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# Planning Dredging Operations with Persistent Berth Depth Monitoring Techniques

DREDGING SUMMIT & EXPO '17

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# Maritime Movement of Goods - Stakeholder Interests

Those who want **MAXIMUM DEPTH UNDER KEEL:**

- Pilots
- Harbour Master
- Coast Guard
- Vessel Owner
- Vessel Insurer
- Captain

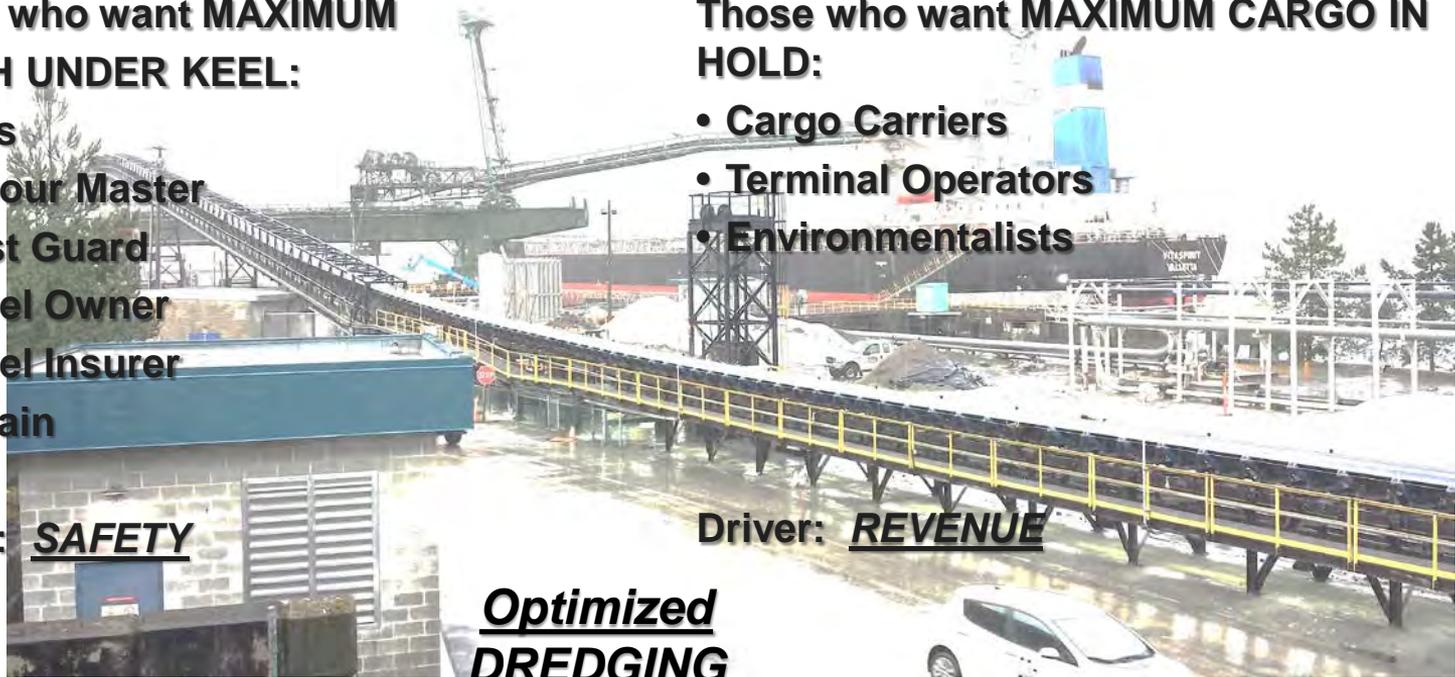
Driver: **SAFETY**

Those who want **MAXIMUM CARGO IN HOLD:**

- Cargo Carriers
- Terminal Operators
- Environmentalists

Driver: **REVENUE**

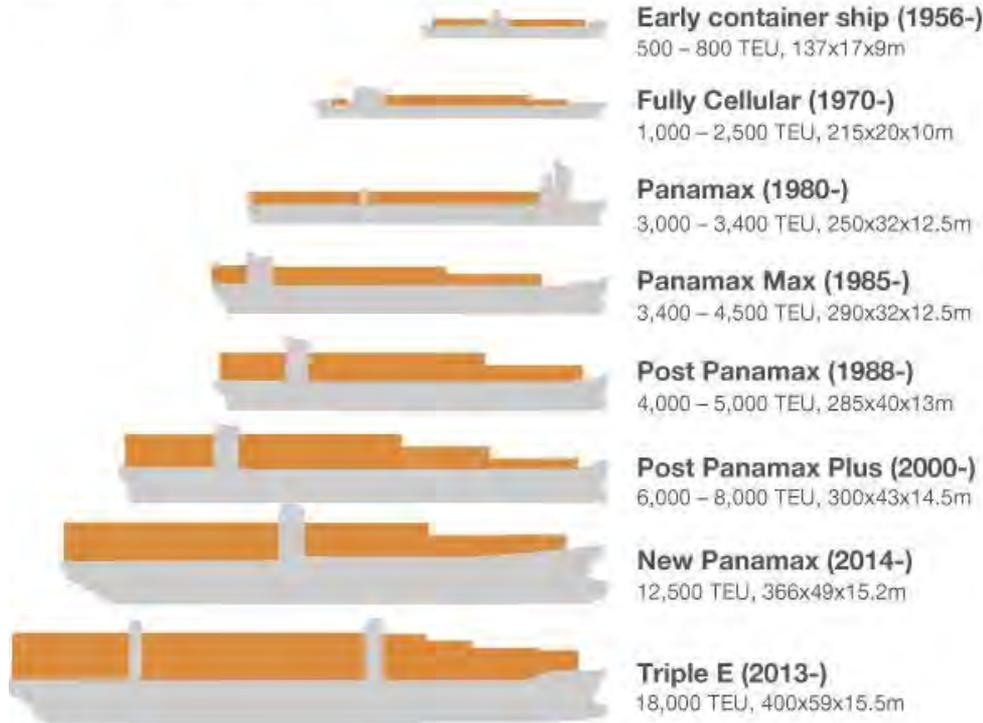
**Optimized DREDGING**





# Dredging Project Driver: Vessel Draft

TEU: twenty-foot equivalent units.  
length x width x depth below water in metres



## Issues: Bottom behavior post-dredging

- Subsidence
- Rate of siltation
- Impact of storm events
- Frequency of resurvey
- Frequency of redredging

# ***New Jurisprudence in the US concludes Dock Owners Liable for Unsafe Berth***



Uncharted!



Litigation – 10 years!



\$55 million damages



\$44 million damages

# Periodic Survey

- Pros:

- Known procedures
- Familiar output
- Established contractors



- Cons:

- Poorly suited to rapidly changing environments
- Reactive (done after groundings)
- Interferes with Operations
- Cost impact to revenues
- Requires expertise to operate
- Requires expertise to maintain
- Requires expertise to post-process data
- More surveys = more money



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# Dual-Axis Sonar (DAS)

This *profiling* sonar is specifically designed for long-term immersion in the harshest of conditions

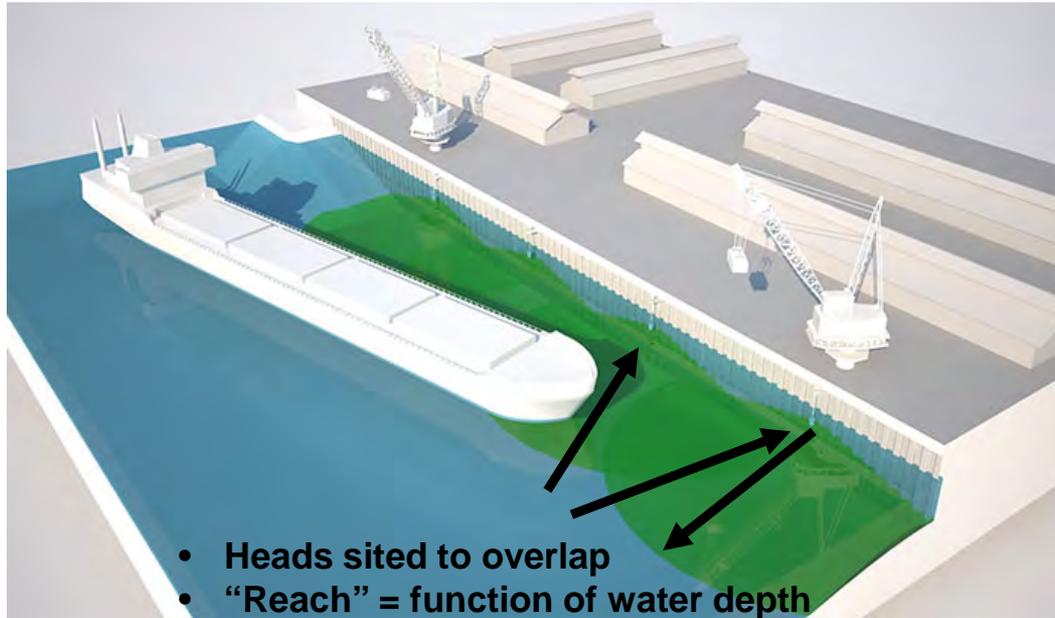




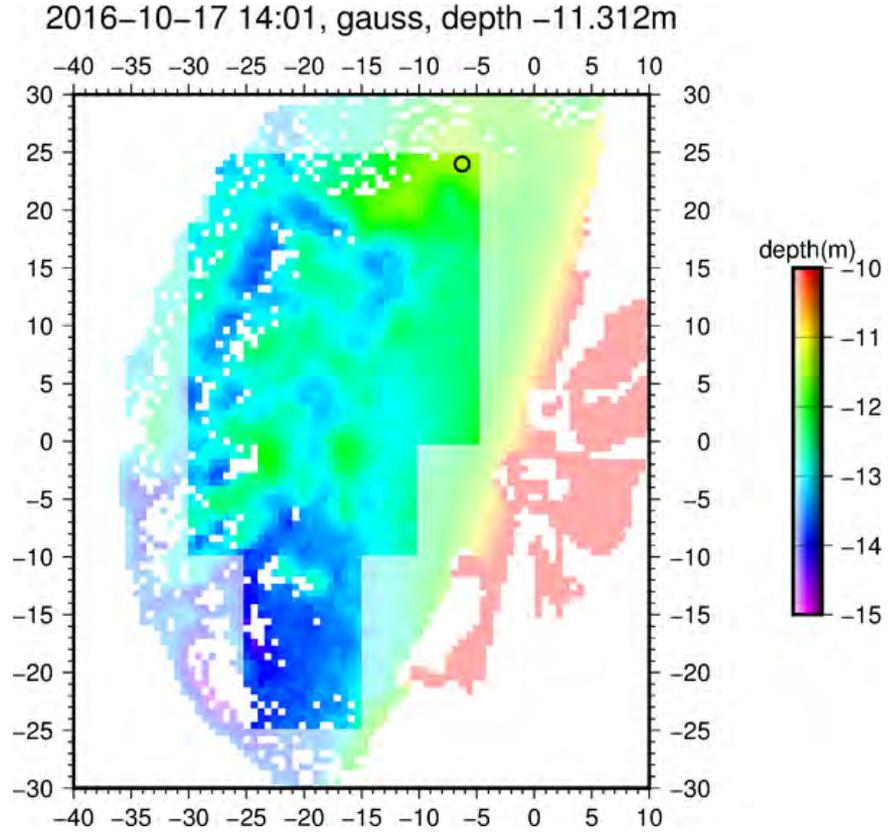
# Berth Depth Monitoring and Reporting System

Persistent Survey Value Proposition:

- Maximize cargo during loading;
- Minimize grounding risk when berthing.



# 3D bottom map produced by dual axis sonar



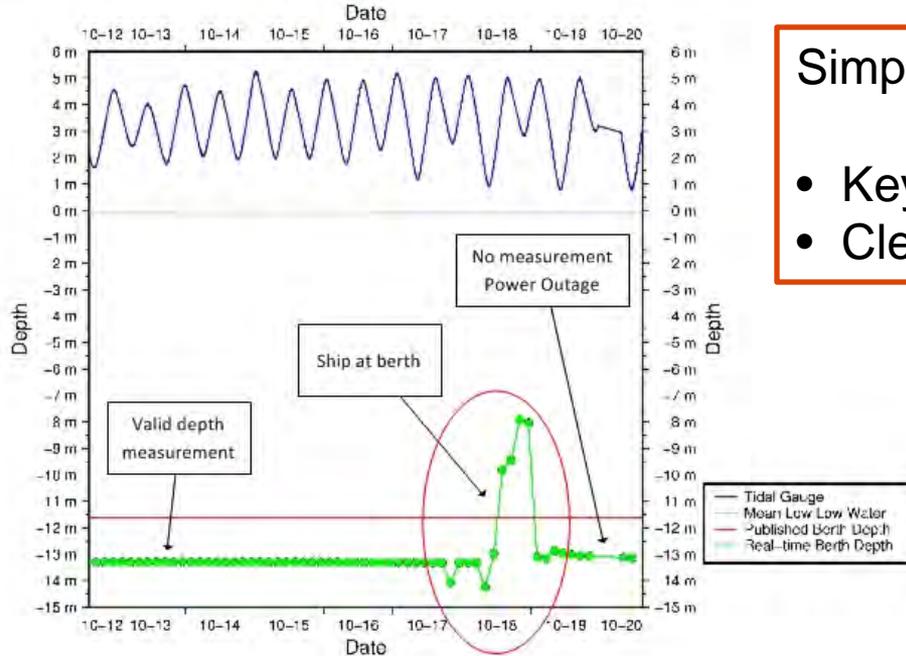
# Depth Monitoring Results



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## Depth plot

Interval (hours): 6 12 24 48 96 192

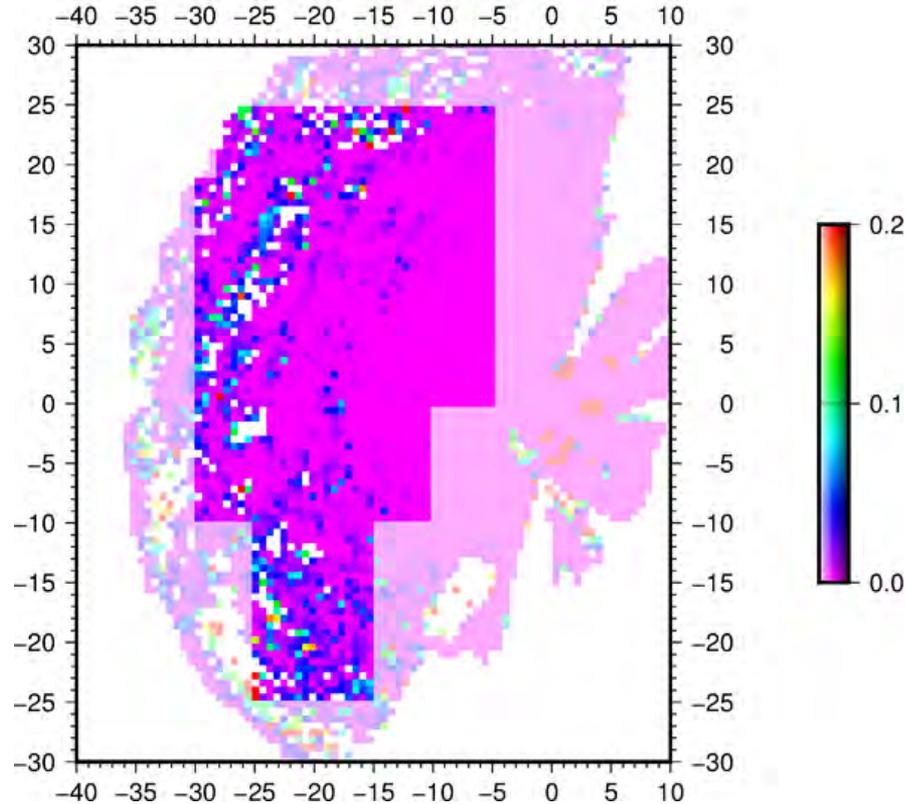


## Simple Graphic User Interface

- Key datums
- Clear go/no-go information at a glance

# Difference plot – scan to scan

2016-10-17 14:01, variance



# Pacific Coast Terminals

## Hazardous Debris Detection

- Crab traps wrapped in steel mesh – .9m x .7m x .7m.
- Hollow, smaller than IHO target
- Proxy for dumped trash



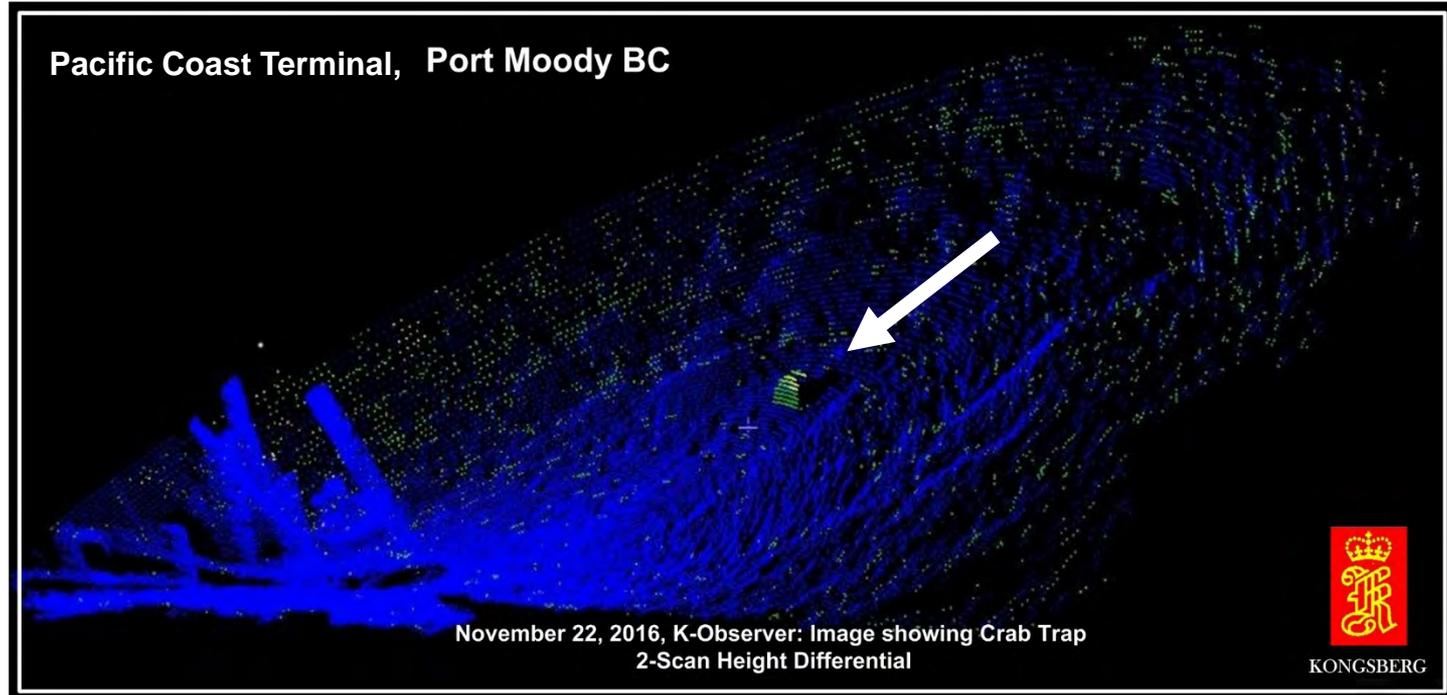
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# Pacific Coast Terminals

## Hazardous Debris Detection

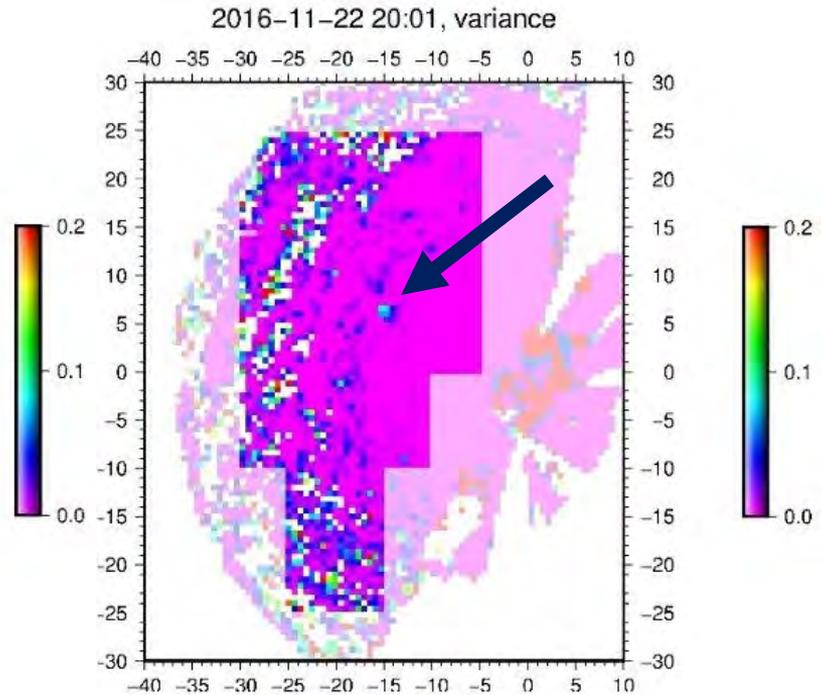
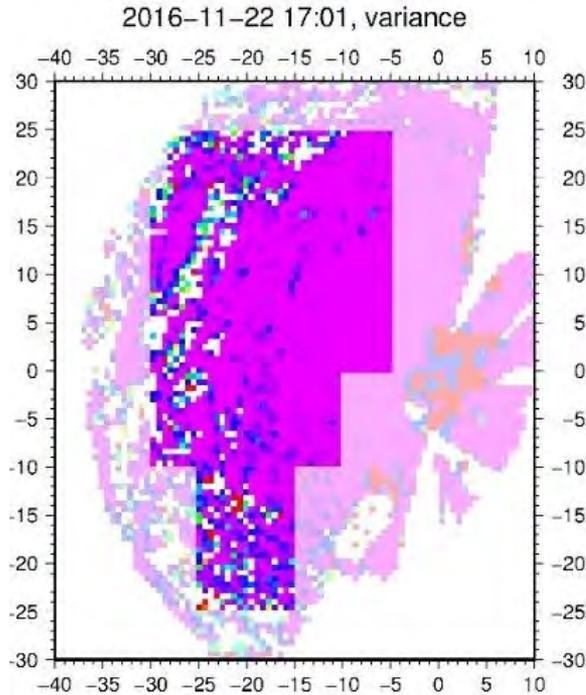


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# Pacific Coast Terminals

## Hazardous Debris Detection





# What Persistent Survey Does

- Continuous Scanning
- Very Precise Instrument
- Comparable to Hydrographic Survey – Reports Change Over Time
- Use Reference Target to Confirm Accuracy
- Detect And Report Foreign Objects Immediately
- Set Thresholds to Trigger Intervention
- Provide Web-Based Access to Stakeholders
- Integrate to Vessel Traffic Services or Portable Pilotage Units

# What Persistent Survey Does Not Do

- See Beyond Grazing Angle
- Accurately Define Navigable Mud
- Operate Without Periodic Maintenance
- Remain In Situ In Icing Conditions
- Is Not Tamper-Proof – Requires Security

# Dredging Case Study: Forrest Kerr Hydroelectric Plant



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# Dredging Case Study: Excessive Silt Loading in Desanding Bays



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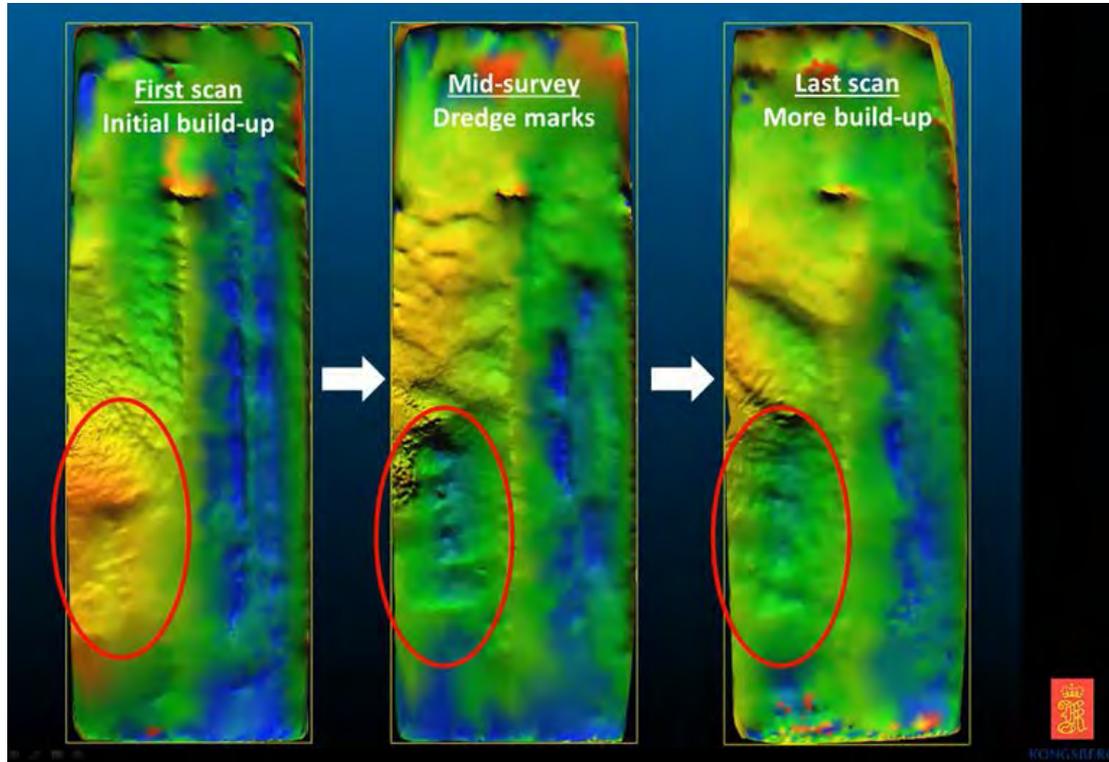


Dredging Summit and Expo '17

# Dredging Case Study: Dual Axis Sonar Images of Dredging Operations



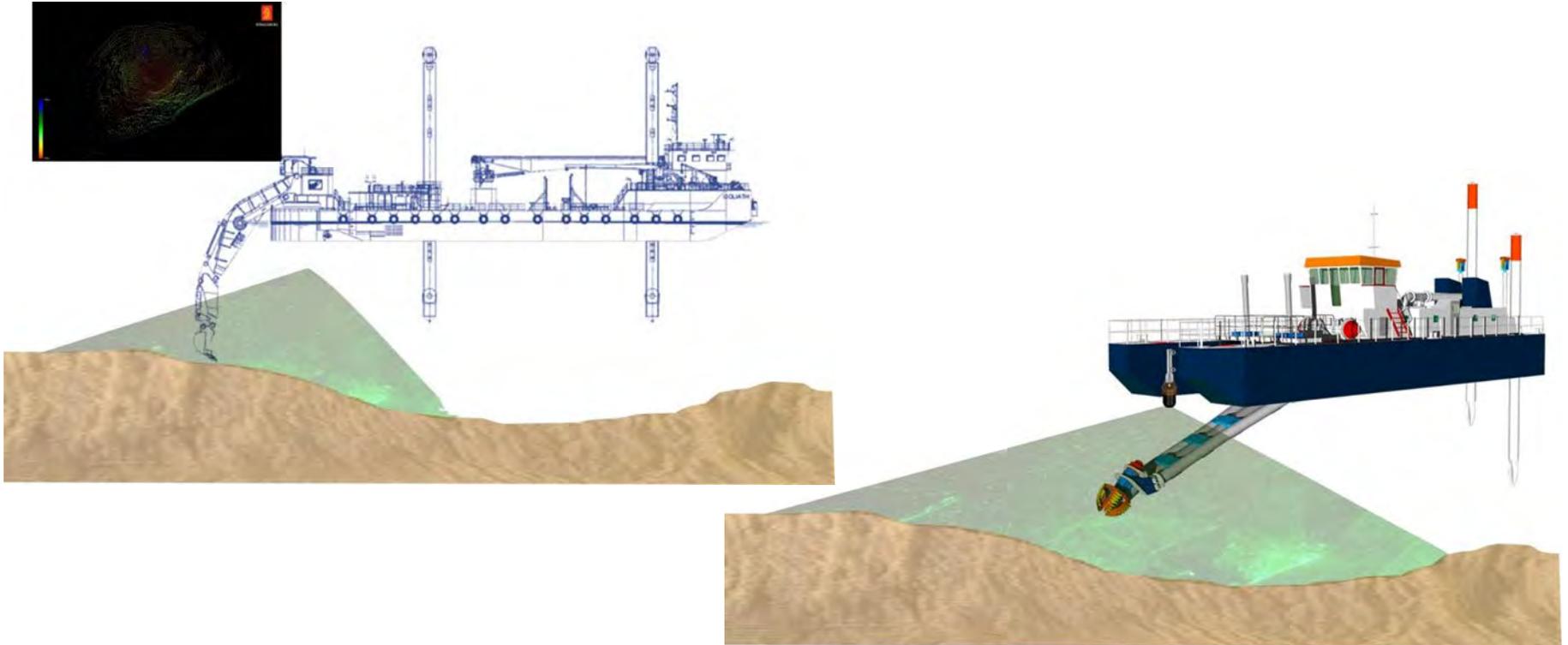
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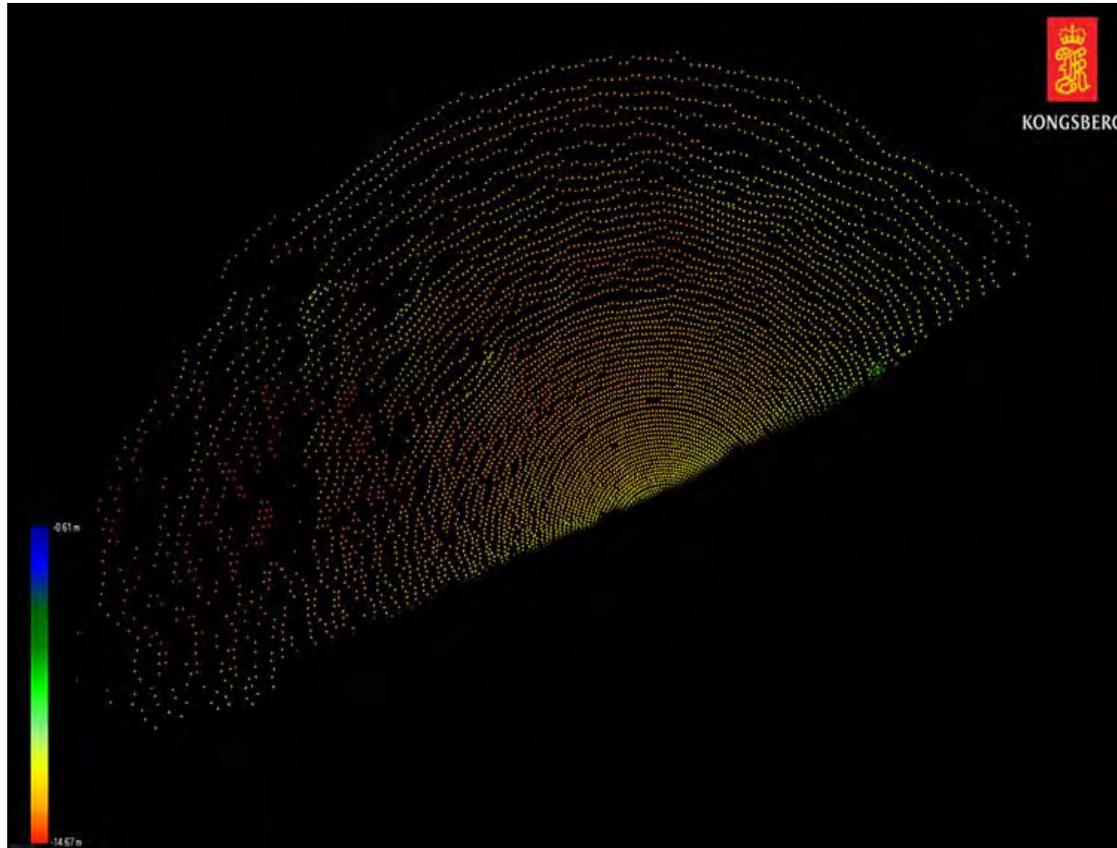
# Other Dredging Concepts: Quality Control and Performance Verification



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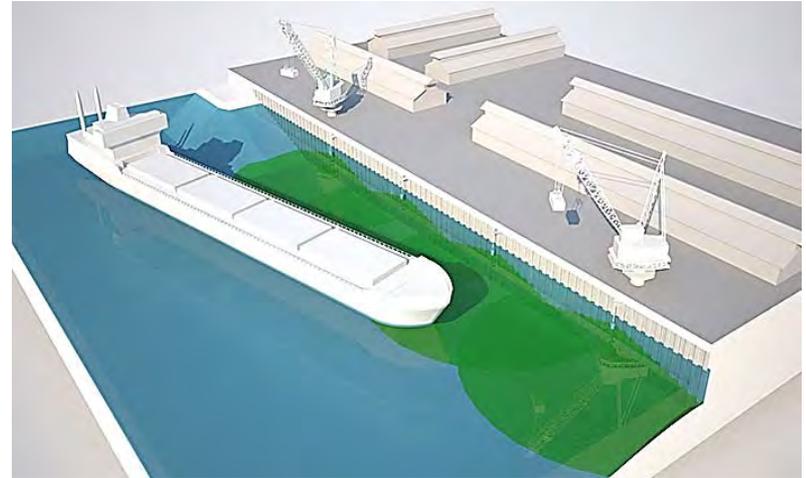
# Post-Dredging Point Cloud – 2-Minute Scan





# Conclusion

- Drawbacks of Periodic Survey:
  - Inability to understand changes occurring between surveys
    - Natural events are random
    - Foreign objects end up in berth pockets
  - Jurisprudence creates obligations for berth owners
- Advantages of Persistent Survey:
  - Viable and Reliable Technology
  - Monitors change on continuous basis
  - Accessible by multiple stakeholders
  - Allows safe vessel operation and optimization of cargo capacity
  - Allows better planning for dredging operations





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# WORLD CLASS

THROUGH PEOPLE, TECHNOLOGY AND DEDICATION

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