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DBTG 2024 | Day 2 | 14:30 – 14:50

Elevating Safety in Dry Bulk Terminals

Advanced Radar Solutions for Protecting Workers and Equipment in all Adverse Conditions

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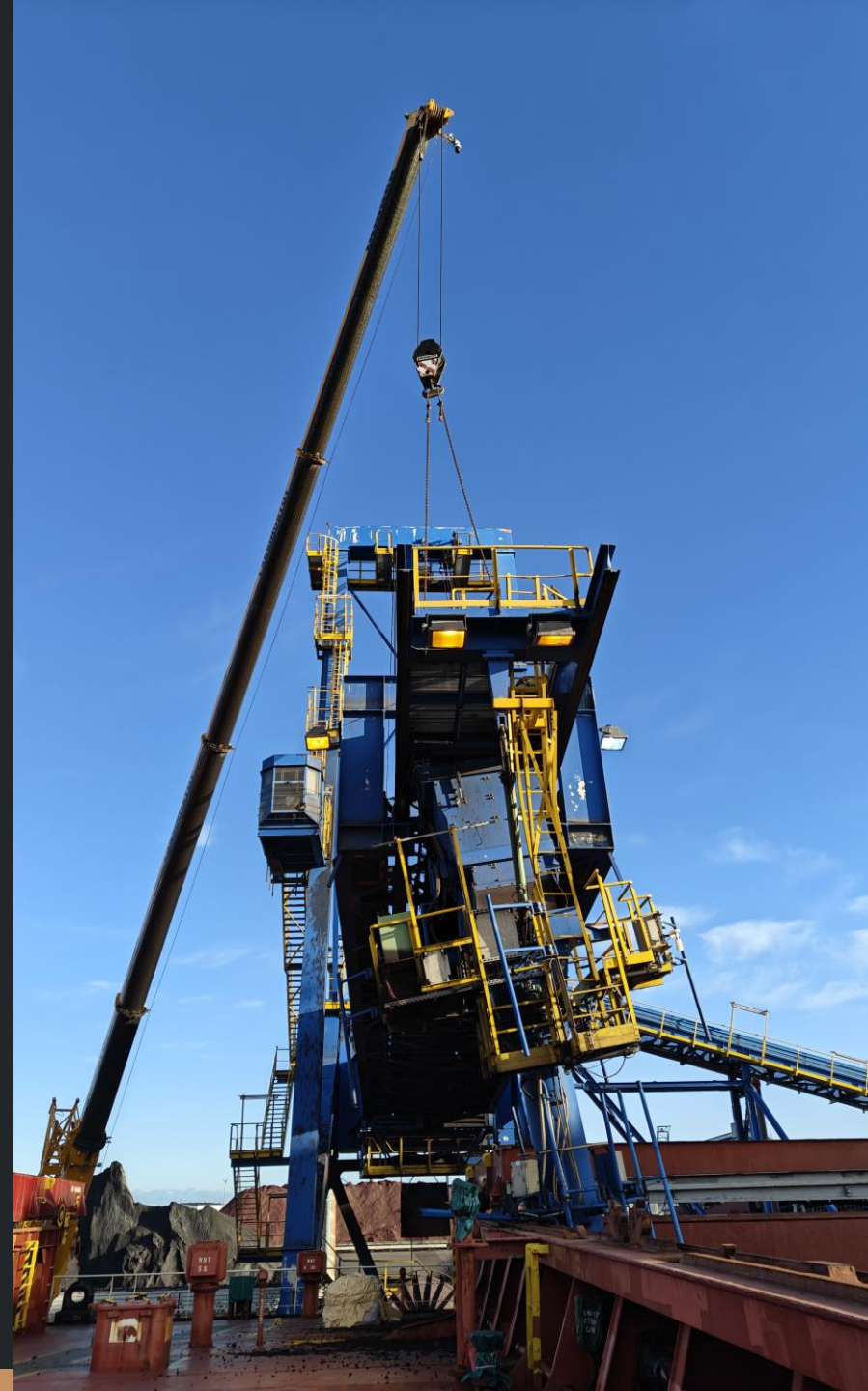
November 12th 2024

the industrial radar company | www.indurad.com

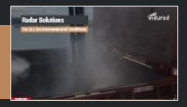


Agenda

Content Overview

1. Introduction to indurad

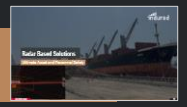
2. 3D Radar Technology



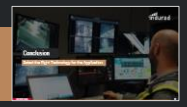
3. Industry Challenges

4. Case Study – Glencore

5. Safety Improvement Opportunities



6. Conclusion



7. Questions

About indurad

Born out of Mining – Build for Harsh Conditions

HIGH VALUE SOLUTIONS FOR MINES & PORTS

End-to-end from crusher via plant, train loading, stockyards to ship loading

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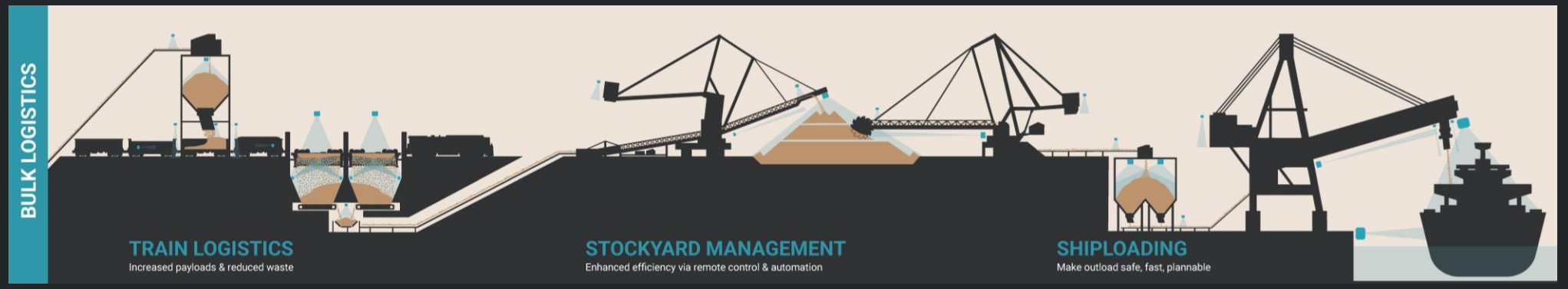
Anti Collision

Inventory Control

Positioning & Localization

Digitalization & IoT



Advanced Automation

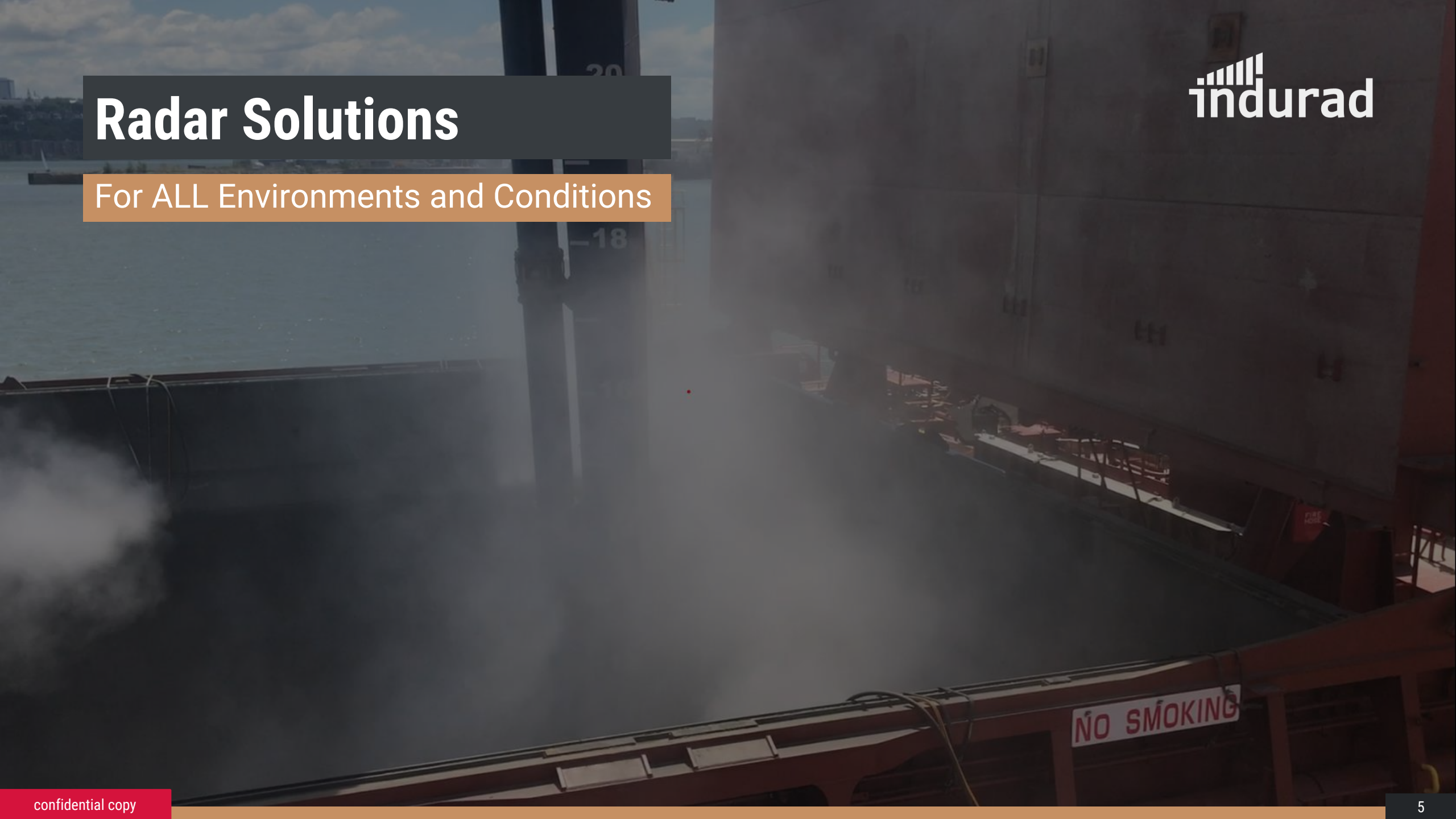
Process & Optimization

Operator Assistance

Remote Operation

Radar Solutions

For ALL Environments and Conditions



Radar Advantages

Reliability in all Conditions/Industries - ZERO housekeeping

Fully operational

Ideal Technology for Terminals

Radar is the most suitable technology for terminals and materials handling applications, proven to operate reliably in harsh conditions

		Radar	Laser
Rain		✓	✗
Snow		✓	✗
Heat		✓	✗
Dust		✓	✗
Fog		✓	✗
Contamination		✓	✗

"… your system runs like clockwork. Timex watches had this commercial: 'takes a lickin' and keeps on ticking'. Well, your system is like a Timex watch…"

- Engineer at Siemens Energy Services

Industry Challenges

The Case for Improving Safety

Container Gantry Crane Collapse at Keelung Port, Taiwan

Monday, Oct 14 2024

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Common Challenges

How do you address these Challenges in Challenging Conditions?

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1. Berthing of Vessels

- **Damage to Pier or Vessel:** Incorrect vessel positioning or poor maneuvering during berthing.
- **Equipment Damage:** Cranes, loaders, and unloaders positioned near the berthing zone.
- **Port Charges and Liability:** Financial penalties, compensation claims, Increase in insurance premiums, damage to vessels, or structural repairs.

2. Loading or Unloading Arm/Spout Protection

- **Collision with Vessel Hatch or Equipment**: Improper alignment or movement of the loading/unloading arm.
- **Material Spillage**: Not accurately positioned, spillage can occur, leading to loss of product, cleanup costs, and potential environmental hazards.
- **Downtime for Repairs**: Damage to loading spouts can halt operations until repairs are made, causing costly delays and reducing terminal throughput.

3. Boom Protection

- **Collision with Vessels**: The vertical or horizontal movement of booms without adequate collision detection systems can result in significant damage to both the vessel and the loader/unloader boom.
- **Damage to Adjacent Equipment**: Boom collision with cranes, other loading/unloading equipment, or vehicles.
- **Downtime, Repair Costs and Demurrage: Resulting in reputational damage and financial strain**.

4. Operator Fatigue and Negligence

- **Human Error**: Operators can make mistakes due to fatigue, stress, or distraction.
- **Safety Risks to Operators**: Without adequate protection systems, operators in cabins are vulnerable to accidents.
- **Increased Maintenance and Downtime**: Errors from fatigue or negligence lead to frequent equipment breakdowns and wear.

6. Long Travel of Rail-Bound Machines

- **Collision with People or Vehicles**: Rail-bound without adequate collision avoidance can pose a serious threat to workers and vehicles operating nearby.
- **Damage to Other Rail-Bound Equipment**: Stackers, reclaimers, and cranes on the same rail.
- **Operational Interruptions**: Accidents involving long-travel machines can bring entire loading/unloading operations to a standstill.

7. Mobile Machines Operating on Stockpiles

- **Collisions with Mobile Equipment**: May collide with trackless mobile equipment operating in and around stockpiles. Inadequate visibility or miscommunication between.
- **Risk to Infrastructure**: Trestles, feeders, and other infrastructure elements.
- **Limited Operator Visibility**: Limited or restricted visibility to operators of large machines.

Case Study – Successful History

Seeing through Water Spray, Dust, Fog, Rain and Snow

Customer Testimonial

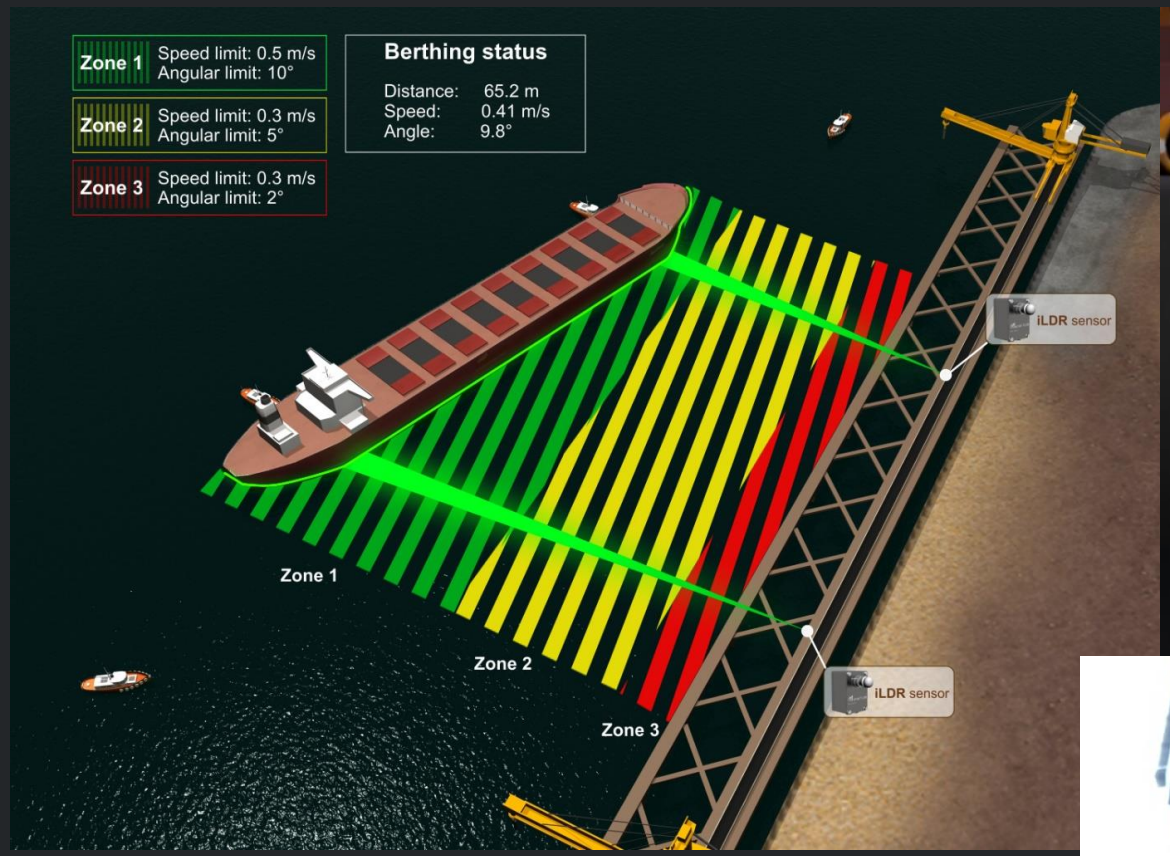
Glencore: Rusty Hopper (P. Eng) Engineering Specialist

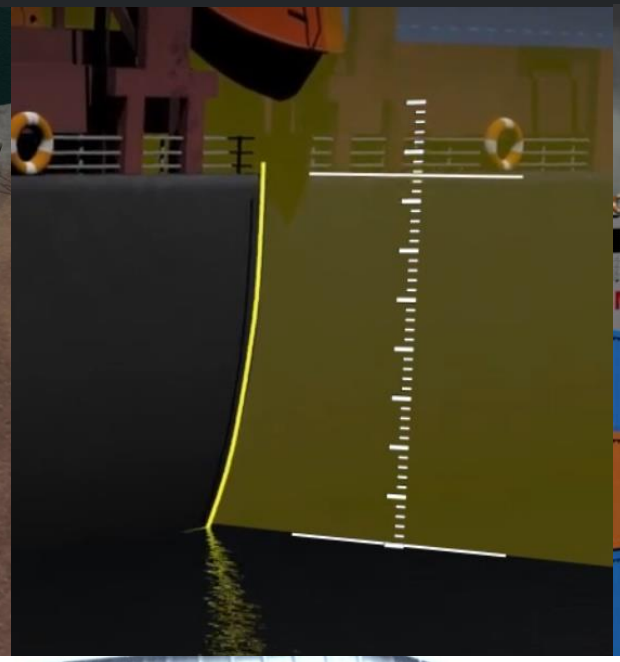
Radar Based Solutions

Ultimate Asset and Personnel Safety

Berthing Solutions

Distance | Ship Drifting Off Wharf | Tide Measurement | Visualization



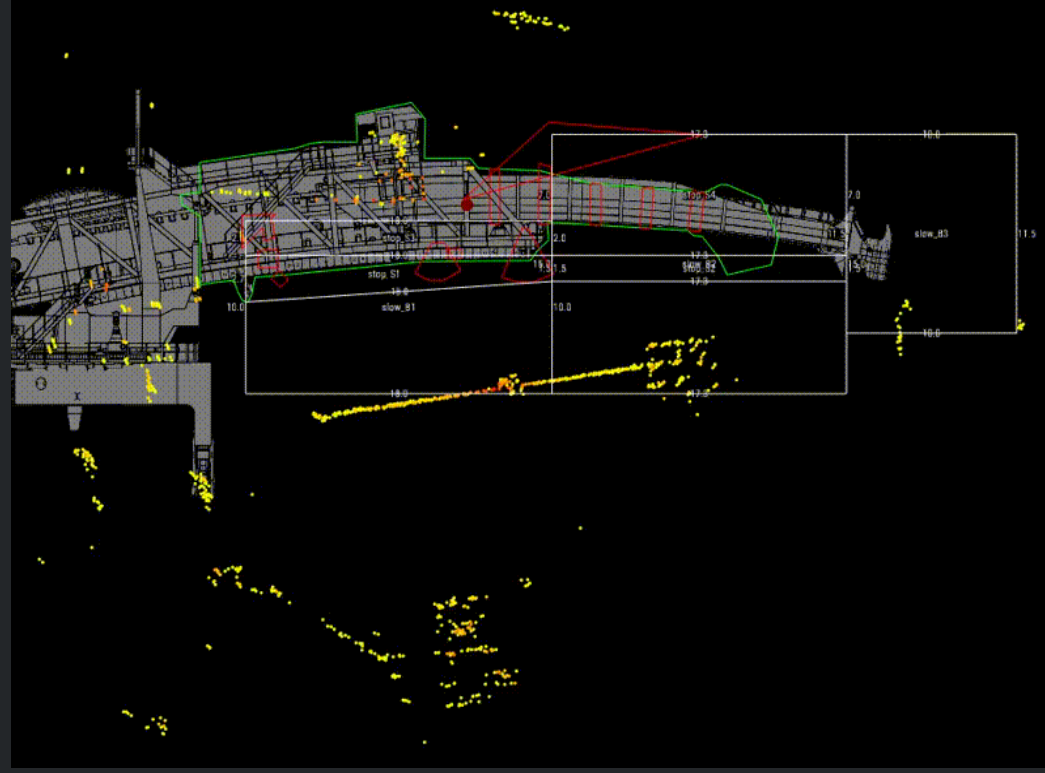


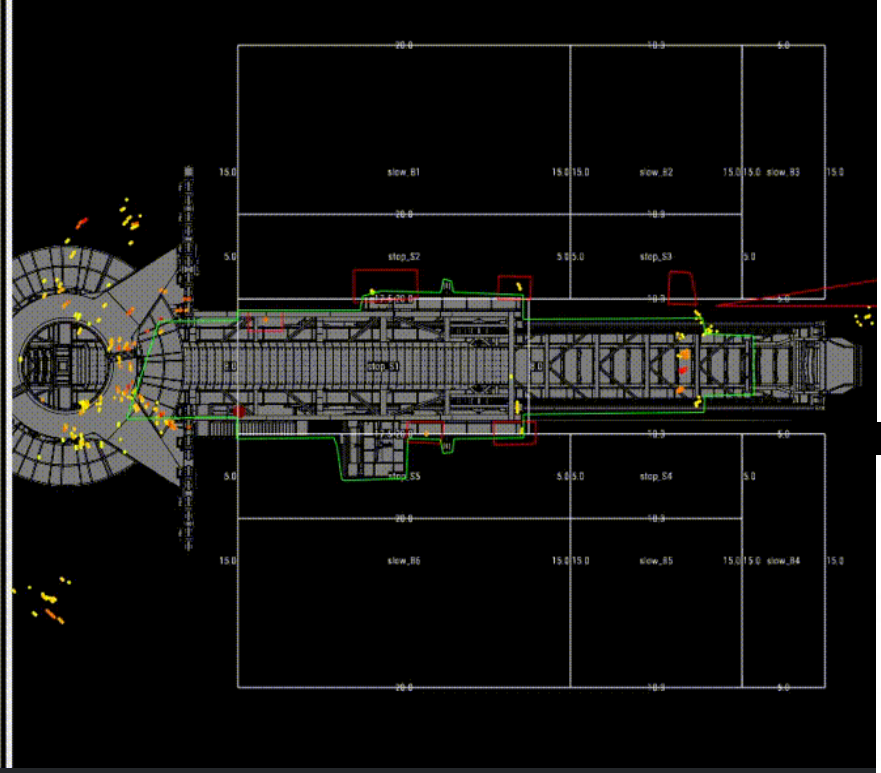
https://www.youtube.com/watch?v=jELfhMvbYc4&feature=youtu.be

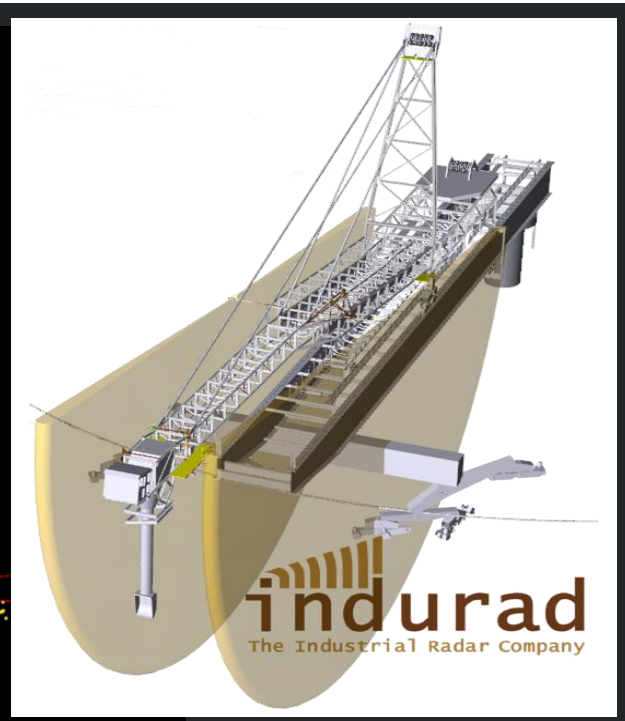
2D Boom Collision Avoidance (Under and Sides)

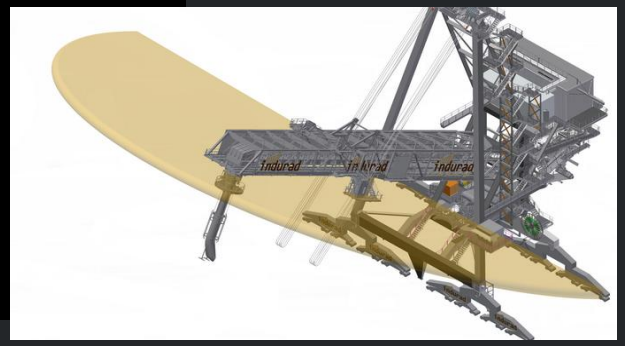
2D CAS Zone configuration for Telescopic Booms & Chutes

Boom to Vessel
Boom to other Infrastructure
Boom to Vehicles









1D/2D Shiploader Spout Protection

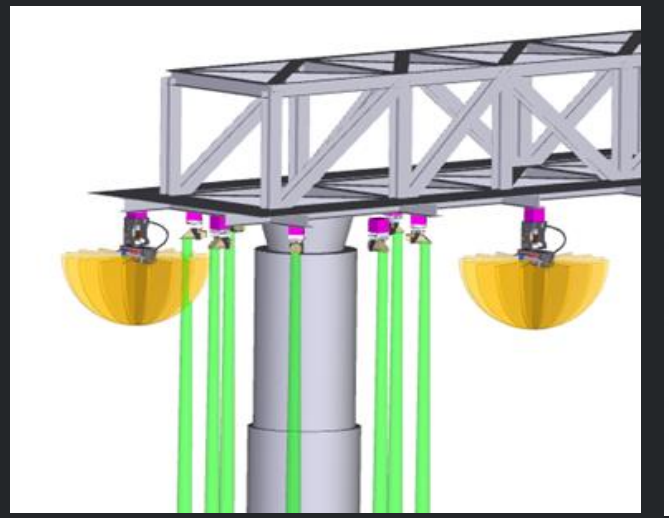
High Accuracy, High Range Linear Dynamic Radar

1D or 2D distance around the spout

- Usually, 4-8 sensor required
- Real time & low latency (20ms measurement interval)
- Warnings, signaling the operator to stop movement <- e-Stop for spout
- Prevents from collisions between spout with hatch egdes

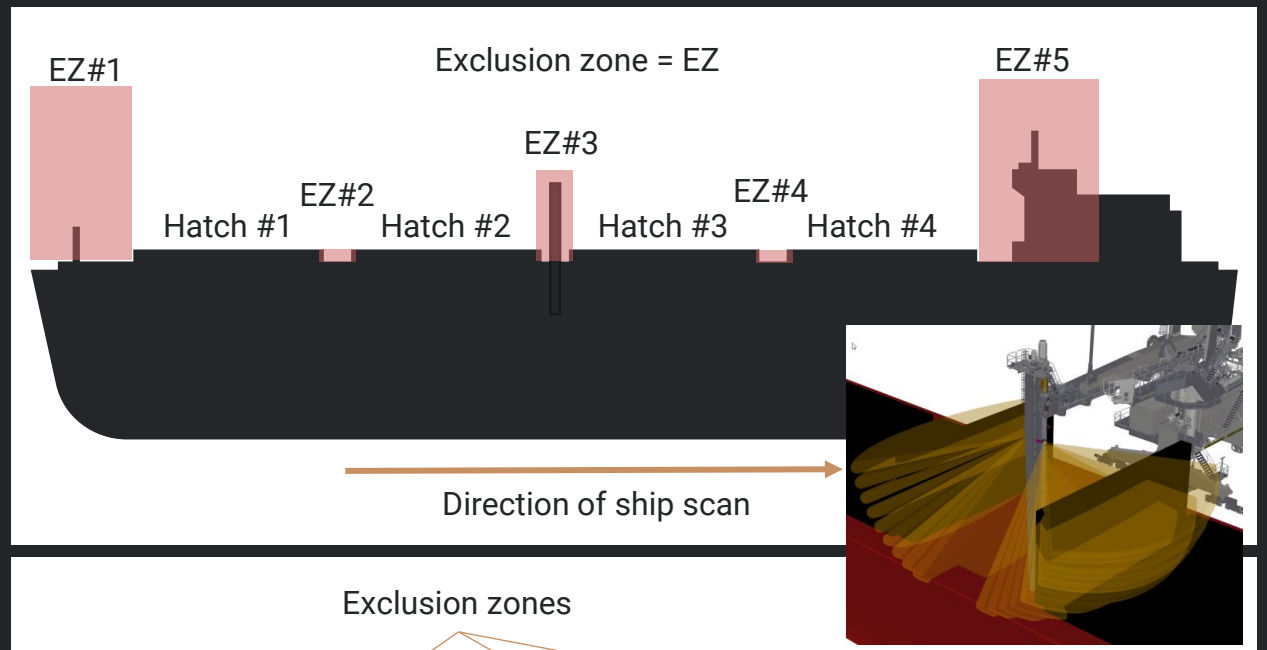
Transmitting signals to PLC

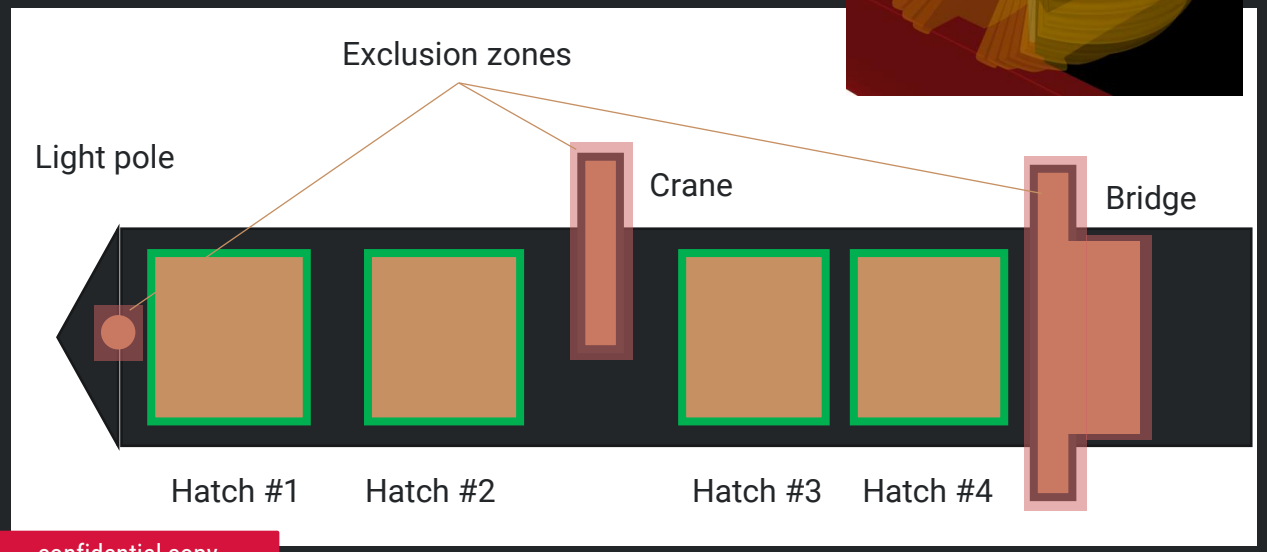
- via defined interface
- Status bits per sensor
- Status bit CAS Spout System
- Distances



2D/3D Mapping of the Deck (Vessel)

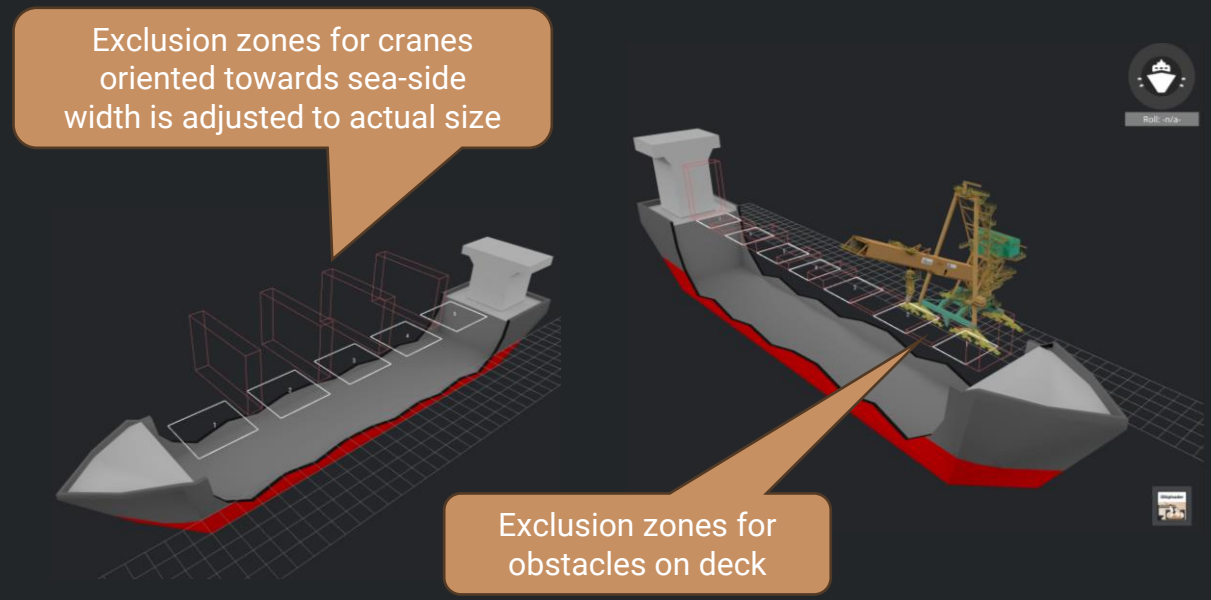
Creating of 3D Exclusive Zones





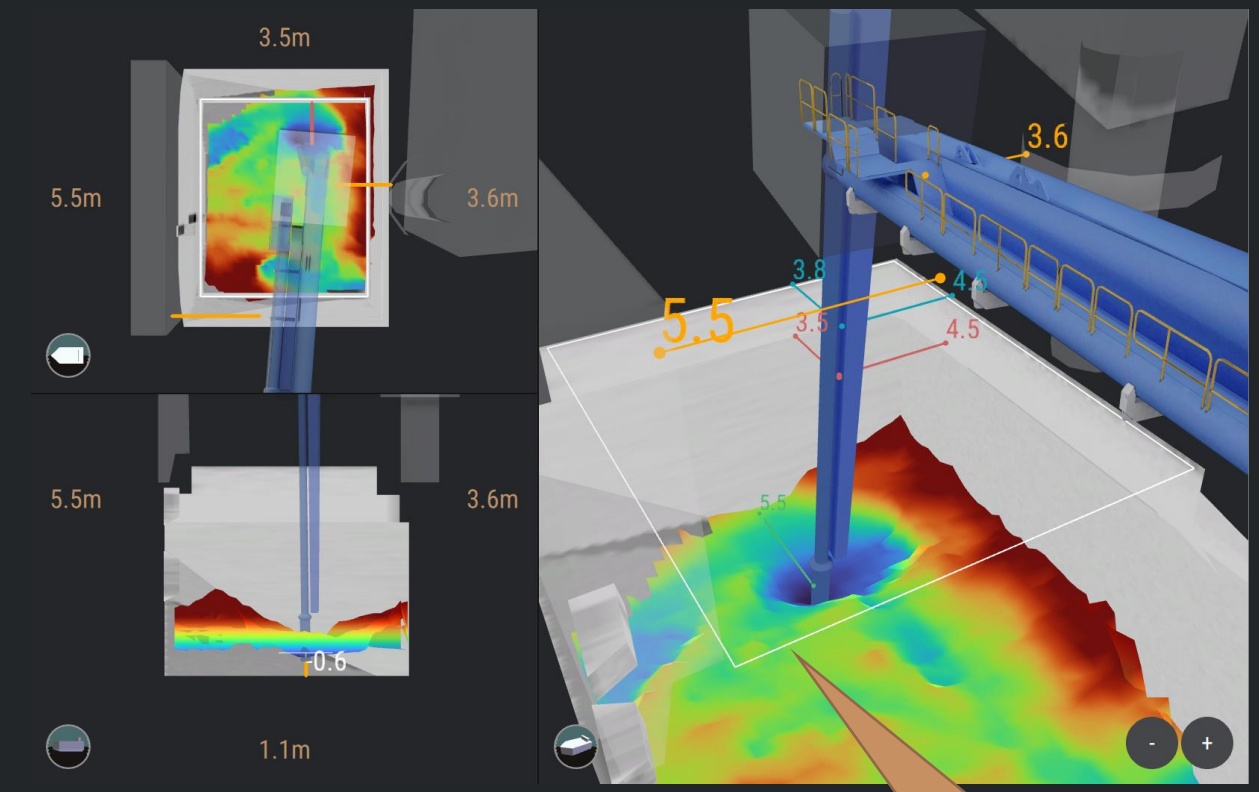
Operator interactions

- Enter key vessel data (PLC HMI):
  - Vessel ID
  - Total # of hatches
  - Select vessel type a) sliding hatches or b) folding hatches
  - Select position of bridge in relation to berth: bridge on left side or right side
- Drive to position of hatch #1 (manually or by entering the waypoint in the PLC)
- Start scan (via PLC HMI)
- Verify scan results of first and last hatch (iOAU) and confirm (PLC HMI)



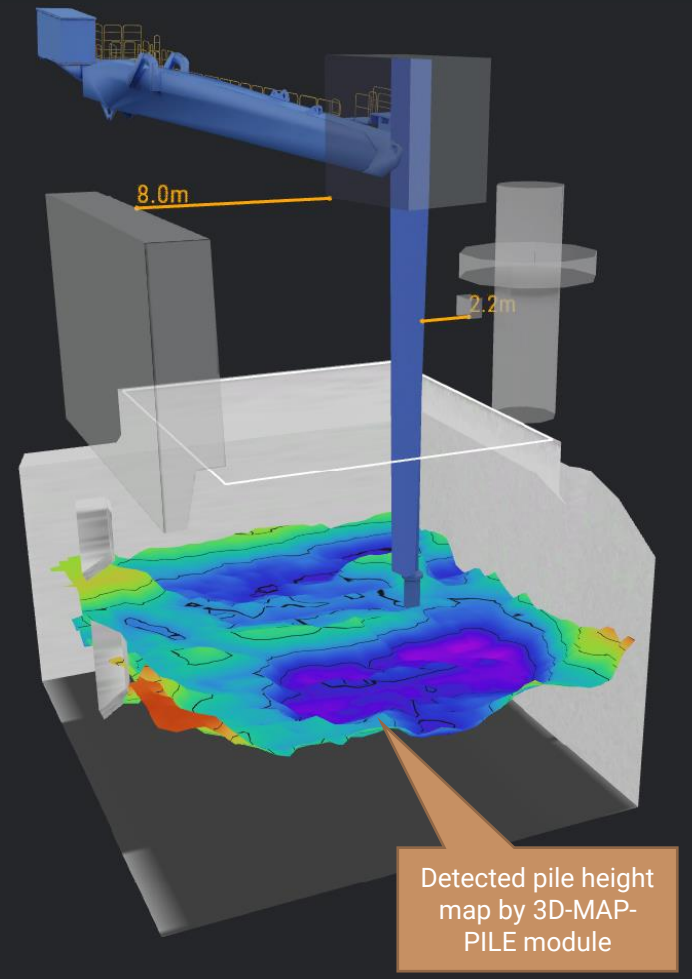
3D Hatch Collision Avoidance

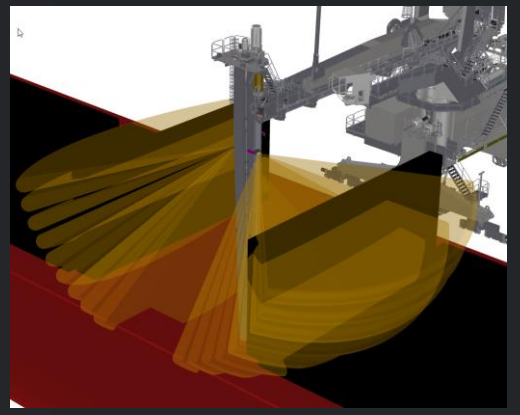
Multilayered Safety and Visualization | Advanced Operator Assistance

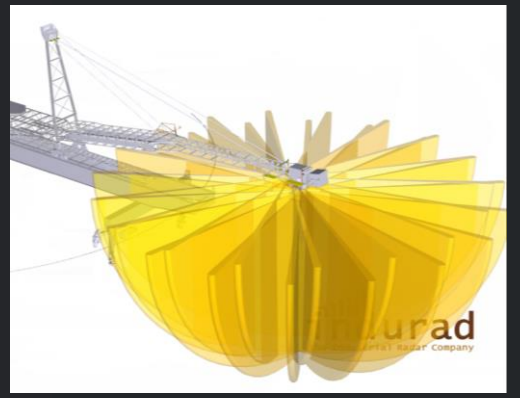


Visualization of Distances to Hatch

Detected hatch by 3D-MAP-HATCH module





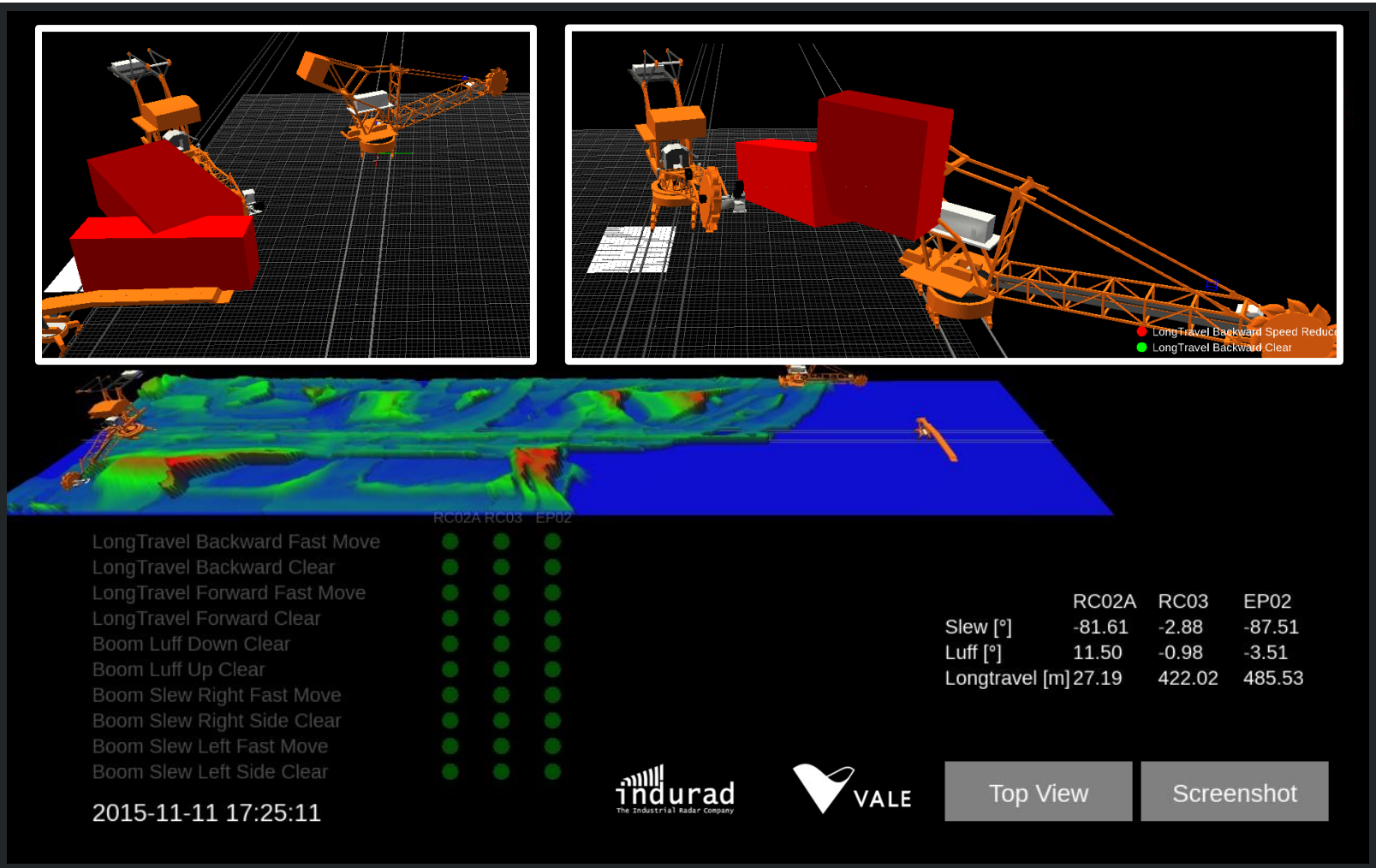


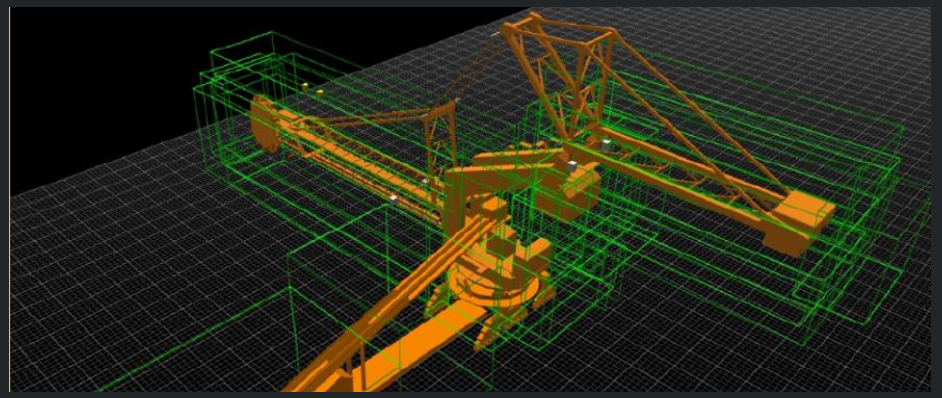
Detected pile height map by 3D-MAP-PILE module

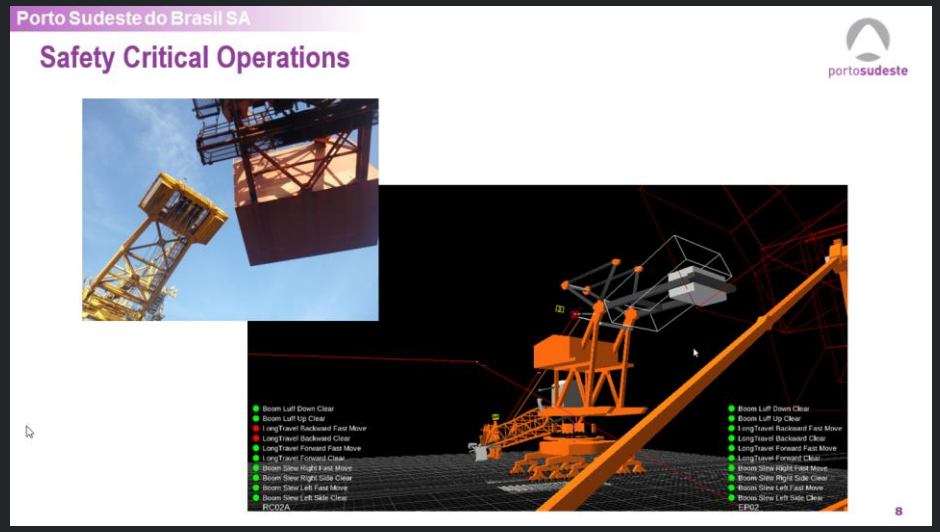
Distances to Deck Objects and Pile

GNSS Machine 2 Machine/Object 3D CAS

Inclusive for Shiploaders/Unloaders and Stockyard Machines

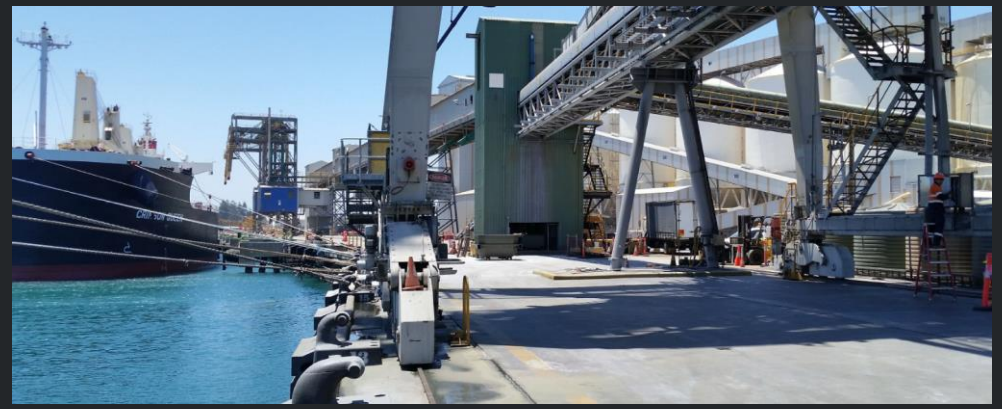


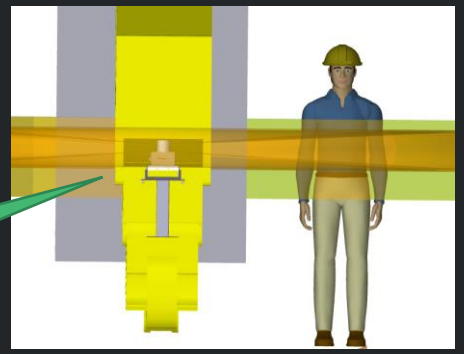




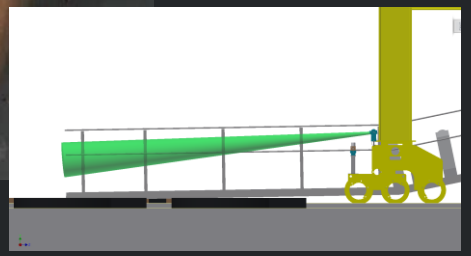
Rail Collision Avoidance

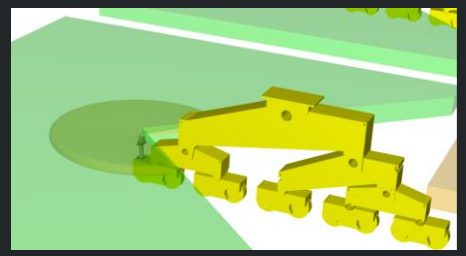
Protecting People, Vehicles and Equipment





Person filtered by 2D zone and alarm will be avoided





Safety for Vehicles & Persons on Stockyards

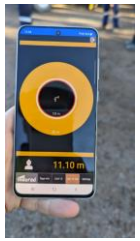
Localization with iRTT/GNSS

RTLS Localization Anchors

- ✓ Sync latency (<1ns)
- ✓ Increased # of tracking participants
- ✓ Improved accuracy (distance error <10cm)
- ✓ TDOA/AOA/PMU/TOA

Operator Display

- ✓ Low latency
- ✓ off the shelf hardware
- ✓ Modernised Qt QML GUI
- ✓ Android App (LV)
- ✓ Thick Client (HV)



Equipment Tags

- ✓ Sync latency (<1ns)
- ✓ Easy M12 sockets
- ✓ Enhanced tracking accuracy
- ✓ All Ethernet (except vehicle CAN)

Personnel Tags

- ✓ Refined reliability
- ✓ Lamp integrated
- ✓ Inductive charging

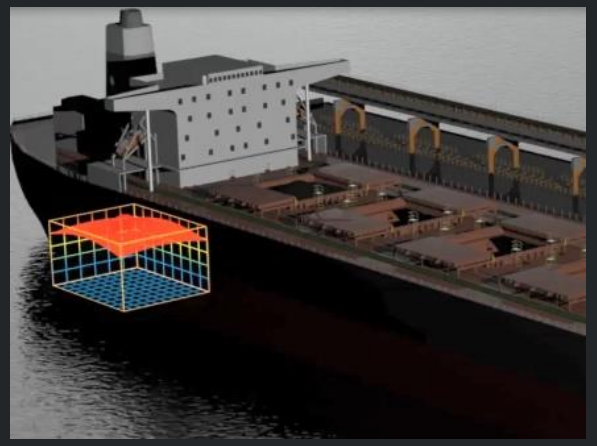
Central processor

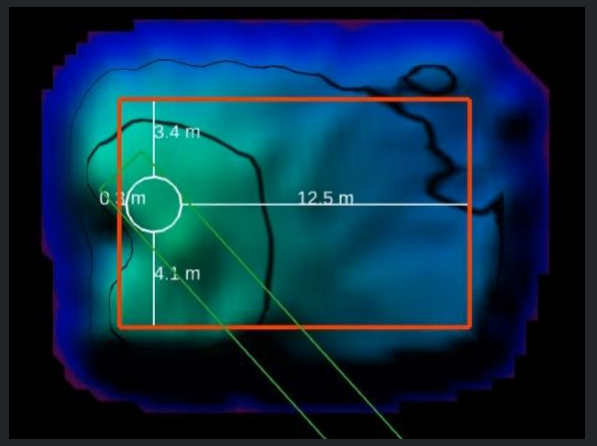
- ✓ off the shelf sourcing
- ✓ Easy to replace
- ✓ High Power & Slim
- ✓ Enhanced connectivity (WLAN, Bluetooth, LTE)

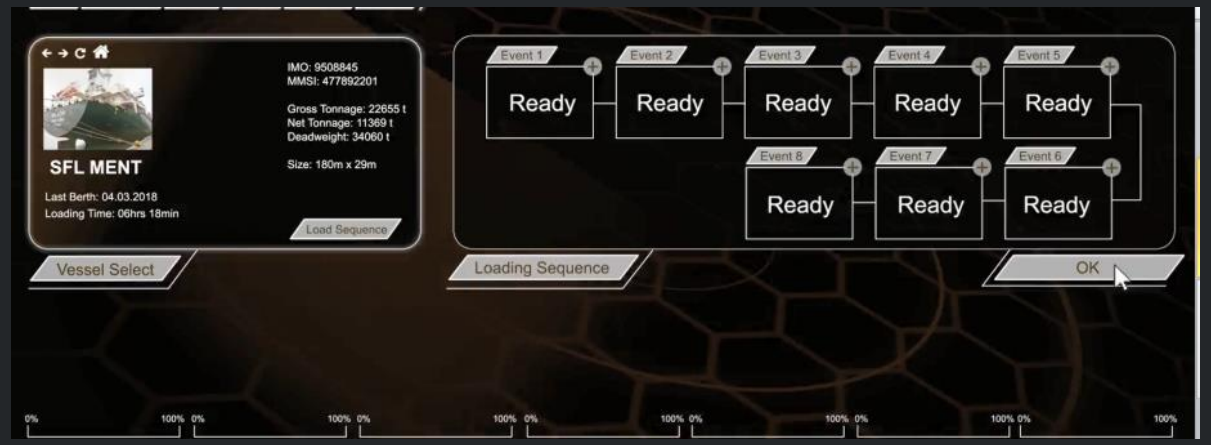
Teleremote Operation

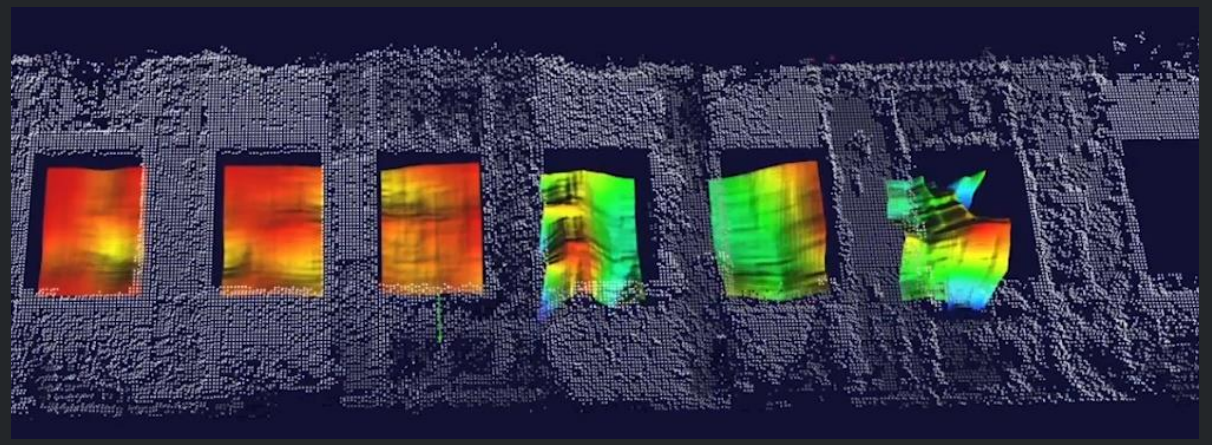
Shiploader Full Automation

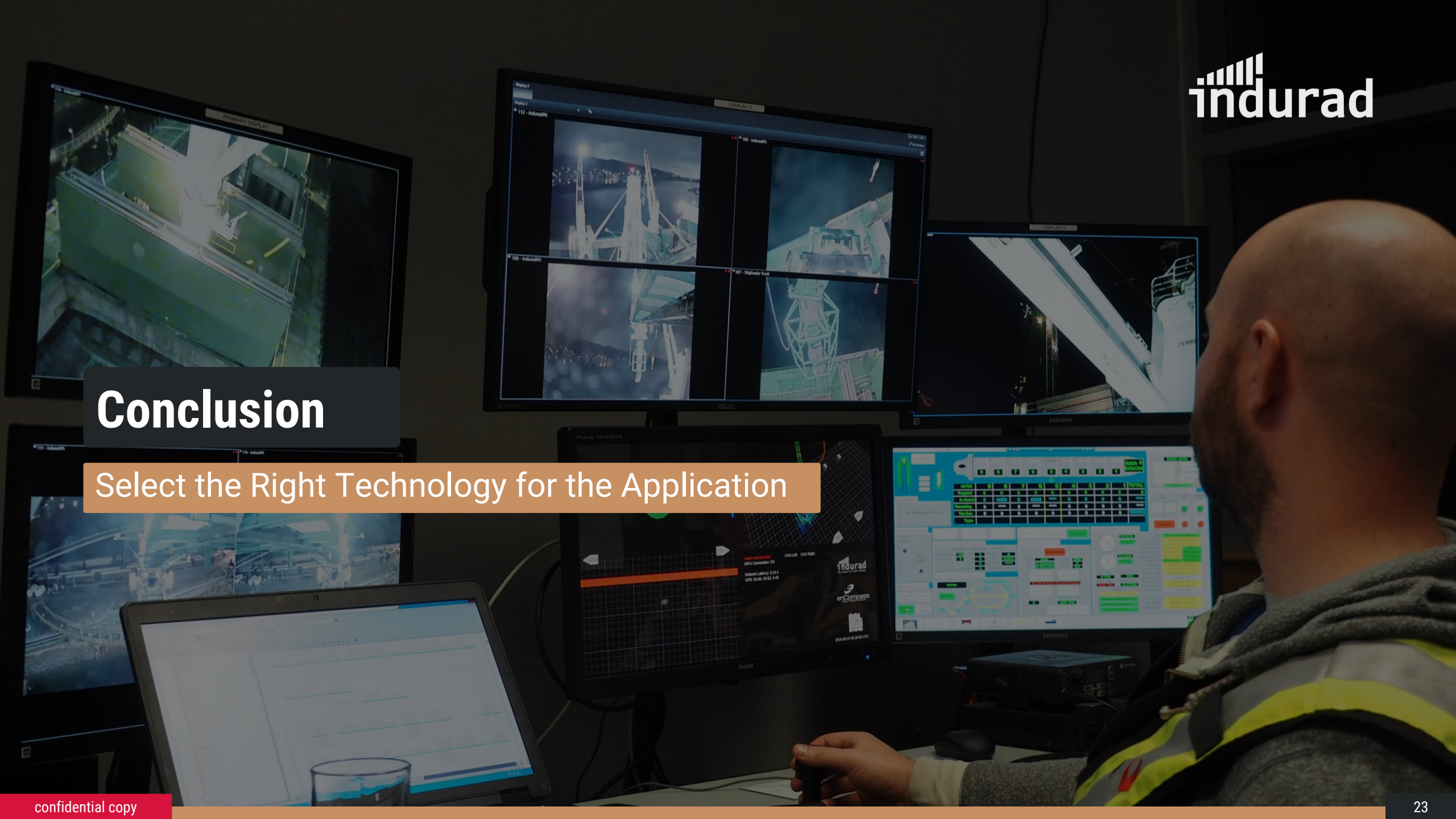
First in the World, Fully Autonomous Vessel Loading (Coal)





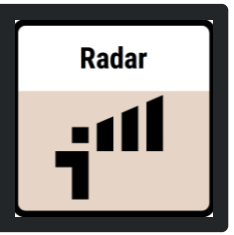






Conclusion

Select the Right Technology for the Application



Conclusion

Revolutionizing Terminal Operations with Resilience of Radar

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1. **Enhanced Environmental Resilience**
   - ✓ 2D/3D radar sensors have proven effectiveness in **harsh conditions** (rain, dust, snow, mist)
   - ✓ Case studies demonstrate **robust performance** in maintaining visibility and safety under extreme challenges.
2. **Optimizing Safety and Efficiency**
   - ✓ Improves **safety** protocols (PDS, CAS).
   - ✓ Provides **real-time**, **accurate** data for better decision-making.
3. **Future Outlook and Opportunities**
   - ✓ The successful application of 1D/2D/3D radar opens possibilities for further **automation** and **digitization**.
   - ✓ Promises **safer, more efficient, sustainable operations**.

Customer Testimonial

EECV: Tobias Böke – Project Manager

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Questions?

Adriaan Goosen

adriaan.goosen@indurad.com

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