knots
Duration	440 hours		468 hours
Anchorage Time	28 hours		0 hours
Demurrage Fees	\$15K	-\$15,000	\$0
Total Fuel Consumption	605 MT		542 MT
Cost of Fuel	\$544K	+\$53,000	\$491K
	Net Profit*	\$38,000	



Going Forward: Enhanced Maritime Collaboration Platform

Continued industry collaboration and development of the Collaborative Berth Scheduler

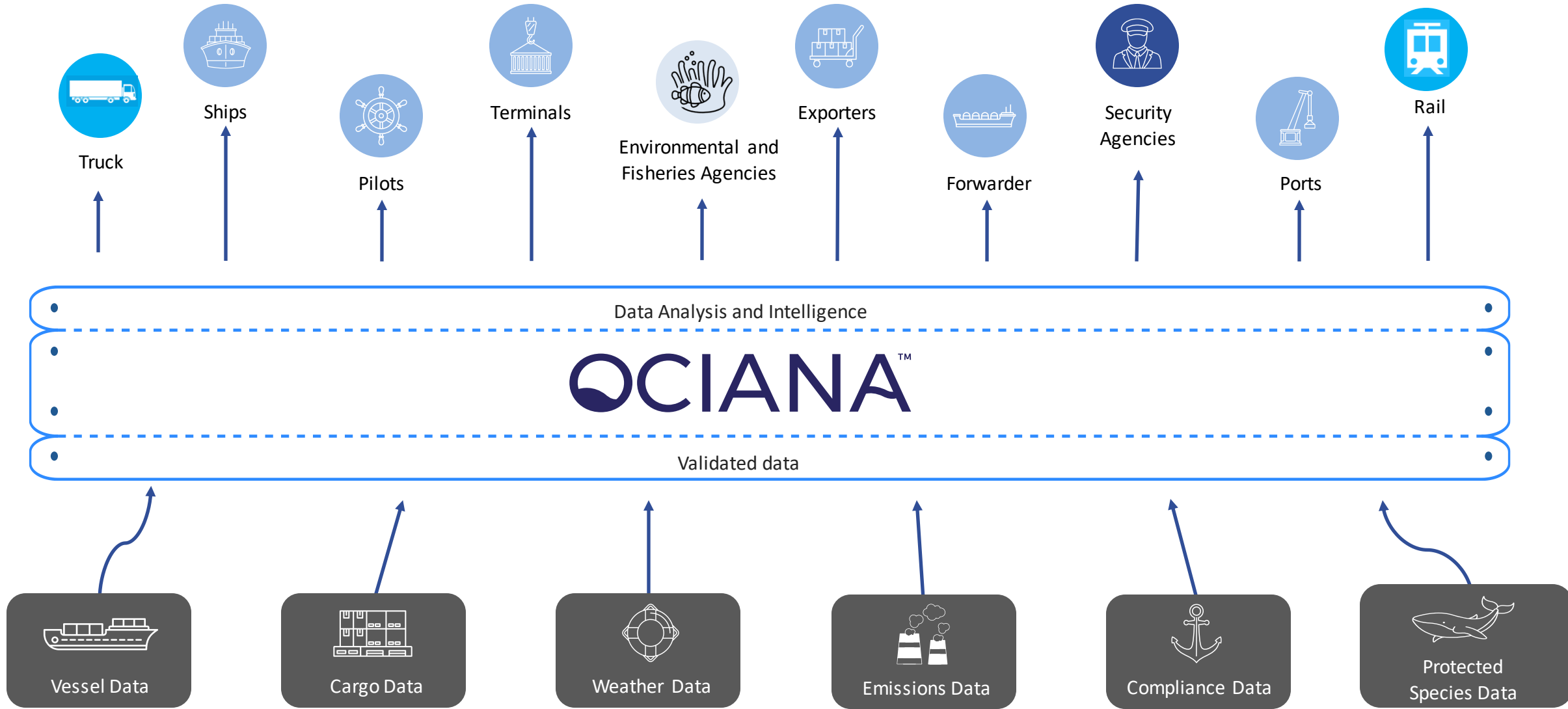
- Leveraging Canada's Ocean Supercluster project
- Bringing together more maritime stakeholders globally
 - Ports
 - Pilotage Authorities
 - Waterways Management Authorities
 - Ship Operators

Digitization Ambitions

- Maritime Single Window
- Expanding into **landside operations** to enhance coordination in shipping



Enhanced Maritime Collaboration Platform





Key Takeaways

Collaboration and Communication

- **Multi agency** collaboration -- bringing together agencies operating in separate locations
- **Improved transit times** for ships
- **Reduction of delays** to maritime stakeholders
- **Reduced fuel consumption** and inherent reduction of GHG
- **Human resource schedule optimization** through enhanced coordination
- **Optimization of berth occupancy**
- **Support day-to-day** planning for Harbour Masters



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