CSL's Fleet Management
A journey towards connected vessels for operational excellence & analytics

Jean-Frederic Lavoie (CSL)
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CSL GROUP

Who we are …

Jean-Frederic Lavoie

Vessel / O2 Digital Manager

CSL Group

Remi Duquette

Vice-president

Maya HTT Ltd (**PI integrators for CSL**)

Agenda

- Overview of CSL
- Key business drivers leading to the digitalization of CSL's fleet
- How a distributed architecture of the PI System was deployed
- Change management process of getting Ship's crew on-board
- Key business needs to automate various processes
- How Maya's PI integration experts lead CSL towards a successful journey
- Key lessons learned along the digital transformation journey
- Next potential steps in providing improved resiliency, availability, utilization, and enhanced visibility into CSL Business Processes

MAYA HTT LTD – COMPANY OVERVIEW

Insightfulness that brings out the exceptional in the best

Who we are …

- Largest simulation company in Canada
- 1982: Founded & privately owned
- 35+ years in software development, R&D, engineering, sciences
- Growing organically with partnerships …
  - 1986: SDRC / Siemens PLM
  - 2008: Atos
  - **2012: OSIsoft**
  - 2013: Siemens BT & Intel
  - 2018: HPE, MindSphere, AWS

~30 solutions in 15 markets

175+ Employees

100+ Developers
46 Masters
38 PhDs
27 Engineers
27 Languages
15 PI Experts
1 great team

Worldwide Projects

4,500,000+ PI tags
1,000,000+ cars
10,000+ aircraft engines
1000+ engineering projects
100+ data center sites
50+ satellites in orbit
1 great hockey stick

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What we do at CSL GROUP

Canada Steamship Lines operates modern Self-Unloaders, Bulkcarriers, Transhippers and Cement carriers across the World. We provide customers with innovative high-capacity self unloading and transhipment solution

The **size** and **flexibility** of our fleet guarantees a **safe reliable**, **efficient** and **cost-competitive** service to our customers

The cargo we transport includes iron ore, coal, ilmenite, salt, slag, limestone, dolomite, wheat, corn, soybean, canola, gypsum and cement in various forms

GROUPE CSL GROUP

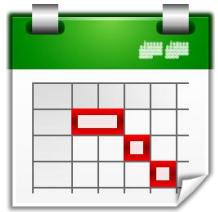
SUMMARY OF O2 PROGRAM

Goal : Optimization of the of the Operations (O2)

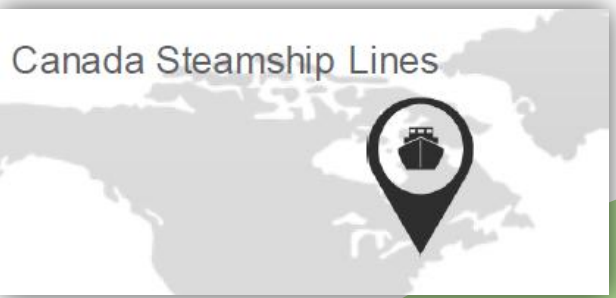
- ✓ Vessels Performance
- ✓ Fleet Performance
- ✓ Environment & Regulatory Compliance
- ✓ Energy Efficiency
- ✓ Condition-based Maintenance

O2 Program Timeline

- ✓ Initiative started in January 2016
- ✓ Pilot on 2 ships in 2017
- ✓ Enterprise agreement with OSIsoft in 2018
- ✓ Selection of MAYA HTT Ltd as trusted PI integrators in 2018
- ✓ Deployment on 16 ships in 2019



PROCESS TO SUCCESS



Pilot on 2 Ships

Fleet Management Center & HQ Setup

MVP Deployment on 16 Ships

Deployment on all CSL Ships

2017 2018 2019

KEY BUSINESS DRIVERS LEADING TO THE DIGITALIZATION OF CSL'S FLEET

CHALLENGE

Improving operations has always been a **Primary Concern** of CSLers, and remains a **Key Business Priority**

- **Regulations not always easy to follow (there are no street signs)**
- **Lots of manual entries & paperwork**
- **Distributed fleet**

SOLUTION

Setting up a **Digital Infrastructure** will provide us with **New Ways** to achieve optimized operations

- **Interactive Dashboards**
- **Fleet visibility**
- **Runtime information**

RESULTS

Improved decision making and traceability on operations, safety and efficiency.

Targeted ROI of O2

- **Better fuel efficiency**
- **Less manual entries**
- **Less voyage disruptions**
- **Pre-infringement warning**
- **Data driven maintenance**

AUTOMATED REPORT (1 OF 2)

Unloading Report

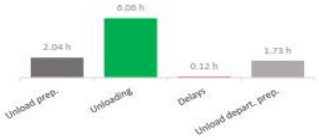
Vessel:	Thunder Bay	Unloading Port:	PICTON	Rate Requirements:	3000	tph
Trip	18020	Loading Port:	WINDSOR	Cargo:	SALT	

General Comment(s)

No comments - Typical Picton unload

Timeline

Unloading port stay 9.95 h



All fast unloading port:	09/Sep/2018 21:47	Finished unloadi	10/Sep/2018 06:01
Start unloading:	09/Sep/2018 23:50	Vessel departun	10/Sep/2018 07:45

Delays

Number	1 time(s)
Duration	0.12 hours

	Prep. & Delay (Start)	End	Duration	Category	Reason
Prep.	09/Sep/2018 21:47	09/Sep/2018 23:50	2.04	Port	WAITING FOR BERTH / GO
1	10/Sep/2018 03:53	10/Sep/2018 04:00	0.12	Port	REPAIRS / BREAKDOWN
2					
3					
4					
5					
6					
7					
8					
9					
10					
Depart. Prep.	10/Sep/2018 06:01	10/Sep/2018 07:45	1.73	Vessel	WEATHER

Performance

Tonnage

Ship Totalizer	29171 t
BOL	28891 t
Error Margin	-0.97 %

	Rates (tph)	Unloading Times (h)	Tons / kWh	Tons / kg of fuel
Gross	4672	6.18	3.3	14.4
Net	4767	6.06	3.3	14.6
Port Stay	2903	9.95	2.5	11.8

Ton/AE running hour 1762

Belt Usage Indicator 78.5 t/km

Stop indicative rates

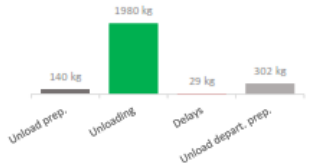
Port	4672 tph
Maintenance	4767 tph

AUTOMATED REPORT (2 OF 2)

Fuel Consumption

Unloading port stay

Total **2451** kg

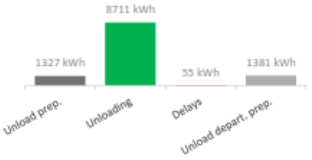


Fuel Fraction	
HPU / Controls	**261** kg
Conveyors Drives	**1321** kg
Ballast	**158** kg
House Load	**711** kg

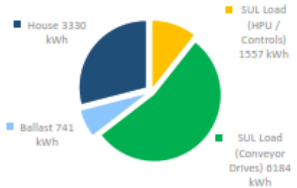
Electrical Load

Total Ship's Electrical Load

11474 kWh



Unloading port stay



Auxiliary Engine

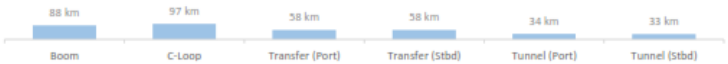
	Running hours (h)	Nb of Starts	kWh
AE #1	6.4	1	4458
AE #2	8.4	0	5713
AE #3	1.6	0	353
Total	**16.4**	**1**	**10524**

At the same time	Running hours
1 AE running	3.4
2 AE running	**6.6**
3 AE running	**0.0**

Belt

Distance

Total **368** km



Motors

	1st Start		Last Stop		Peak (High)			Average when Unloading				Unloading
	Power	Speed	Power	Speed	Power	Speed	RTD Temp.	Power	Speed	RTD Temp.	Boom Angle	kWh
Boom (Master)	29	1800	15	1800	235	1800	59	200	1788	51	17	1210
Boom (Slave)	29	1800	15	1800	235	1800	45	199	1788	40	-	1209
C-Loop (Master)	63	1803	49	1801	256	1800	73	219	1781	61	-	1327
C-Loop (Slave)	63	1803	49	1800	256	1800	72	219	1781	60	-	1328
Transfer (Port)	22	-	6	-	31	-	29	24	-	37	-	145
Transfer (Stbd)	17	-	10	-	27	-	28	22	-	38	-	135
Tunnel (Port)	22	675	18	1327	119	1329	53	71	1287	44	-	432
Tunnel (Stbd)	13	675	16	1327	111	1418	48	65	1257	42	-	396

	Power Ratio
Boom (Master / Slave)	0.1%
C-Loop (Master / Slave)	-0.1%
Transfer (Port / Stbd)	**7.2%**
Tunnel (Port / Stbd)	**8.4%**

	Unloading		
	Peak (High)	Average	
Outside Temp.	-	-	°C
VFD Room Temp.	35.6	33.4	°C

OSIsoft. PI World

HOW A DISTRIBUTED ARCHITECTURE OF THE PI SYSTEM WAS DEPLOYED

CHALLENGE

Many ships around the world. Moving data collection systems with reduced network access in many areas.

- Central fleet support center with remote and **moving factories (ships)** without significant IT infrastructure
- Combining remote operational activities and central business tracking needs is complex

SOLUTION

Central Fleet Management Support

- ✓ PI Data Archive server
- ✓ PI AF Server
- ✓ PI Analytics
- ✓ PI Notifications
- ✓ PI Vision Server with “Maya developed” custom Swagger web API for custom web dashboard on ship bridge and engine control room
- ✓ PI Integrator for BA for machine learning

Distributed on each Ship

- ✓ Self-sufficient IT systems on-board with PI collectors and buffering
- ✓ Remote access to dashboard web apps

RESULTS

- ✓ Easier and cheaper to deploy
- ✓ Standardized deployment
- ✓ Easier to maintain (both IT and OT)
  - Central server and fleet management ready to support
  - 16 ships in operations mode
  - Nice and small O2 IT blackbox hardware on ship

DRIVERS FOR DISTRIBUTED ARCHITECTURE

Day to Day Operations

New dashboard Onboard

- Intelligent indicators
- Tips: Oops, I forgot!
- Easy sharing of information
- Automated logging, less paperwork

Fleet Support Center

Use data to make better fleet-level decisions

- Early failure detection
- Maintenance plan optimization
- Cycle analysis and reports
- Advanced troubleshooting

HOW DOES O2 WORK ?

Position
Speed
Fuel consumption
Running hours
Electrical load
Safety checks
…

Weather

IMOS

Geofencing

Compliance

Algorithms

Machine Learning

Implement new functionality that does not exist today

CHANGE MANAGEMENT PROCESS OF GETTING CREW ON-BOARD

CHALLENGE

- Captain's request : Make our job easier, reduce the paperwork!
- Data is locked in vessels, dependent on people, forms and processes.

SOLUTION

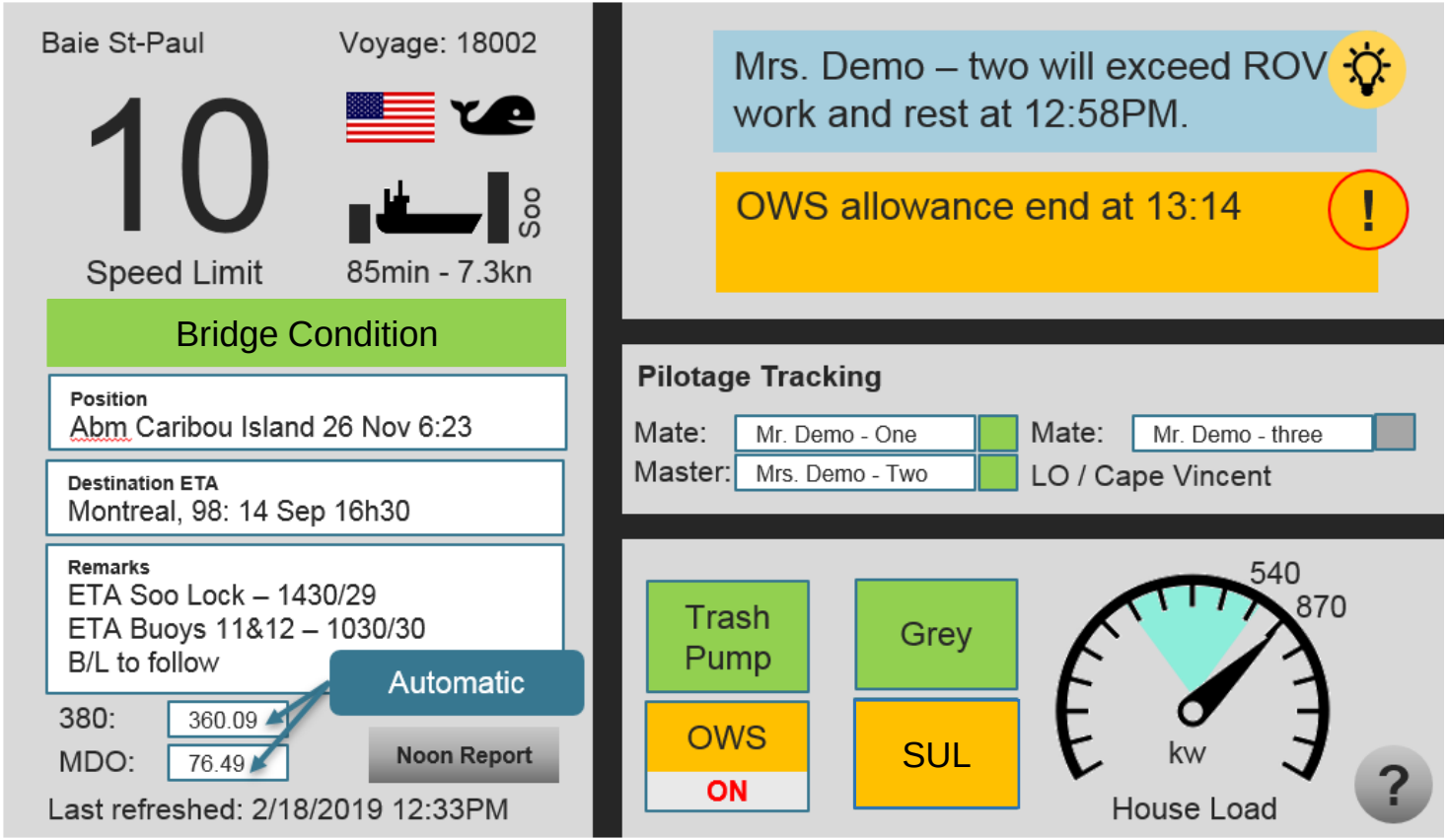
Custom web App connected through PI web API and PI AF SDKs to provide the crew with a value added interactive HMI.

- Leverage latest HTML5 features
- Customize for Captains and Crew
- Easy to use and deploy
- Great and "sexy" UX

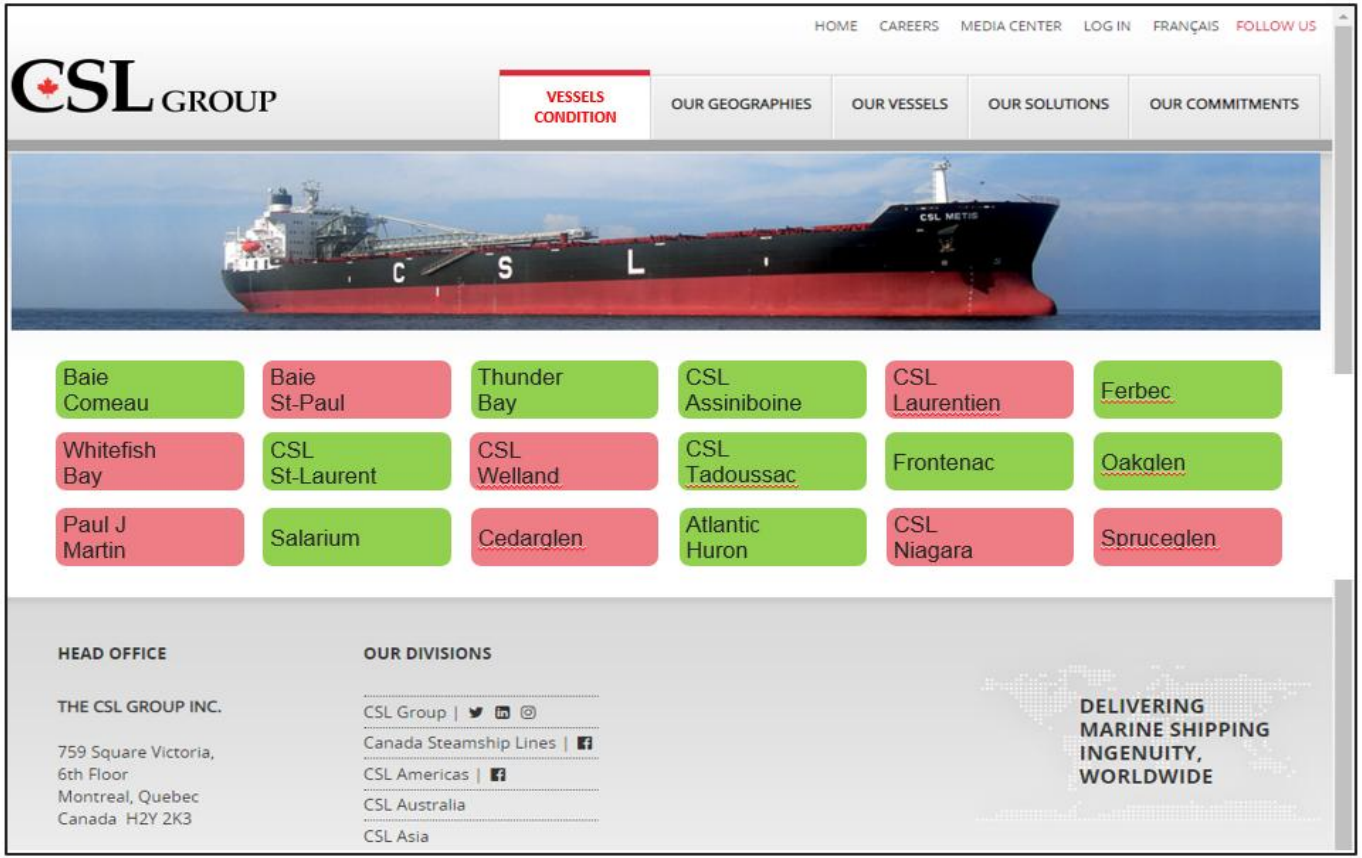
RESULTS

- ✓ Intuitive and easy to use HMI
- ✓ Good crew adoption
- ✓ Less paperwork
- ✓ Better audit trail

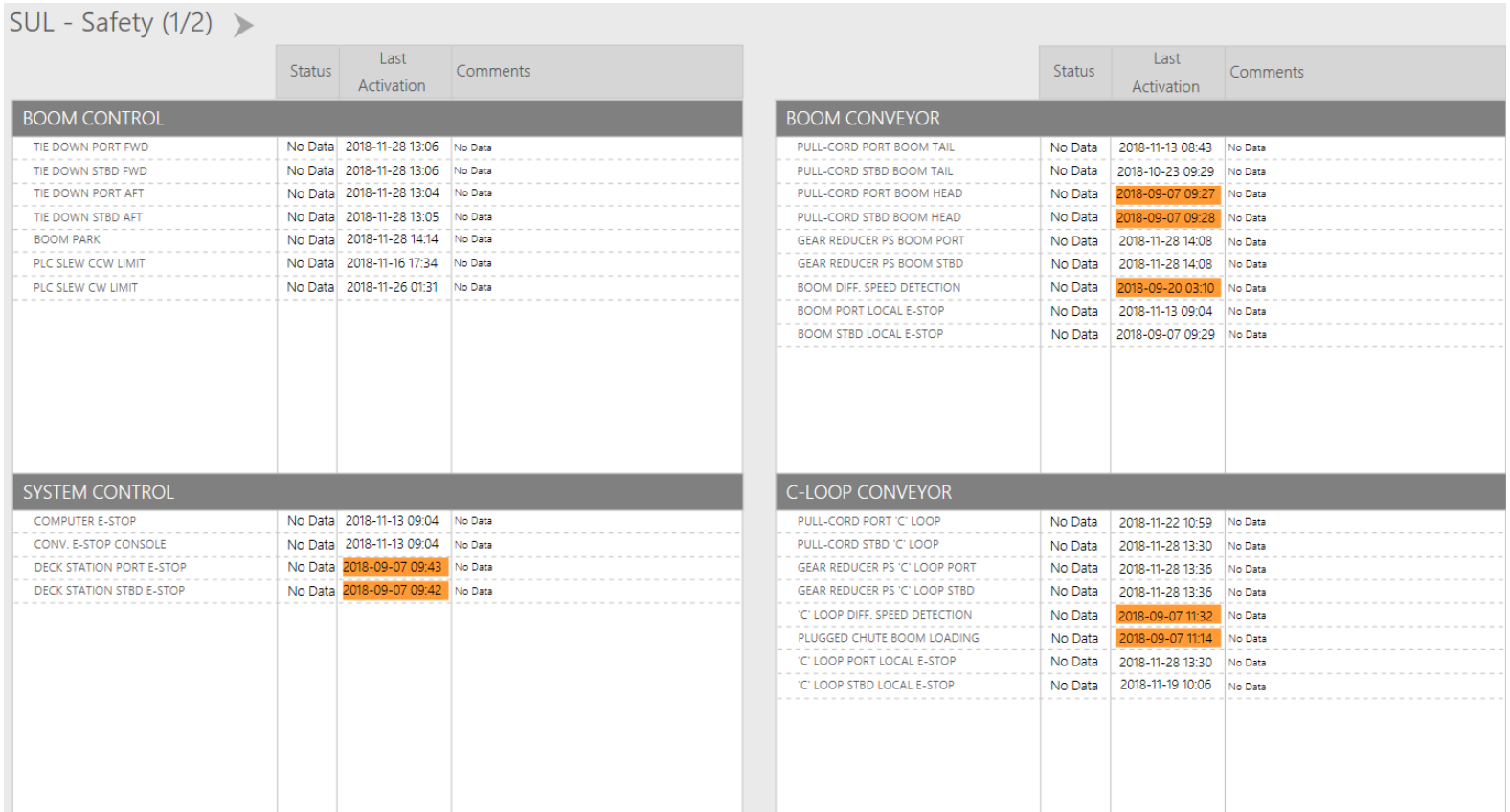
BRIDGE HMI



DASHBOARD VIEWS – FLEET VIEW OF VESSEL'S BRIDGE CONDITION



“AUTOMATED” SAFETY CHECKS



DASHBOARD VIEWS – INDIVIDUAL VESSEL VIEW

CBM Analysis

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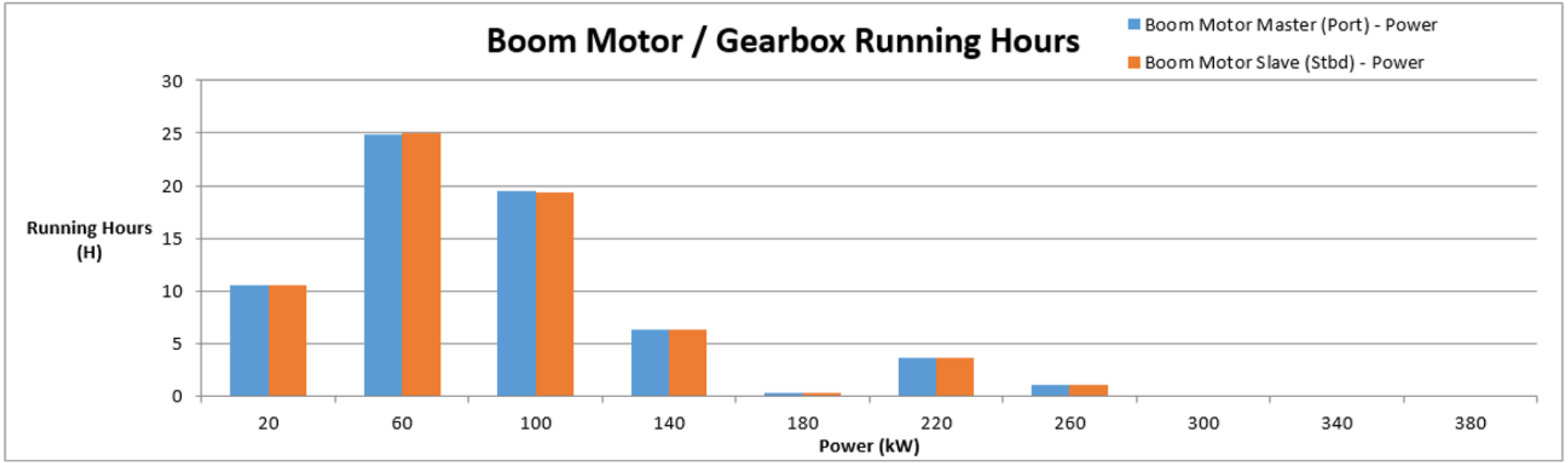
GEAR REDUCERS - Running Hours Versus Output Power



KEY LESSONS LEARNED ALONG THE DIGITAL TRANSFORMATION JOURNEY

CHALLENGE

Any digital transformation affects people and processes

Typical for any project …

- People change management
- Process change management
- Technology change management

SOLUTION

Steering committee created

Start small & grow overtime

Agile approach taken

- Run workshops with all key stakeholders as early in the process
- Get early consensus on process changes to avoid “this is not the way we do things”
- Prototype early and fail fast – you will make mistakes, make them early and identify risks early
- Use a sandbox for mock-ups and early testing and adoption

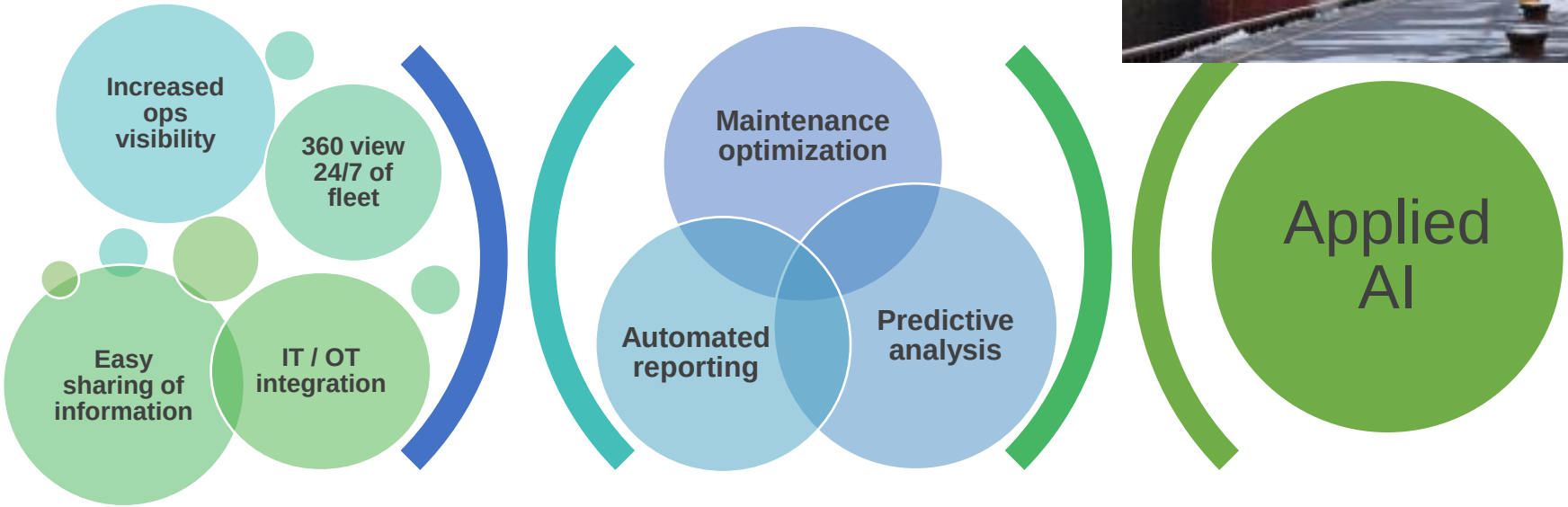
RESULTS

First MVP deployment of O2 on target

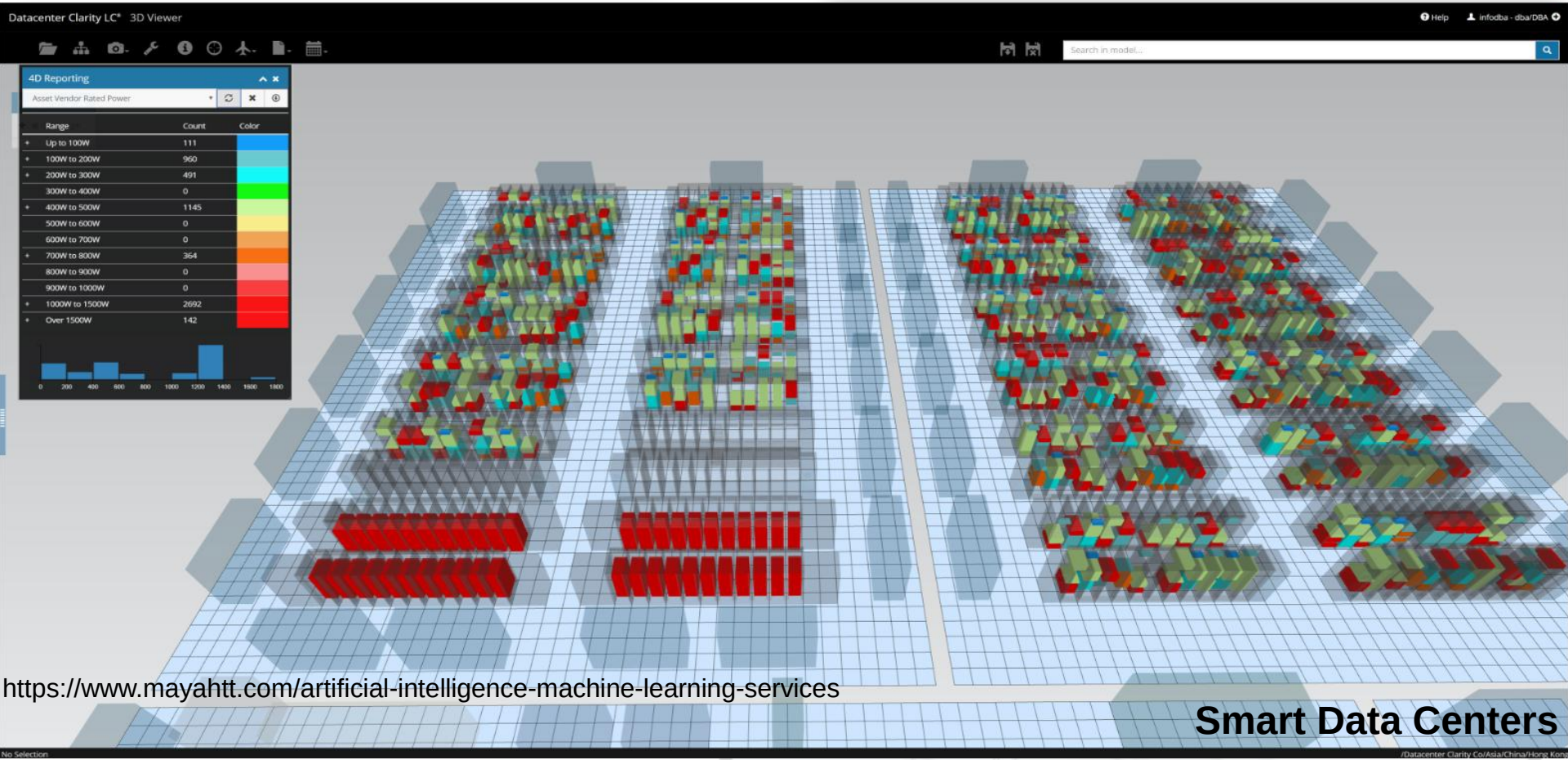
Early feedback taken into account

- People aligned
- Early prototyping reduced risk
- Early dashboarding feedback

ROADMAP TO PROVIDE IMPROVED **RESILIENCY, AVAILABILITY, UTILIZATION,** AND **ENHANCED VISIBILITY** INTO **CSL**'s **BUSINESS**



INSIGHTFULNESS THAT BRINGS OUT THE EXCEPTIONAL IN THE BEST



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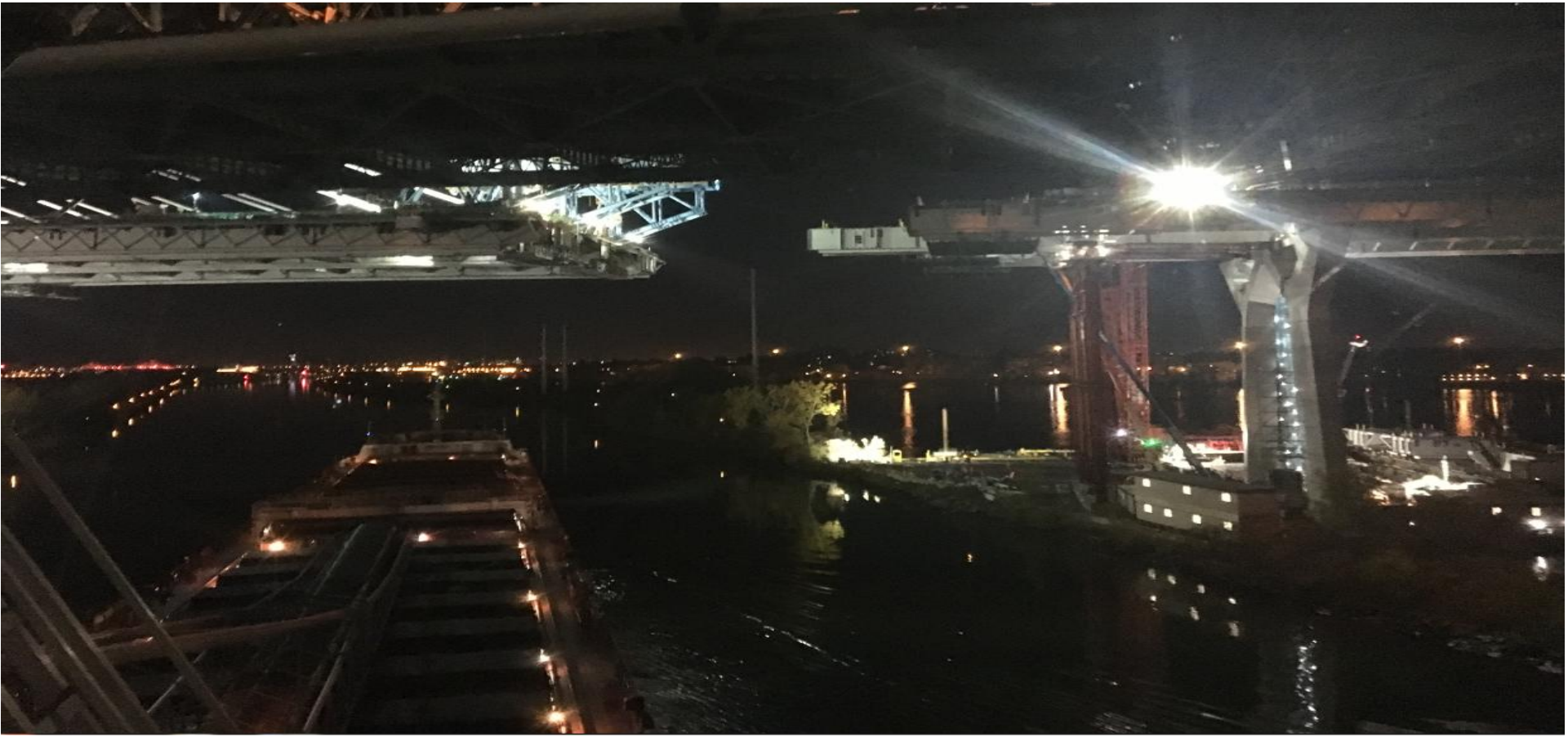
Smart Data Centers



Questions?

Please wait for the **microphone**

State your **name & company**

Please remember to…

Complete Survey!

Navigate to this session in mobile agenda for survey