



NEXT GENERATION TECHNOLOGIES

Supply Chain Digitization and Green Solutions

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SUPPLY CHAIN DIGITIZATION
AND GREEN SOLUTIONS

Agenda

01 Introductions

02 Locomotives & Shuttlewagon

03 Shore Power

04 RailConnect

05 TOS & Port Optimizer

06 Closing & Q/A

NEXT GENERATION TECHNOLOGIES

Today's Featured Speakers & SMEs



SOUFYANE MEFTAH
Pre-Sales Solutions Architect



TODD BARNETT
Product Director, Terminal Operating System



MOLLY HANFLAND
Strategy & Marketing Leader



GREG REESE
Technical Sales Manager, Maritime & Energy Solutions



BYRON TALBOT
Regional Sales Manager, Shuttlewagon Division



ANDREW PARKER
Senior Director – Rail Solutions Architect, TMS



WE ARE WABTEC

Leading global provider of equipment, systems, digital solutions and value-added services

Drawing on over 150 years of experience,
we are leading the way in safety, efficiency,
reliability, innovation, and productivity.



Next Generation Technologies

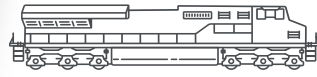
Wabtec Battery Electric Locomotive FLXdrive

ROADMAP TO

Carbon-Zero Locomotives



Emissions Reduction Technologies

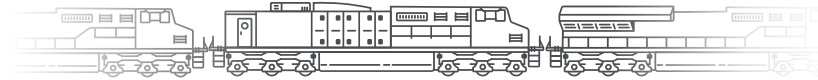


Diesel-Electric

*HDRD, Bio-Diesel
SFC improvement
Modernizations*



Today



**Battery-Electric
Operating In Consist**

**LOCOMOTIVE CARBON
EMISSIONS**



Hybrid Shunter



Electric-Hybrid



Battery-Electric Lead



**Hydrogen
Fuel Cell**

HYDROGEN AVAILABILITY

GREY H2

BLUE H2

GREEN H2

2015

2020

2030

STOCKTON TO BARSTOW

FLXdrive 1.0 Demonstration

36

TRAINS

13,320

MILES

~6,200

GALLONS SAVED

0

MAJOR FAILURES

Mainline Battery Loco Demonstration

STOCKTON

BARSTOW

KEY ACCOMPLISHMENTS

Safety & Reliability

Tractive Effort

Regenerative Braking

External Charging

TO Integration

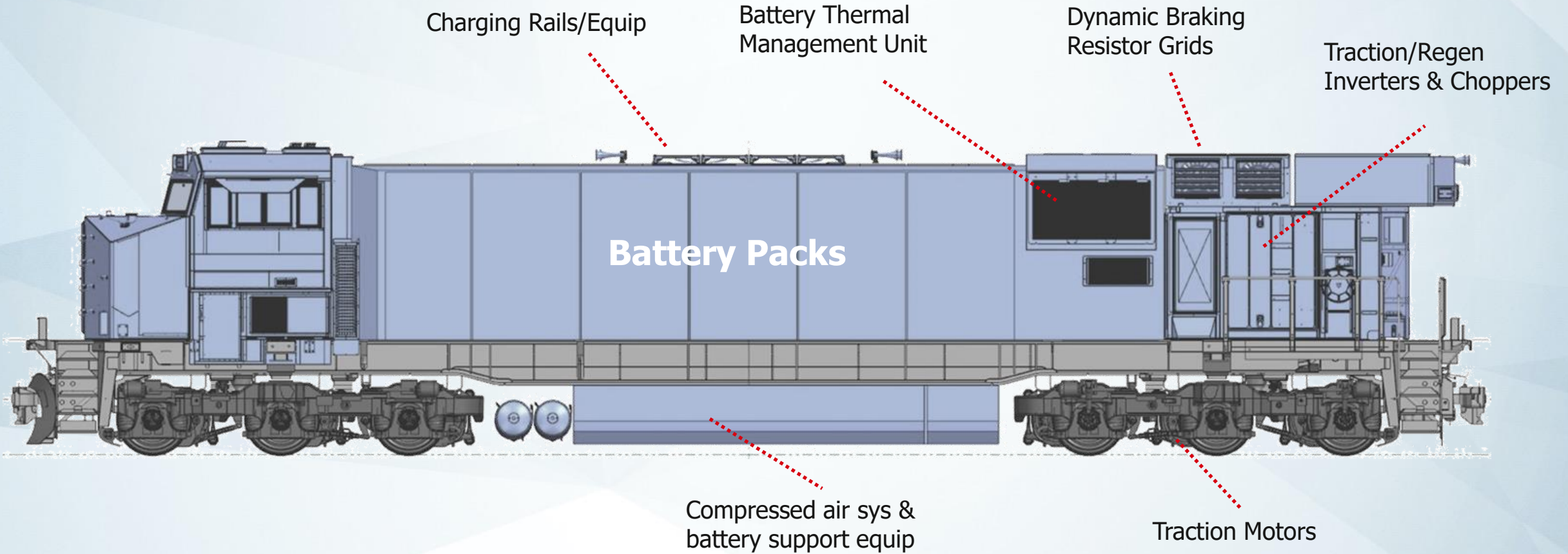
Fuel Savings Avg 11%...
As Predicted

NEXT STEP

Build upon the success of FLXdrive 1.0
with a commercialized 2.0

BATTERY ELECTRIC

FLXdrive Mainline Locomotive



FLXDRIVE

Battery Electric Portfolio

Technology Scalability

FREIGHT



1.0
FLXdrive

2.0
FLXdrive

3.0
FLXdrive
FLXextender

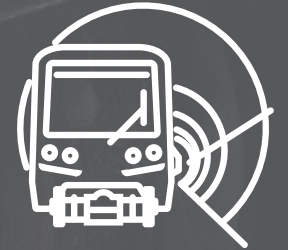
YARD



FLXswitch

Railcar Mover

PASSENGER



NYCT

MBTA

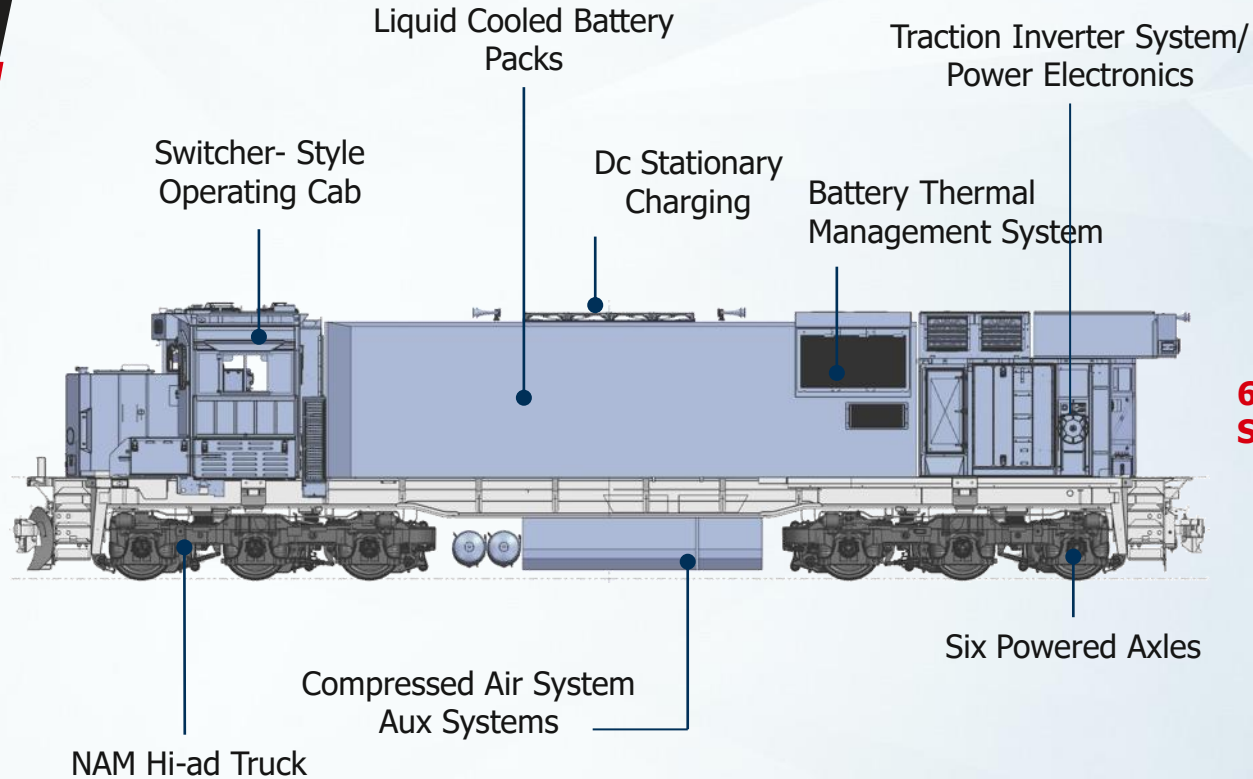
INNOVATION IN FUEL CONSUMPTION

FLXswitch

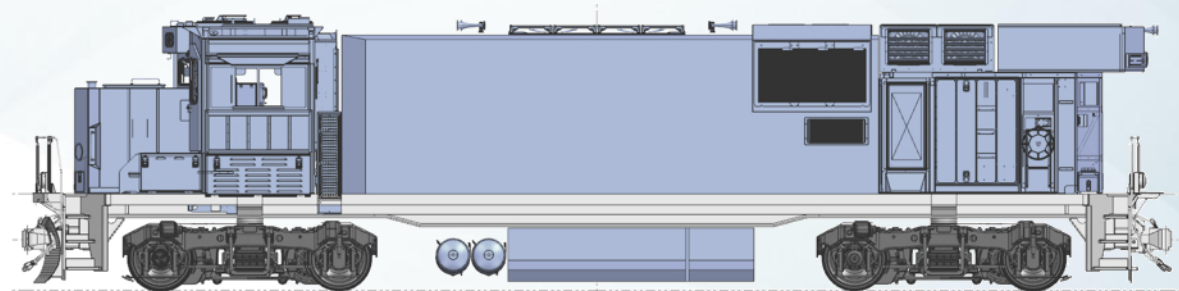
AC Battery Electric Switcher

PRODUCT FEATURES

- Full diesel switcher replacement. AC traction system. 32 t/axle
- Most applications will only need 1 charge per day (1.5MWh usage in 20 hours)
- 2.4 - 4MWh nameplate battery capacity
- 4-6 powered axles w/ single axle control
- Liquid-cooled batteries
- 2-4 hours to reach 90%+ charge
- DC charging on top of locomotive
- DC chopper design for blended dynamic brake with regen charging



6 axle Yard Switcher



4 axle Yard Switcher

FLXDRIVE

FLX Loco Market adoption

FLXdrive Demonstrator



FLX Orders – Customer Adoption

AUSTRALIA FLXdrive (Mainline)



1 Unit



2 Units



4 Units

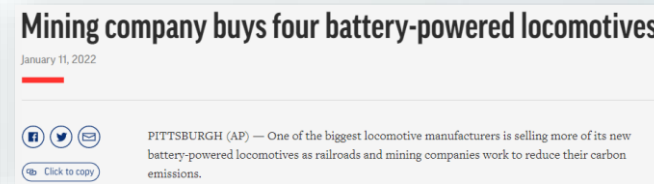
NORTH AMERICA FLXswitch (Yard/Regional)



1 Unit



10 Units



Driving zero emission locomotive solutions with FLXdrive



NEXT GENERATION TECHNOLOGIES

Shuttlewagon Solutions

SHUTTLEWAGON

Clean Evolution

Our passion is to leverage customer input to push the boundaries of technology – nothing is off the table



Tier 4 Final Diesel



**Lithium Ion
Batteries**



**What does the
future hold?**

SHUTTLEWAGON

Clean Rail

SAVINGS OVER 10YR LIFE SPAN

- Fuel Savings “on average” 118%
- Maintenance Savings “on average” 74%

BATTERIES

- Lithium Ion
 - 23kw/pack
 - 6 pack
 - 10 pack
- Regenerative Braking System



Charging Systems

LEVEL 2 CHARGING SYSTEM

- Single Phase
240amp/80V
- 50/60 Hz
- 20% - 90% = 8-10 hrs



LEVEL 3 CHARGING SYSTEM FAST CHARGER

- Run 2 dispensers
- 600ft away
- 60kW/125kW
- 20% - 90% = 2-4 hrs





NEXT GENERATION TECHNOLOGIES

Onshore Power Supply Solutions



Why Electrify?

Aside from the obvious environmental concerns and elimination of gasses and noise, the COP21 in Paris, legal and punitive measures are being instituted



global temperature shall not raise more than +2 degrees Celsius above preindustrial level



it is extremely likely that human influence was the dominant cause of global warming between 1951 and 2010



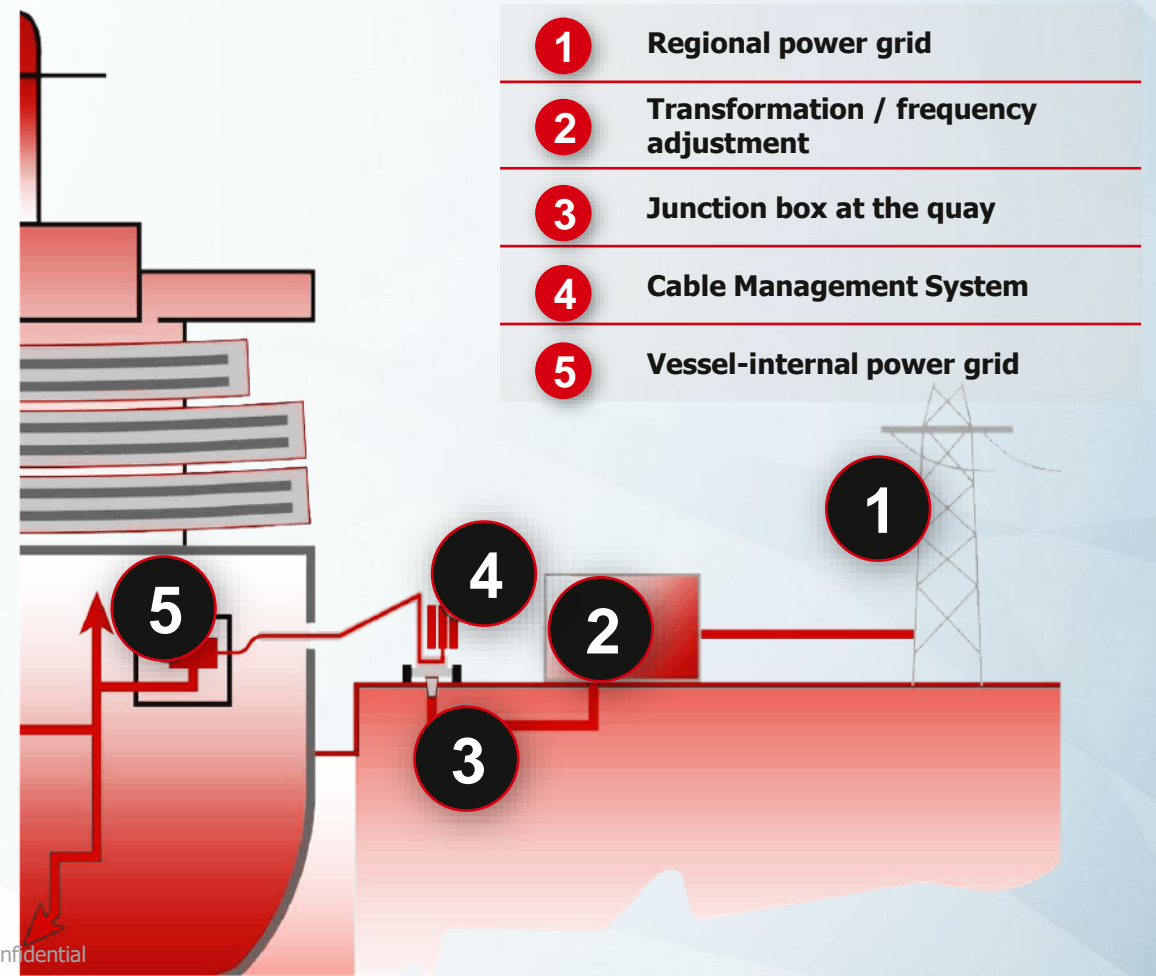
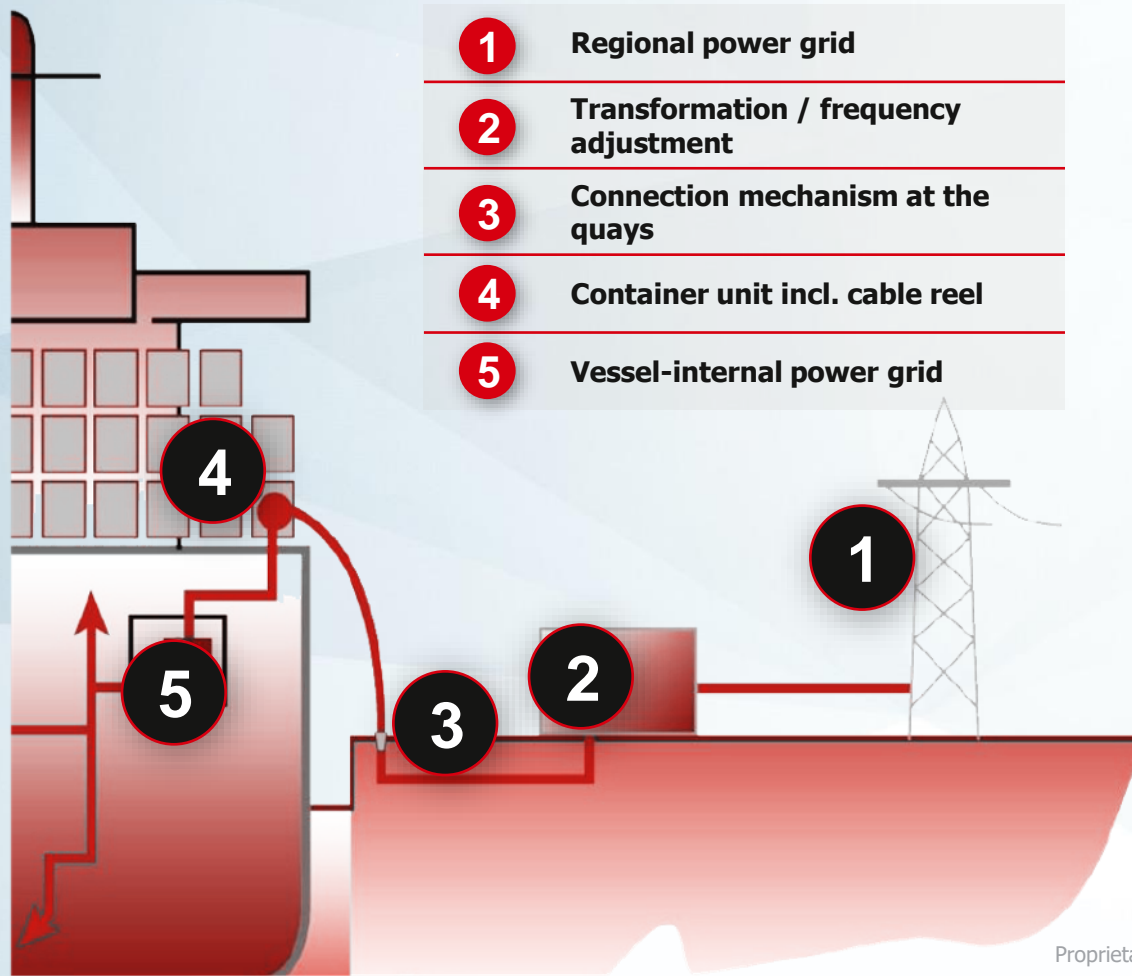
NEWS | 09 August 2021

IPCC climate report: Earth is warmer than it's been in 125,000 years



Shore Power For all Vessels

Shore power or **shore supply** is the provision of shoreside electrical power to a ship at berth while its main and auxiliary engines are shut down.



ONSHORE POWER SUPPLY SOLUTIONS

Biggest challenge: inconsistency of ports and berths

...for various vessels types, LVSC/HVSC



Average Power Requirements



Container vessels

up to 7,5 MVA @ 6,6kV

50/60Hz

- Cable reeling system on ship side inside a container
- Movable or fixed socket in the port



Cruise vessels

up to 20 MVA @ 11kV &
16 MVA @ 6,6 kV

50/60Hz

- Movable CMS in the port
- Socket on ship side



RoRo/RoPax vessels

up to 6,5 MVA @ 11kV &
LV versions up to 1 MW
@ 400V – 690V

50/60Hz

- Fixed or movable CMS in the port
- Socket on ship side
- Alternative: Fully automatic connectin with FerryCharger up to 8MW



Tanker and LNG carrier sometimes Bulk

10,8 MVA @ 6,6 KV

50/60Hz

- Fixed or movable CMS in the port
- Socket on ship side
- Sometimes ship side cable reels are requested



Other ship types

Offshore supply vessels, oil rigs
and Navy etc.

Different HV and LV
applications

50/60Hz

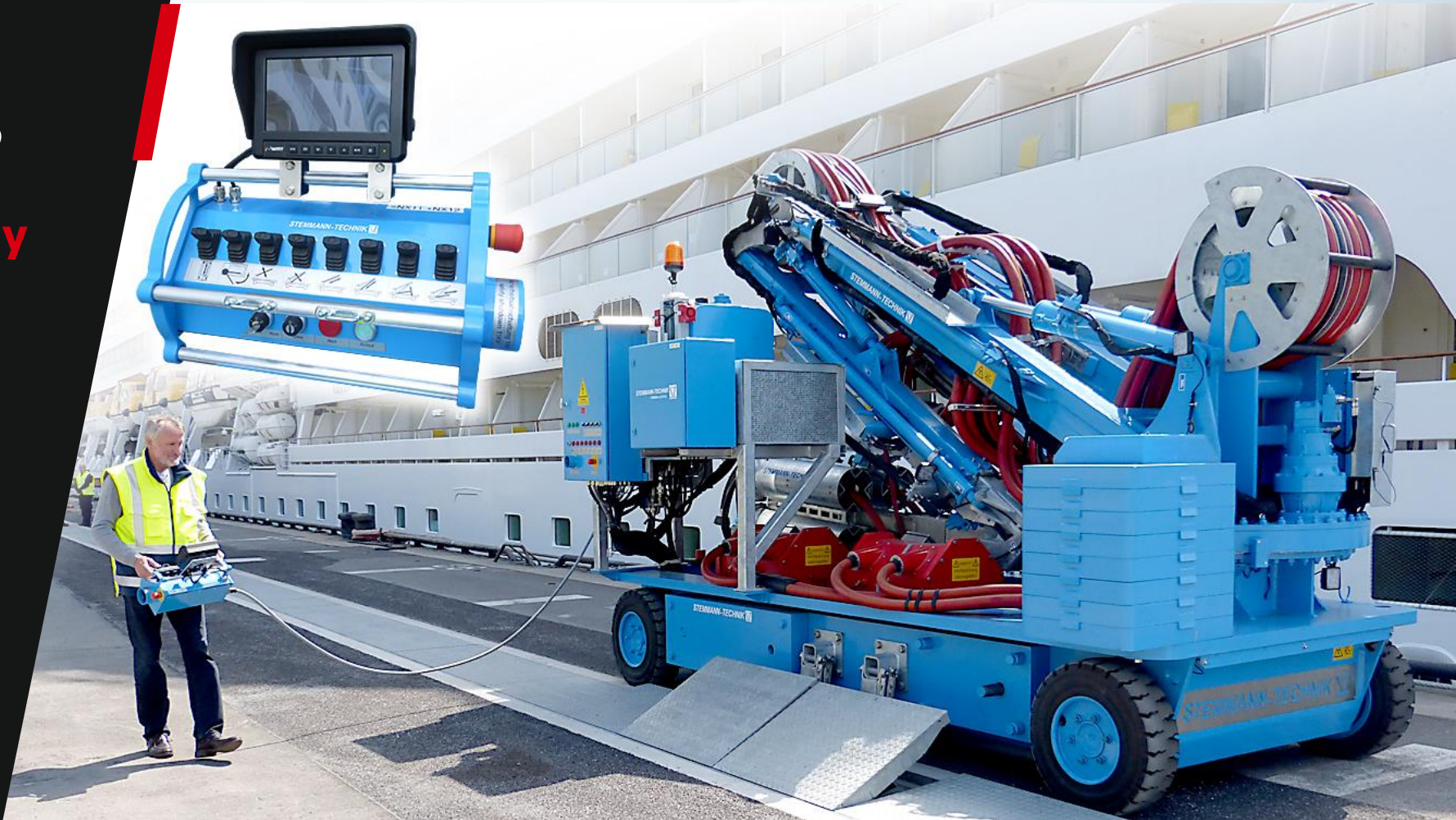
- Fixed or movable CMS in the port
- Socket on ship side
- Sometimes ship side cable reels are requested

ONSHORE POWER SUPPLY SOLUTIONS

ShoreCONNECT for Cruise Liners

Hamburg-Altona, Germany

Land side procedure
can be handled
by one person



HAMBURG-ALTONA, GERMANY

ShoreCONNECT for Cruise Liners

Land side procedure can be handled by one person



END USER

Port of Hamburg, Germany – Siemens

WABTEC SYSTEM SCOPE

- 1 vehicle
- Energy chain in the ground – no junction box

TECHNICAL INFORMATION

- 50/60 Hz
- 12 MVA
- Max 11 kV

WORKING RANGE

- Working range vertical plus hatch: +3.8 to -6m
- Working range horizontal: 300m
- Rotation range: +/- 95° out of the resting position

VEHICLE

- Fully electric, zero-emission, self-propelled
- 5.000mm x 2.500mm x 3.800mm (L x W x H)
- Speed: 3 km/h

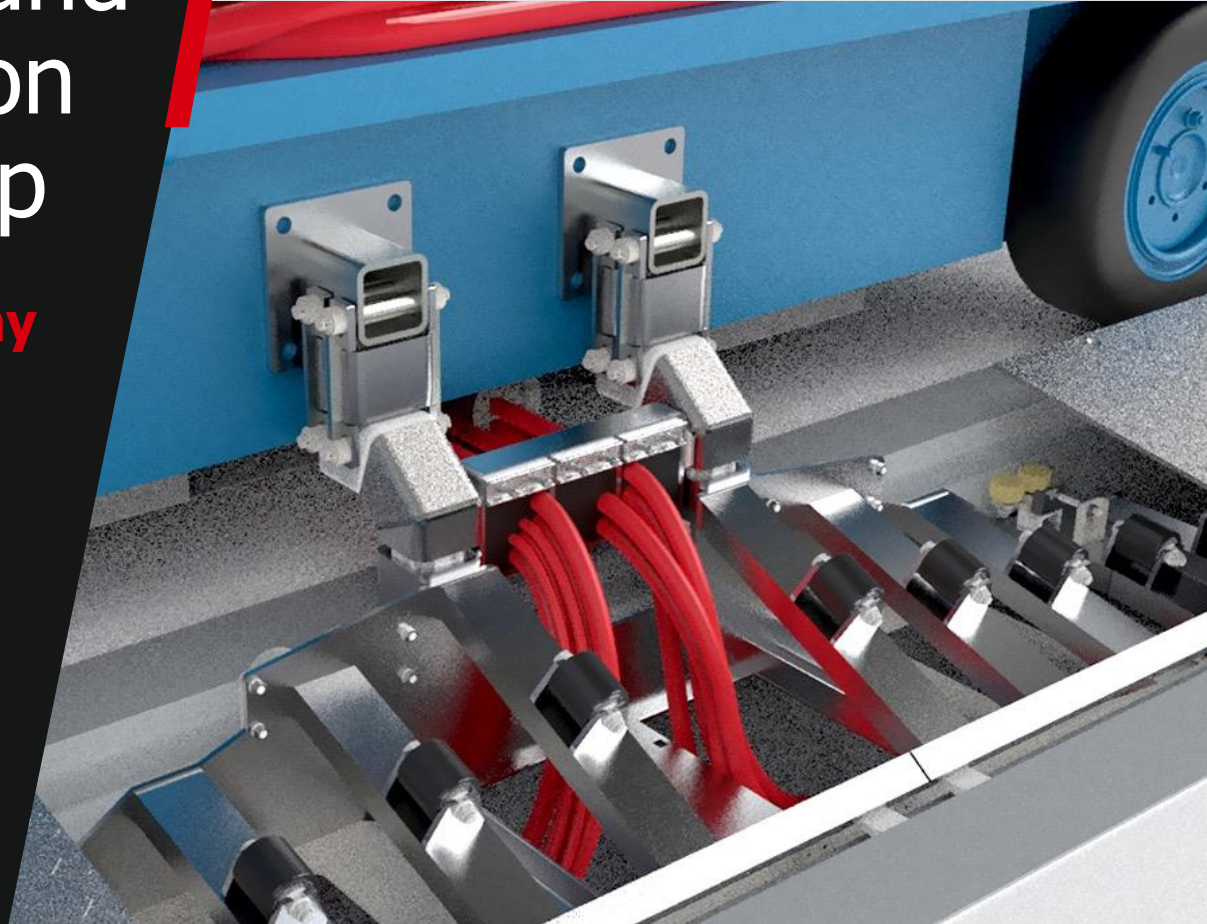
OPERATIONS

- 1 person needed to handle vehicle when connected with junction box
- No physical power needed to handle vehicle, fully remote

SHORECONNECT FOR CRUISE LINERS

Vehicle for fast and simple connection to the cruise ship

Hamburg-Altona, Germany



ONSHORE POWER SUPPLY SOLUTIONS

ShoreCONNECT for Cruise Liners

Kiel, Germany



ONSHORE POWER SUPPLY SOLUTIONS

ShoreCONNECT for Cruise Liners

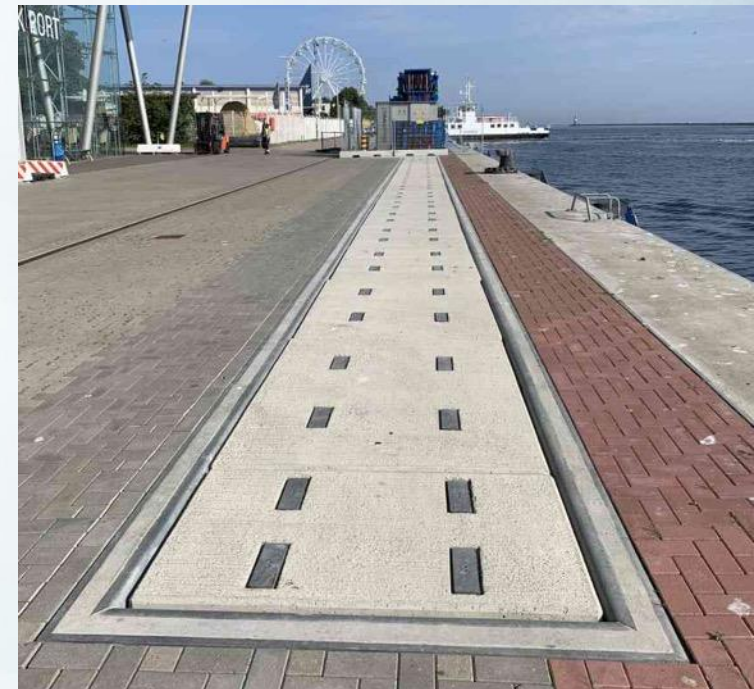
Kiel, Germany



ShoreCONNECT for Cruise Liners

Rostock, Germany

Junction box can
be connected from
two sides



ShoreCONNECT for Cruise Liners

Shanghai, China



ShoreCONNECT for Cruise Liners

Southampton, UK



SHORECONNECT VARIANTS

Cable Dispenser Low Voltage

...for various vessels types – low voltage



END USER

ISDEFE, Spain

WABTEC SYSTEM SCOPE

- 1 cable dispenser LV
- 5 cables

TECHNICAL INFORMATION

- 50 Hz
- Up to 1 MVA
- 1750 A / 400 V

WORKING RANGE

- Working range vertical plus hatch: +7 to +3m
- Working range horizontal: 2m
- Rotation range: +/- 95° out of the resting position

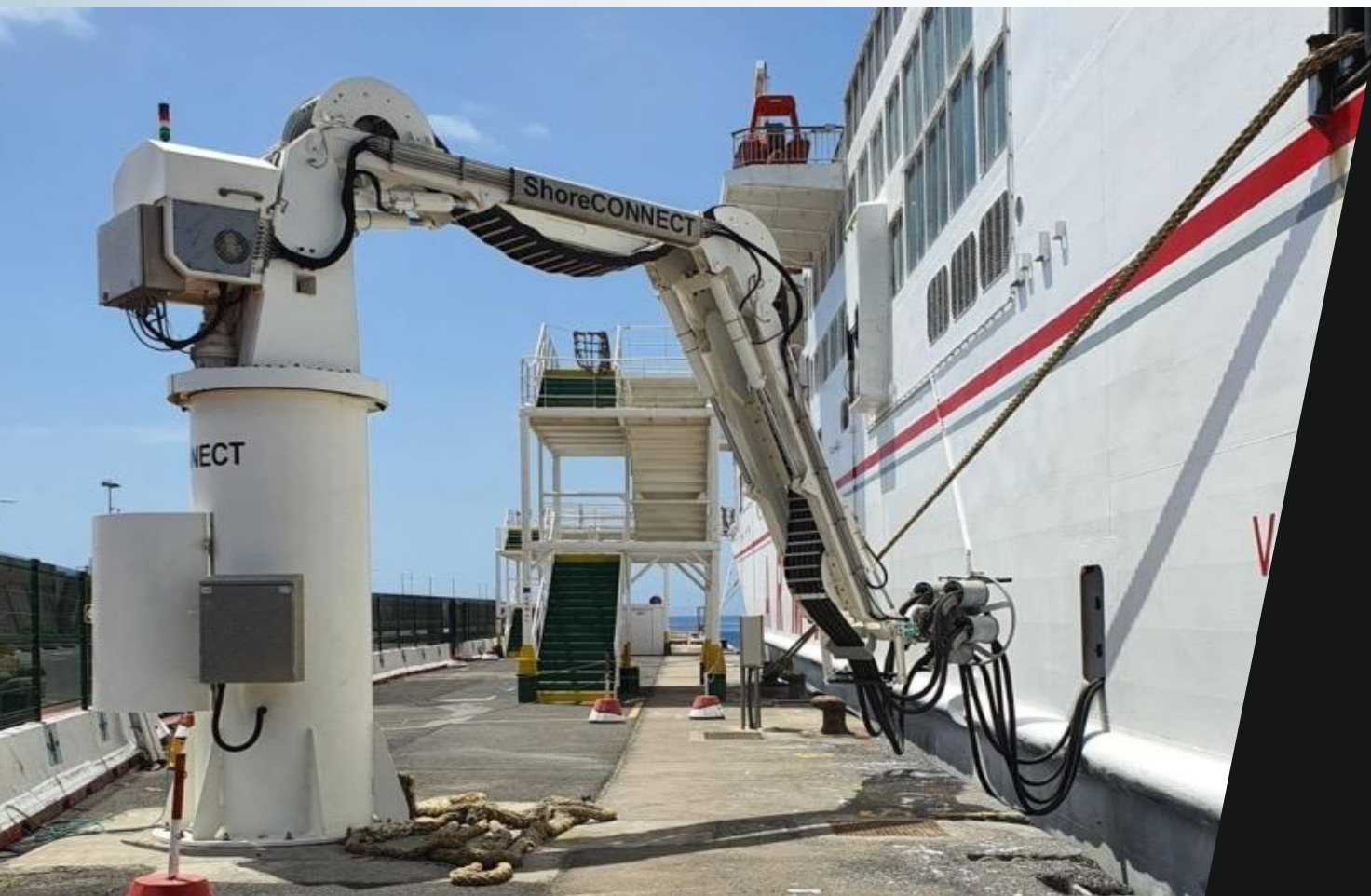
OPERATIONS

- 1 person needed to handle dispenser
- No physical power needed to handle on shore

SHORECONNECT VARIANTS

Cable Dispenser Low Voltag

...for various vessels types – low voltage



END USER

Acciona, Spain

WABTEC SYSTEM SCOPE

- 1 cable dispenser LV
- 5 cables

TECHNICAL INFORMATION

- 50 Hz
- Up to 1 MVA
- 1750 A / 400 V

WORKING RANGE

- Working range vertical plus hatch: +7 to +1m
- Working range horizontal: 5m
- Rotation range: +/- 107°out of the resting position

OPERATIONS

- 1 person needed to handle dispenser
- No physical power needed to handle on shore

PROJECT ROTRA VENITE

ShoreCONNECT Cuxhaven - RoRo



END USER

Niedersachsen Ports, Siemens Gamesa

WABTEC SYSTEM SCOPE

- 1 cable dispenser LV
- 3 cables

TECHNICAL INFORMATION

- 50 Hz
- Up to 750 kVA
- 440 V

WORKING RANGE

- Working range vertical plus hatch: +6,2m to -5m ???
- Working range horizontal: 4m

OPERATIONS

- 1 person needed to handle dispenser
- No physical power needed to handle on shore

SHORECONNECT VARIANTS

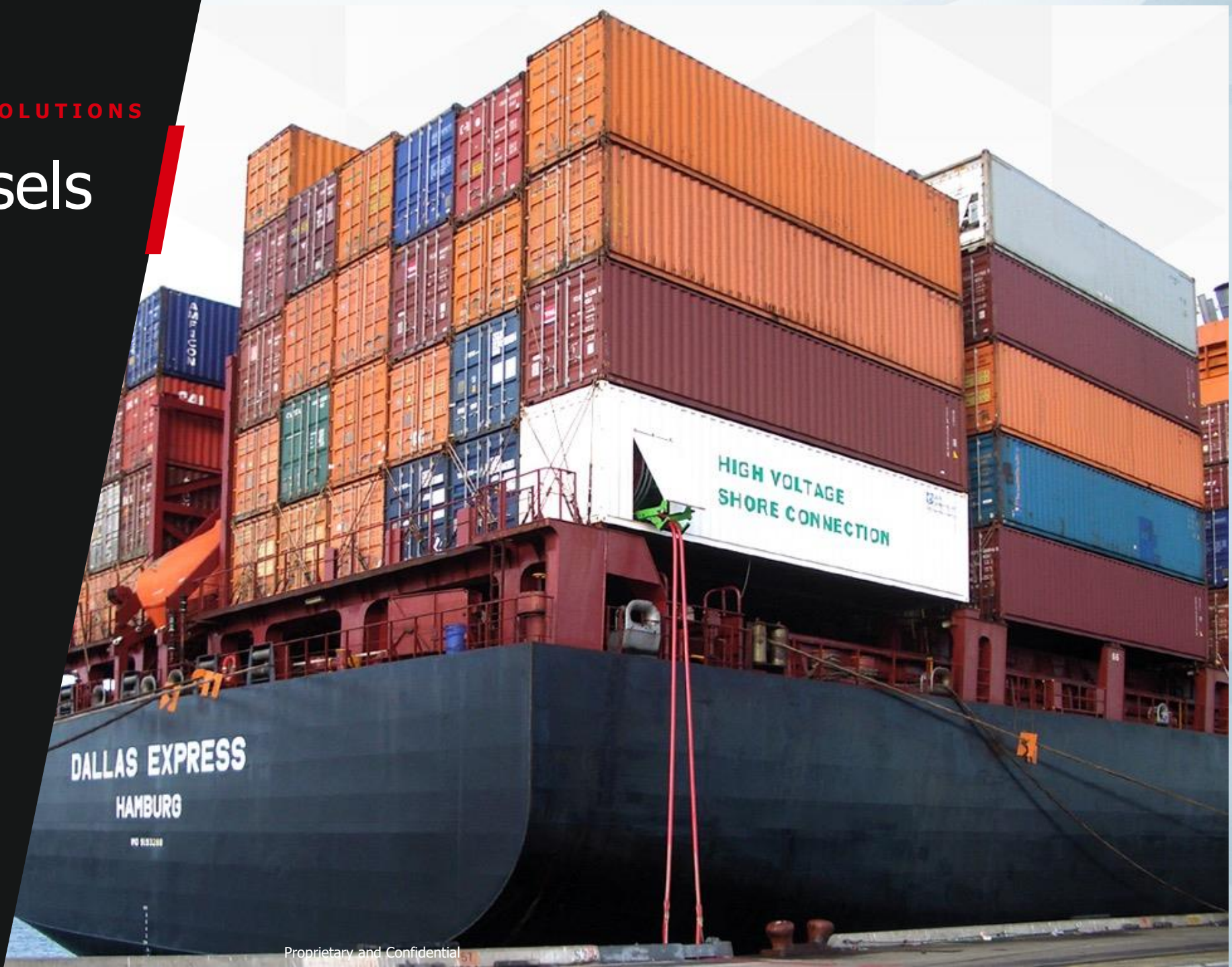
Low Voltage Cable Reel, Triple Spiral

...for various vessels types



ONSHORE POWER SUPPLY SOLUTIONS

Container Vessels



SHORECONNECT

Container cable reel

...for container vessels



RATED POWER

2x 350 A @ 6,6 kV

OPERATIONAL CABLE OUTPUT:

1 up to 35 m

HV CABLE

2x 3x185mm²+PE+(5x2,5)C+12x62,5/125

CABLE OUTPUT SPEED

10 m/min

SCOPE OF SUPPLY

- Cable reel incl. cable
- Plug incl. plug cover
- Roller track

SHORECONNECT

Cable Reel Container Systems

...for various vessels types

The feed of the onshore power supply for container vessels is realized for example by the installation of a 40 ft. HC-container in the bottom storage row.

The system consists of a spiral cable reel with slip ring assembly and fibre optic rotary connector incl. the drives for the reel and the extension system of the roller conveyer.





NEXT GENERATION TECHNOLOGIES

RailConnect™



Wabtec improves the global quality of life by accelerating the movement of freight and commuters in the most safe, efficient and sustainable way.

NEXT GENERATION TECHNOLOGIES

RailConnect™

...is the backbone operational system for railroads of all sizes and operations, for automating, scheduling and managing the day-to-day operations of the railroad.

...provides visibility & tracking of Railcars.

...breaks down the immense amount of data in the industry into a manageable application.

...ensures revenue protection for each traffic cycle.

...is a set of turnkey products, integrated for simplicity and ease of use.



Complete Control at Our Fingertips...

RailConnect Product Suite Overview



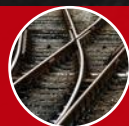
EQUIPMENT EMS

- CHP/CHR
- CHMS
- RVP(+)



REVENUE RMS

- RCM
- Freight/JS (R)
- IC/Switch Charges (T)
- Demurrage/
Storage (T)
- Non-Trans (T)
- RMMS (R)



OPERATIONS TMS

- Waybill mgmt.
- Trains/Schedules/SP
- Yard management
- IC management
- mCrew



MAINTENANCE EY

- CRB
- MMS
- EHS
- EY Mobile



COMMS EDI

- X12/TrainII
- XML/JSON/CSV/T94/S2
92
- MQ/FTP/sFTP
- eBOL
- RCM/REN
- Etc...

Advanced Analytics / Business Intelligence (AA/BI)

RAILCONNECT™

By the Numbers

96%

North American Fleet is moved through **RailConnect**

9M+

Carloads moved Annually through TMS

520

Railroads on TMS (Class I, II & III , Regional & Terminals)

270

Railroads using mCrew (4K+ Users)

6,200+

TMS/RMS Users

60B+

Bytes Sent via EDI annually

3,300+

RCI/RVP Shippers (9K+ Users)

1484

Interchanges with Class I's



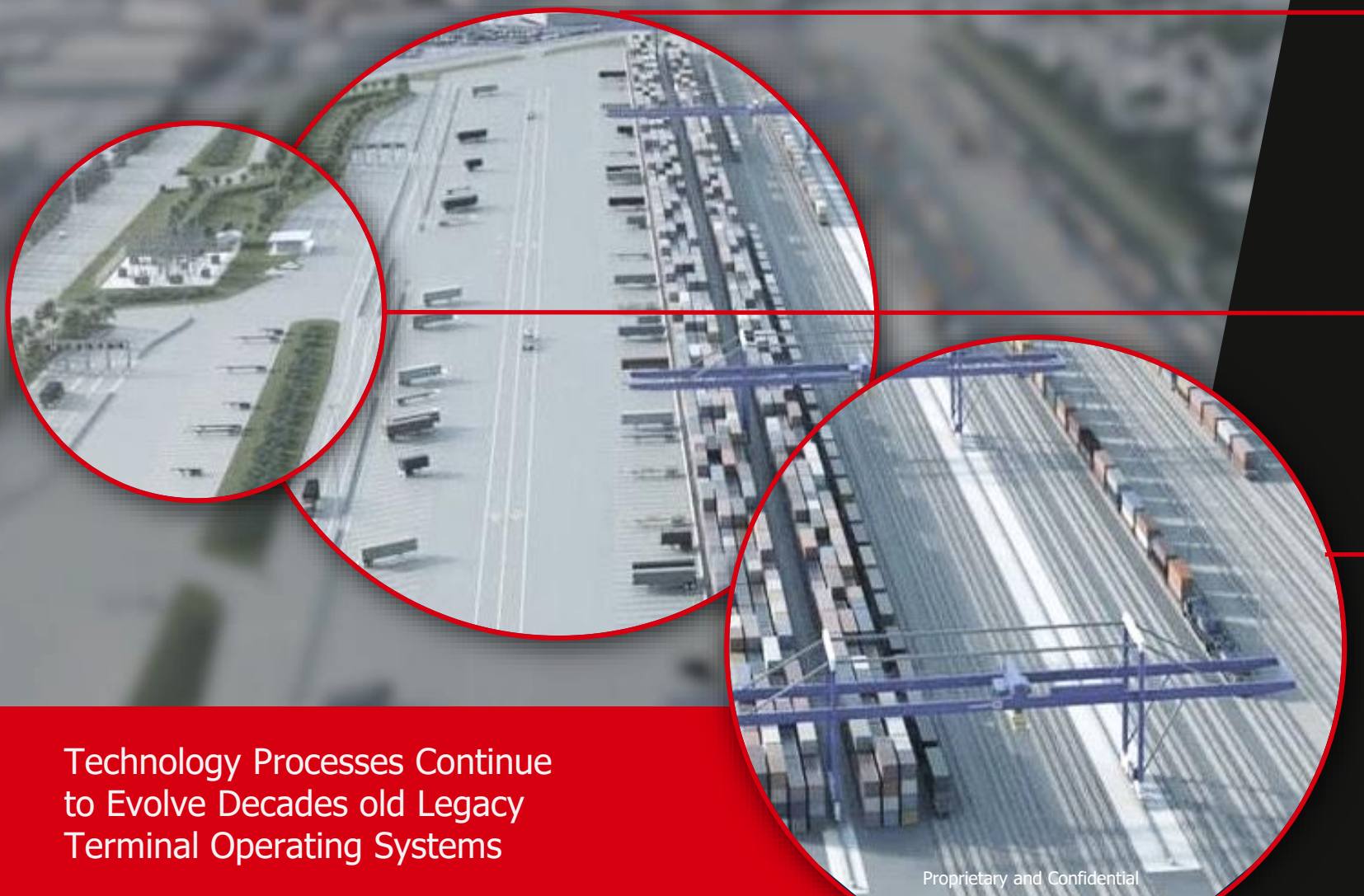


NEXT GENERATION TECHNOLOGIES

Next Gen TOS

A Modernized Terminal Operating Solution from Wabtec

Intermodal Terminals Operations Landscape



YARD OPERATIONS

- Inventory Management
- Stacked & Conventional Ops
- WSC & RTG Lift Equipment
- Container Handling Equipment

GATE OPERATIONS

- Ingate/Outgate
- Automated Gates
- Kiosks

RAIL / RAMP OPERATIONS

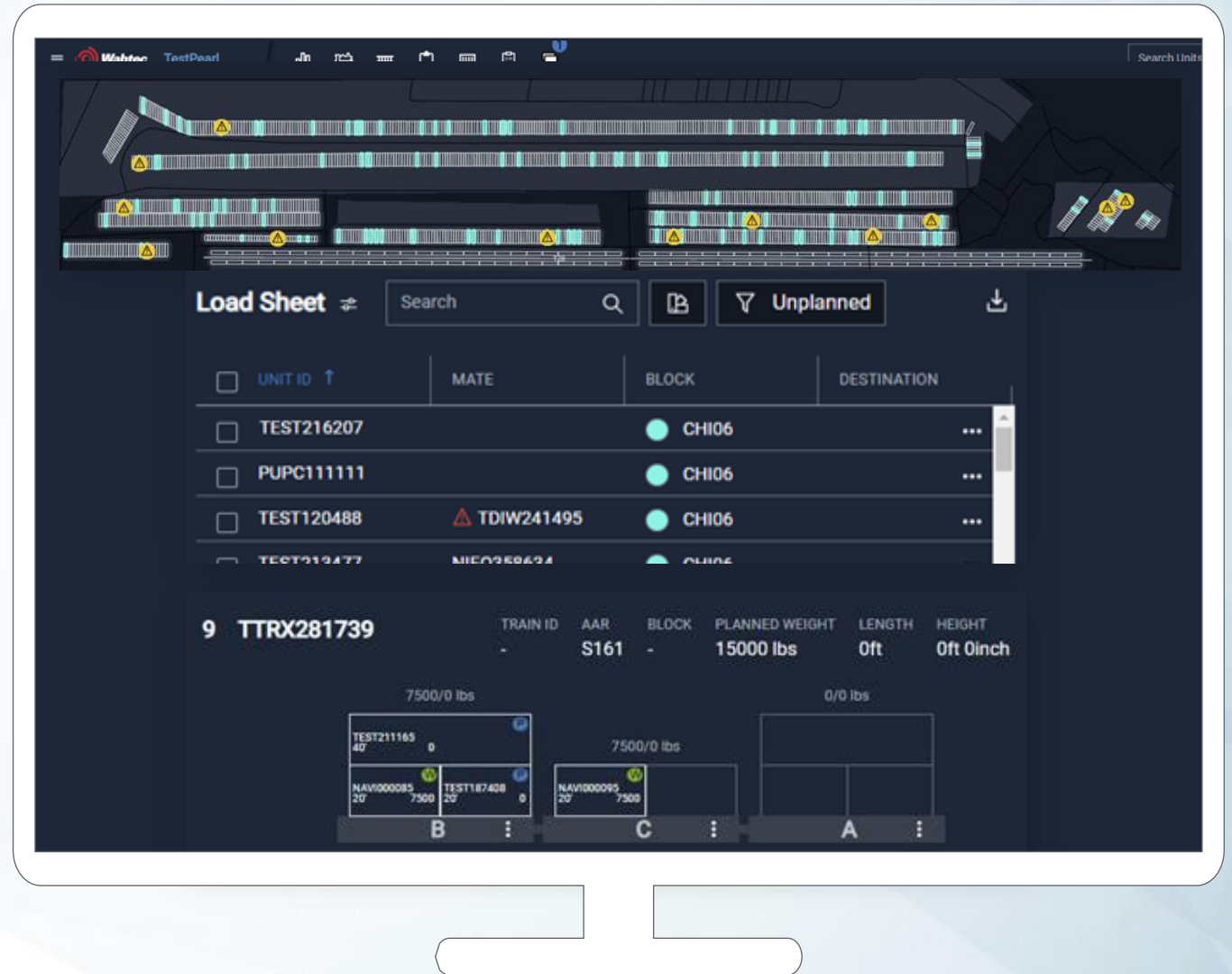
- Loading/Unloading
- Wide Span Cranes
- Rubber Tired Gantry

Technology Processes Continue
to Evolve Decades old Legacy
Terminal Operating Systems

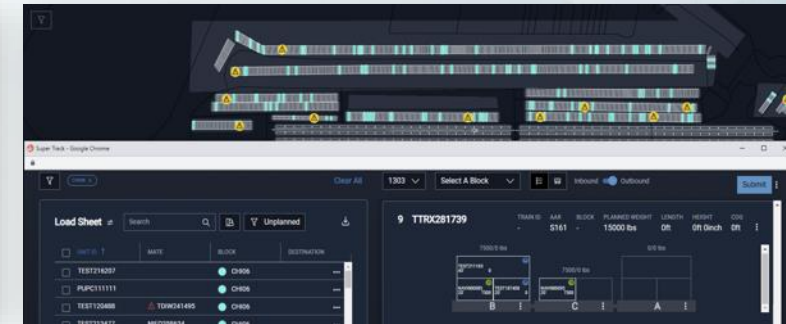
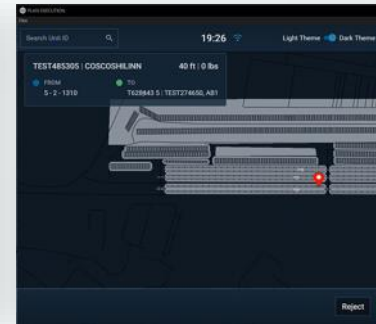
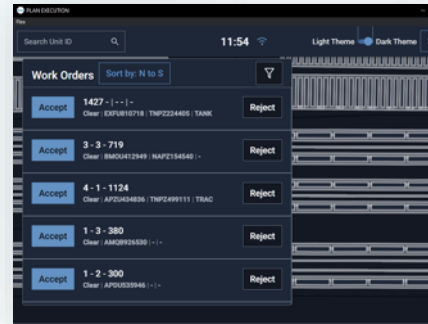
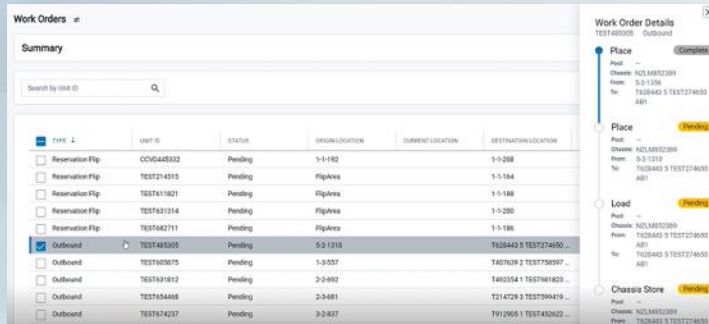
NEXT GEN TOS

A Look Ahead at Next Gen Terminal Operating System (NGTOS)

- Web-based, simple navigation
- Multi-tenancy for all terminals
- Dark & Light Themes (key for VMU operators)
- Mobile access via laptops, tablets & smart-phones
- Modernized, cloud-based infrastructure
- Real-time data feed updates
- Intuitive load planning interface
- Load Sheet & Railcar Profile View for planning
- Optimized bulk-load planning
- Map Based Interactions
- Real-time monitoring of VMU FLEX app
- Offline Mode



Modernization for the Industry



Work Order & Equipment Management

- Add, Manage & Monitor Equipment & Resources
- Work Order Management allows work to allocated to Hostlers & Cranes via FLEX
- Task level visibility of work orders – Place unit, Load Unit, Clear Chassis

Hostler & Crane Work Order Management

- Operators have web-based system
- View and filter on Work Orders available by Track, Train ID and Task Type
- Search for a unit and perform work
- Simple map-based location shows Operator where to move unit (location icon and details).
- Work Orders completed location updates feed NGTOS in real time

Dynamic Load Planning








- Quick and seamless drag and drop planning of units to railcars with a railcar profile view
- Units and Railcars can also be viewed in Inventory and Track Modules with edit capabilities
- Units and railcars are visible on a dynamic map allowing for zoom capabilities and unit detail views

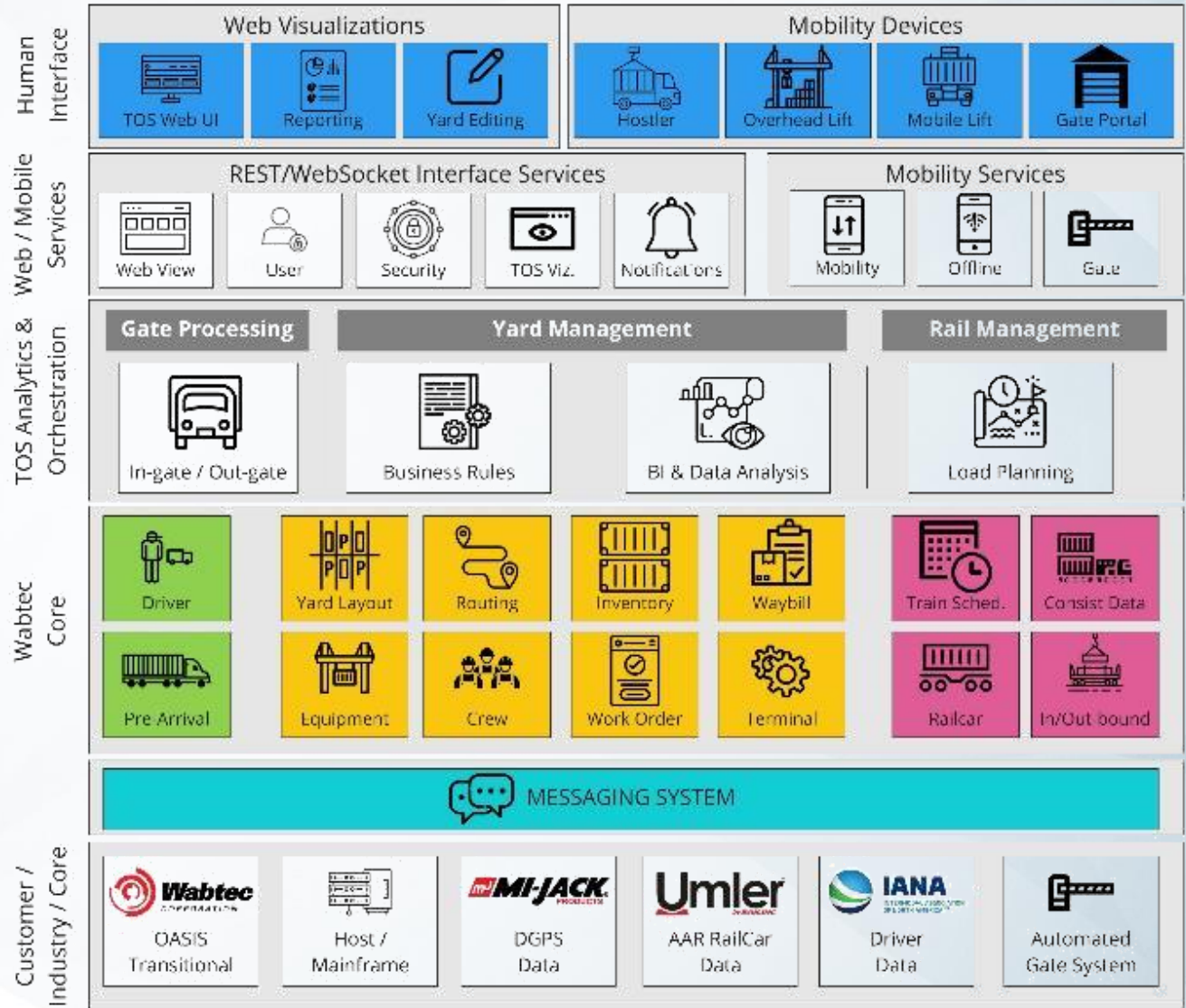
Web-based & Simple Navigation

Real-time intermodal management software with **simple systems usability** to provide **data driven decision making tools** that support **Rail, Yard, and Gate** operations

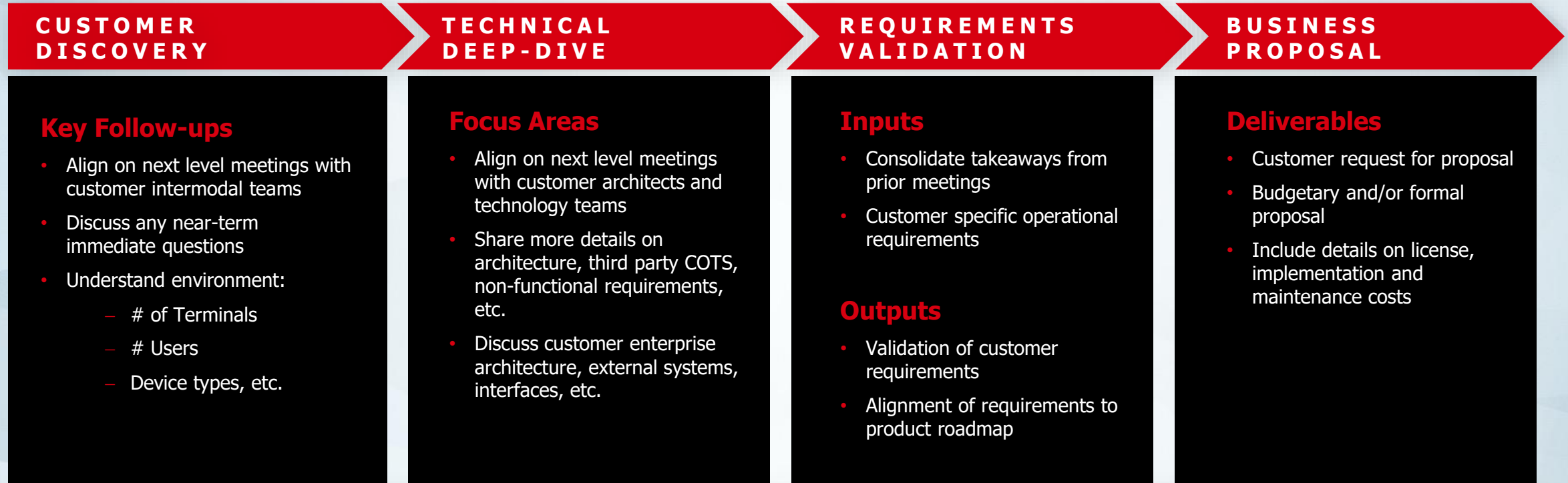
NEXT GEN TOS

Modern Architecture

-  Containerized Cloud Native Architecture
-  Desktop & Tablet Web-Based UI
-  Multi-tenant
-  Highly Available
-  Scalable
-  Modular, Portable/Sustainable
-  External Systems Integration & Ingestion



Next Steps: Engagement Model & Approach



Continuous customer feedback loop along the journey to adapt and validate product fit

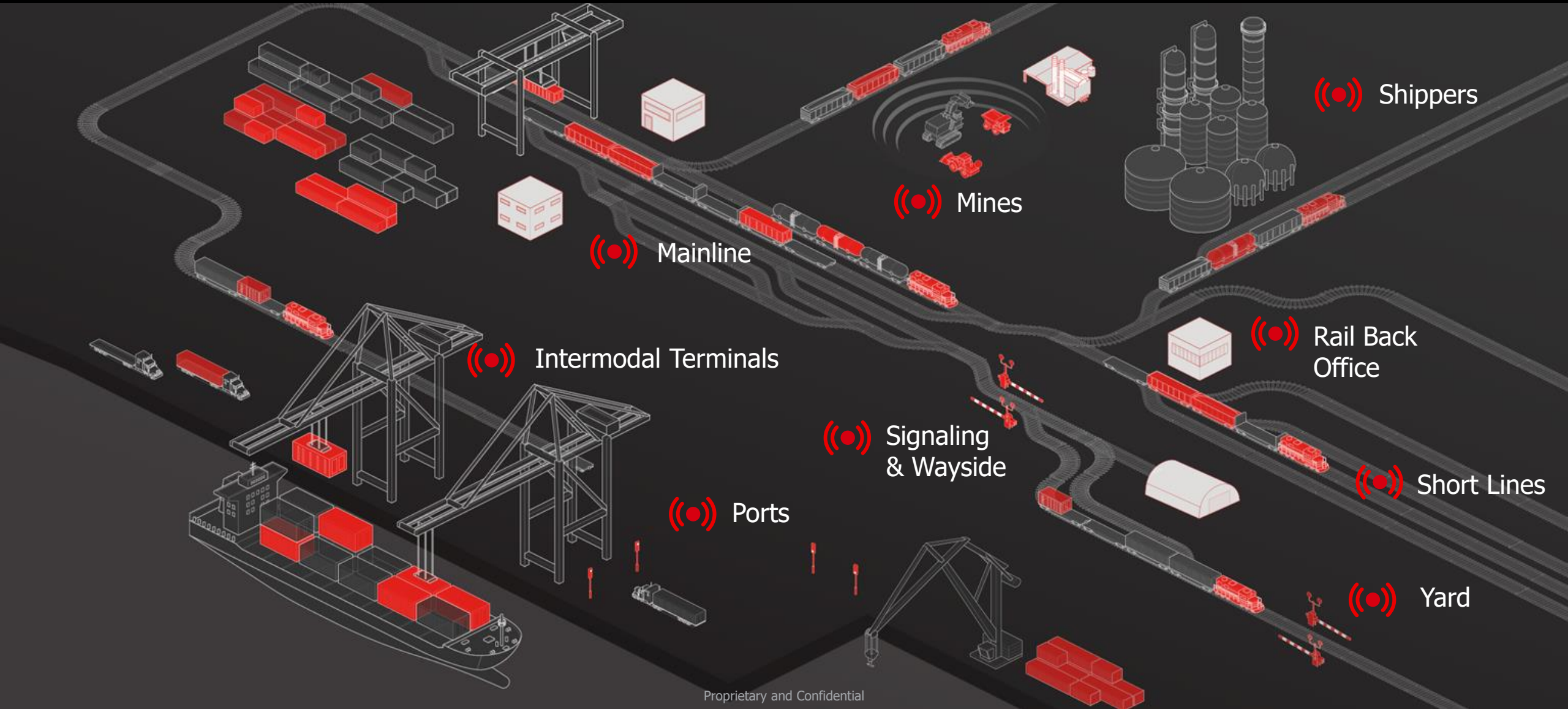


NEXT GENERATION TECHNOLOGIES

Port Optimizer

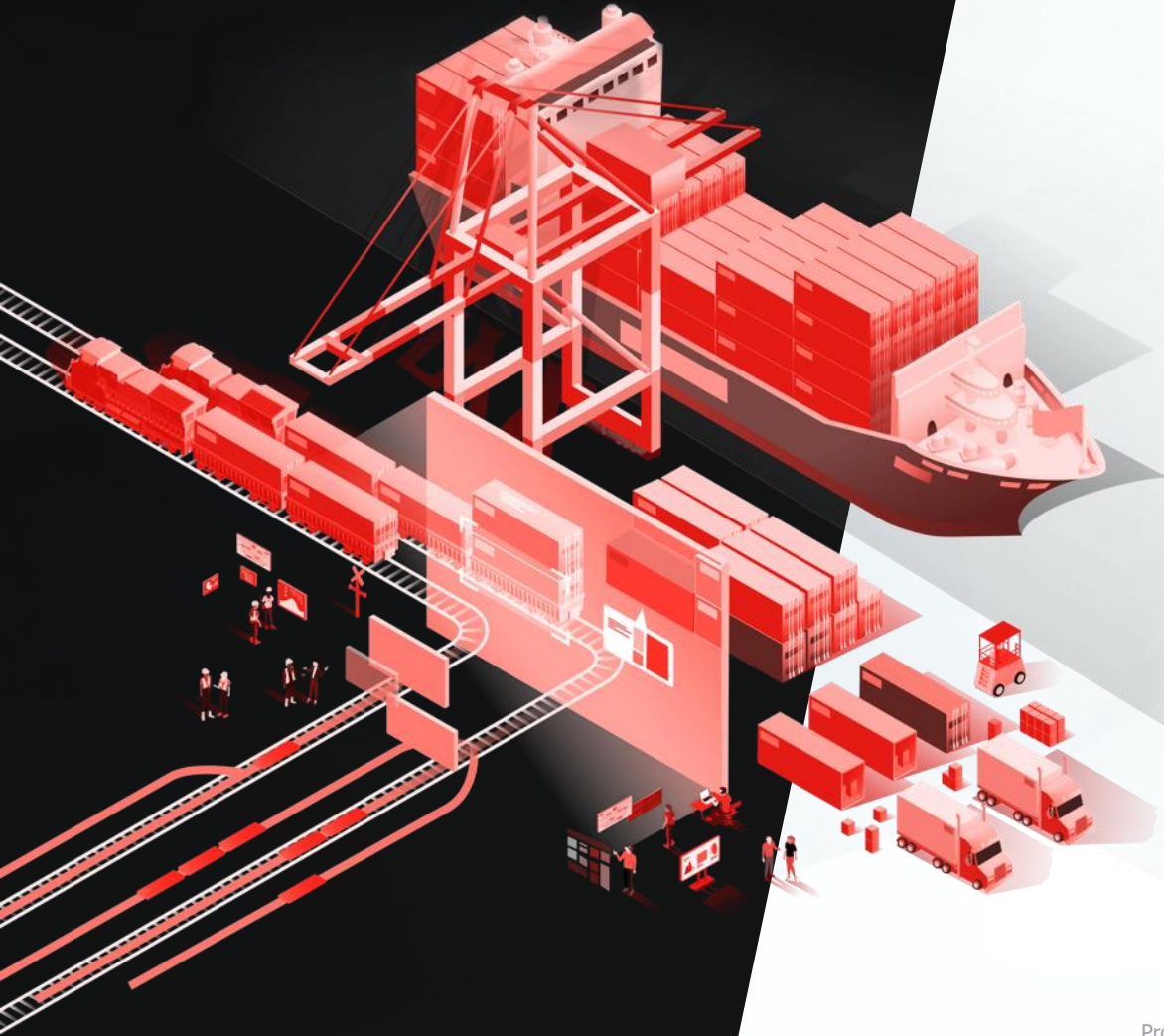


Connecting the physical + digital rail logistics network



WABTEC

Transforming the supply chain through digital



ASSET TRACKING

Vessel & Container Visibility for equipment management & resource planning

CONTAINER MANAGEMENT

Aggregation of data from shipping line & terminals to provide near real-time updates

ANALYTICS KPIs

Actionable insights into terminal operations, container dwell, availability status

WABTEC

A Foundation to Digitization



Track & Trace: Marine Terminal, Railroad, and Multiple Inland Terminals with Imports/Exports

100+ Data Feeds and growing

Multiple lane cargo tracking with real-time visibility of cargo as it moves via rail

Port Authority Control Tower allowing for macro data KPIs

Accessible through **Modern UI and API** connections

Collaborative Partnership since 2016

All Port Optimizer Products deployed

- Control Tower: Operational insights for improved planning
- Track & Trace: Real-time container tracking with 15+ day advanced visibility
- Integrated Supply chain for Port Stakeholders

Project Scope

- 12 Terminals
- 15+ Vessel Operators
- US Customs and Border Protection
- 1100+ Trucking Operators

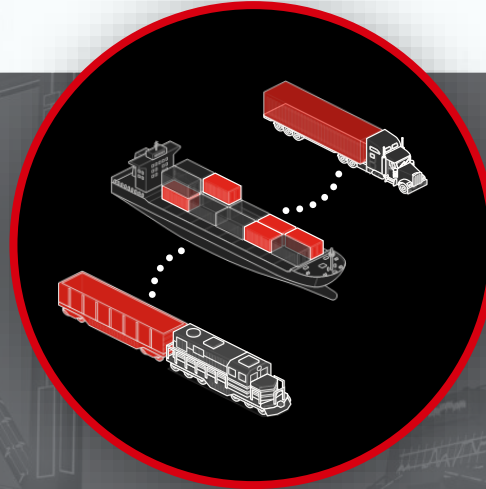
Goal: Increase supply chain performance

- Increase Visibility
- Improve Predictability and Reliability
- Increase Throughput

Road to Digital Supply Chain



**CARGO
VISIBILITY**



**CARGO
OPTIMIZATION**



**GREEN
INITIATIVES**

Track & Trace

- Real-time container tracking from Marine Terminal to Inland Terminal
- Import and Export Visibility
- Container specific details including ETA/Holds/Availability

Marine and inland terminal container tracking

Cargo Overview

9037 Total	4107 Imports	4916 Exports	14 Domestic	466 Available	116 Holds
----------------------	------------------------	------------------------	-----------------------	-------------------------	---------------------

PRIORITY	HOLDS	CONTAINER NO	LAST EVENT	EVENT DATE	TYPE	SIZE	DESTINATION	SHIPPING LINE	VESSEL NAME	VESSEL ETA/ATA
<input type="checkbox"/>	-	HLXU8114676	Discharged	07 Oct 16:46	Load	40HC	Göteborg	Hapag Lloyd	JAN	14 Oct 06:45
<input type="checkbox"/>	-	FCIU7498195	Outgated I...	07 Oct 16:46	Load	40HC	Hallsberg	Hapag Lloyd	JAN	22 Sep 18:50
<input type="checkbox"/>	-	UACU5919836	Outgated I...	07 Oct 16:42	Load	40HC	Hallsberg	Hapag Lloyd	JAN	22 Sep 18:50
<input type="checkbox"/>	-	HASU4631905	Outgated I...	07 Oct 16:24	Load	40HC	Hallsberg	Hamburg Süd	ELBSAILOR	28 Sep 06:30
<input type="checkbox"/>	-	TCLU6637680	Loaded to ...	07 Oct 16:20	Load	40HC	Göteborg	Hapag Lloyd	JAN	06 Oct 14:30
<input type="checkbox"/>	-	MRKU4437559	Outgated I...	07 Oct 16:13	Load	40HC	Hallsberg	Hamburg Süd	ELBSAILOR	28 Sep 06:30
<input type="checkbox"/>	-	CAIU8316260	Outgated I...	07 Oct 16:07	Load	40HC	Hallsberg	Hamburg Süd	ELBSAILOR	28 Sep 06:30
<input type="checkbox"/>	-	MSMU8586640	Discharged	07 Oct 15:57	Load	40HC	Göteborg	MSC	METTE MAERSK	10 Oct 06:30
<input type="checkbox"/>	-	MIEU3064701	Outgated I...	07 Oct 15:48	Load	40HC	Hallsberg	Maersk	MURCIA MAER...	02 Oct 08:15
<input type="checkbox"/>	-	TCNU2442666	On Ground	07 Oct 13:55	Load	40HC	Göteborg	Maersk	-	-
<input type="checkbox"/>	-	TRHU7289527	On Ground	07 Oct 13:55	Load	40HC	Göteborg	Maersk	-	-
<input type="checkbox"/>	-	MSKU0218066	On Ground	07 Oct 13:55	Load	40HC	Göteborg	Maersk	-	-
<input type="checkbox"/>	-	MEDU4829862	Outgated I...	07 Oct 13:37	Load	40HC	Hallsberg	MSC	MSC SHANNON	05 Oct 06:45

Container Details

FCIU7498195 | Trip: Göteborg to Hallsberg | Current Location: Outgated | Last Event: Outgated Inland Terminal | Event Date: 07 Oct | 16:46

No	-	Non-Hazardous	40HC
Train ID (Traffikverket)	Train Name	Wagon Number	Origin
49520	MIXEN221006U	378049513054	Göteborg
Train Departure (ETD/ATD)	Destination	Train Arrival (ETA/ATA)	
06 Oct 09:21	Hallsberg	06 Oct 13:43	
Vessel Name	Shipping Line	Voyage No.	Vessel Arrival ETA/ATA
JAN	Hapag Lloyd	635477	22 Sep 18:50
Port Terminal	Berth Name		
APMT	641		
Assigned To	Added by	Appt Status	Appt Slot

TRACKER

ON VESSEL → DOCKED → DISCHARGED FROM VESSEL → LOADED TO RAIL → ON RAIL → ARRIVED INLAND TERMINAL → OUTGATED INLAND TERMINAL

ON VESSEL: JAN, ETA: 22 Sep | 18:50
 DOCKED: APM TERMINALS, ATA: 22 Sep | 18:50
 DISCHARGED FROM VESSEL: APM TERMINALS, 22 Sep | 19:30
 LOADED TO RAIL: WAGON NO.: 378049513054, 06 Oct | 07:23
 ON RAIL: MIXEN221006U, 06 Oct | 09:21
 ARRIVED INLAND TERMINAL: HALLSBERG, ATA: 06 Oct | 13:43
 OUTGATED INLAND TERMINAL: HALLSBERG, ATD: 07 Oct | 16:46

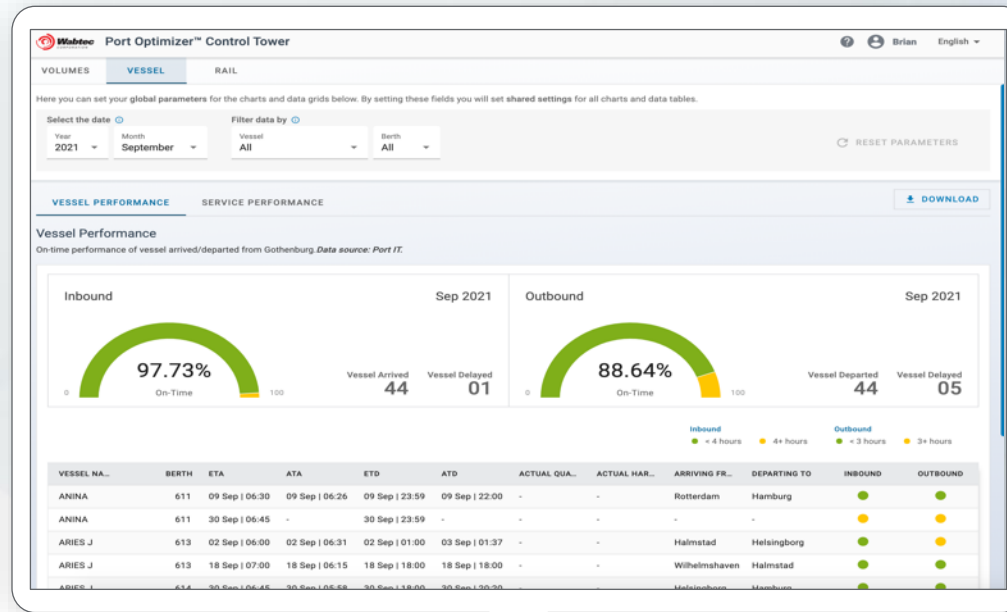
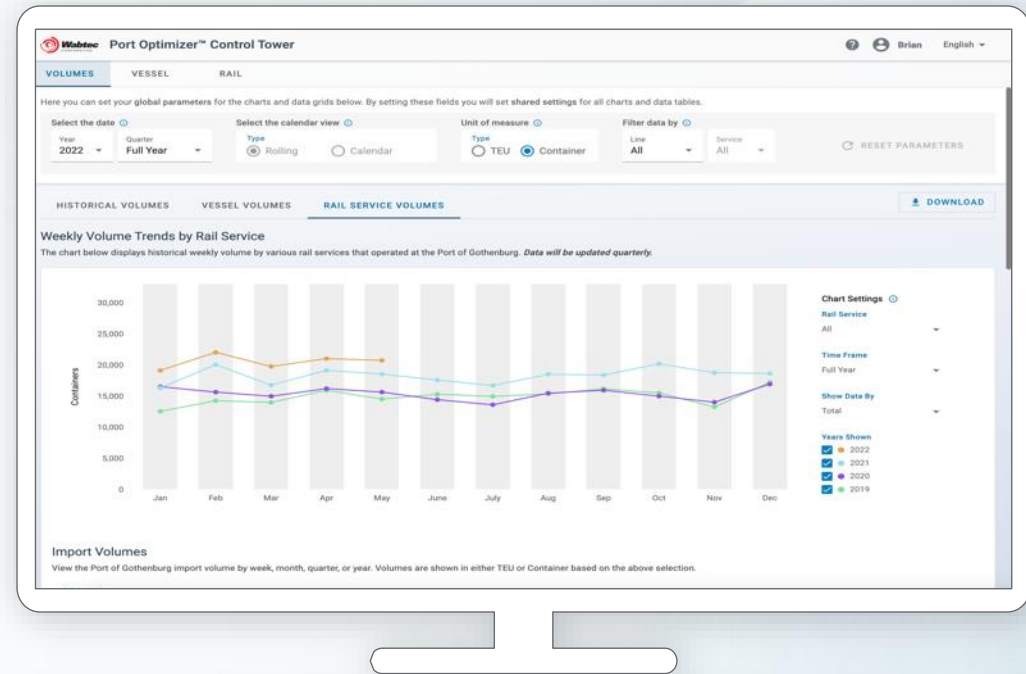
Container details: ETA, Holds, Availability

PORT OPTIMIZER

Cargo Optimization

- Dashboards designed to provide Port intelligence at a macro level
- Enable the Port to make decisions using real-time cargo data across multiple transportation modes
- Actionable KPIs and business intelligence

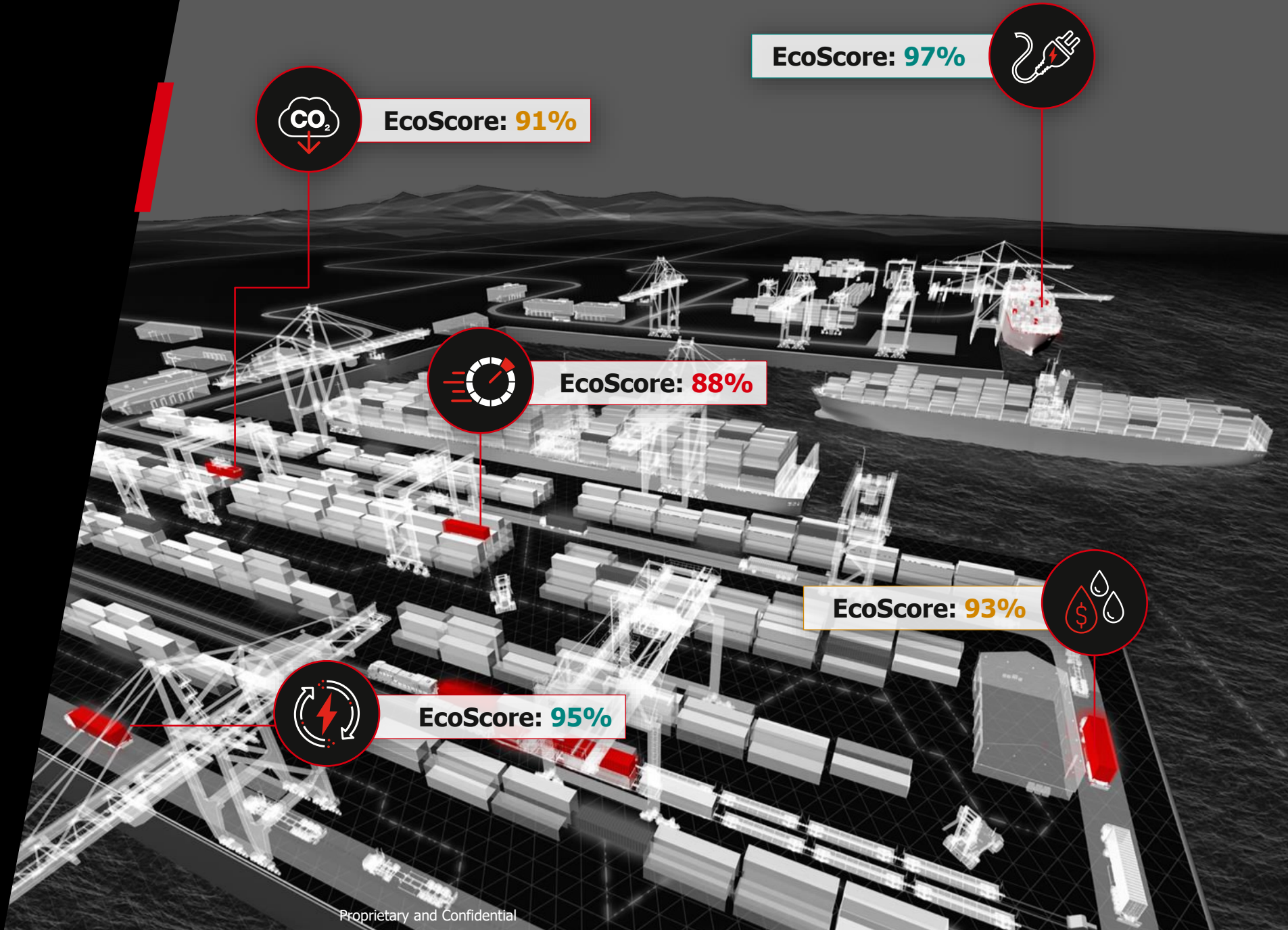
High-level Port Intelligence



Actionable KPIs

Green Initiatives

- Ability to use big data to establish greener cargo movements within the Port
- Better ability to understand the environmental impact of specific cargo moves
- Greater insights into ways to reduce carbon footprints



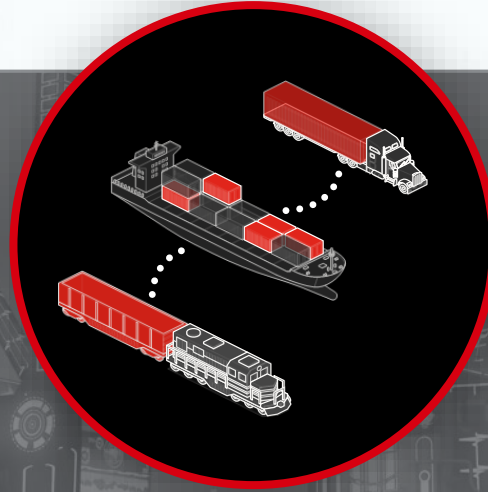
Port Optimizer

Road to Digital Supply Chain



CARGO VISIBILITY

Track & Trace
Control Tower
API Store



CARGO OPTIMIZATION

Energy
Optimization
Rate Optimization



GREEN INITIATIVES

Cargo Routing &
Supply Chain
Optimization

API Enhancement
Next-Gen
Optimization

NEXT GENERATION TECHNOLOGIES

Q&A



An aerial view of a port area, showing a large cargo ship docked at a pier. The ship is filled with stacks of containers. In the foreground, there are numerous stacks of containers and several cranes. The entire scene is overlaid with a semi-transparent red grid pattern.

HELPING TO CREATE THE NEXT GENERATION CARGO HUB

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