



Lessons Learned in Building an Ideal Radar Sensor for Off-Road Autonomy

*Insights from the Development Journey
of RAS3*

Speaker Introduction

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With Navtech Since 2019

Background Aeroelastic Simulation

Segment Leader of Industrial Automation

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Talk Content

Introduction To Navtech & History

Lessons Learnt in Developing a New sensor:

- Performance
- Testing
- Integration

Applications where the technology is applied today

- Underground Mining
- Inland Marine Navigation
- Rail Navigation
- Bulk Handling in Mining

Case Study – Real World Radar Only Navigation

Future Radar Developments

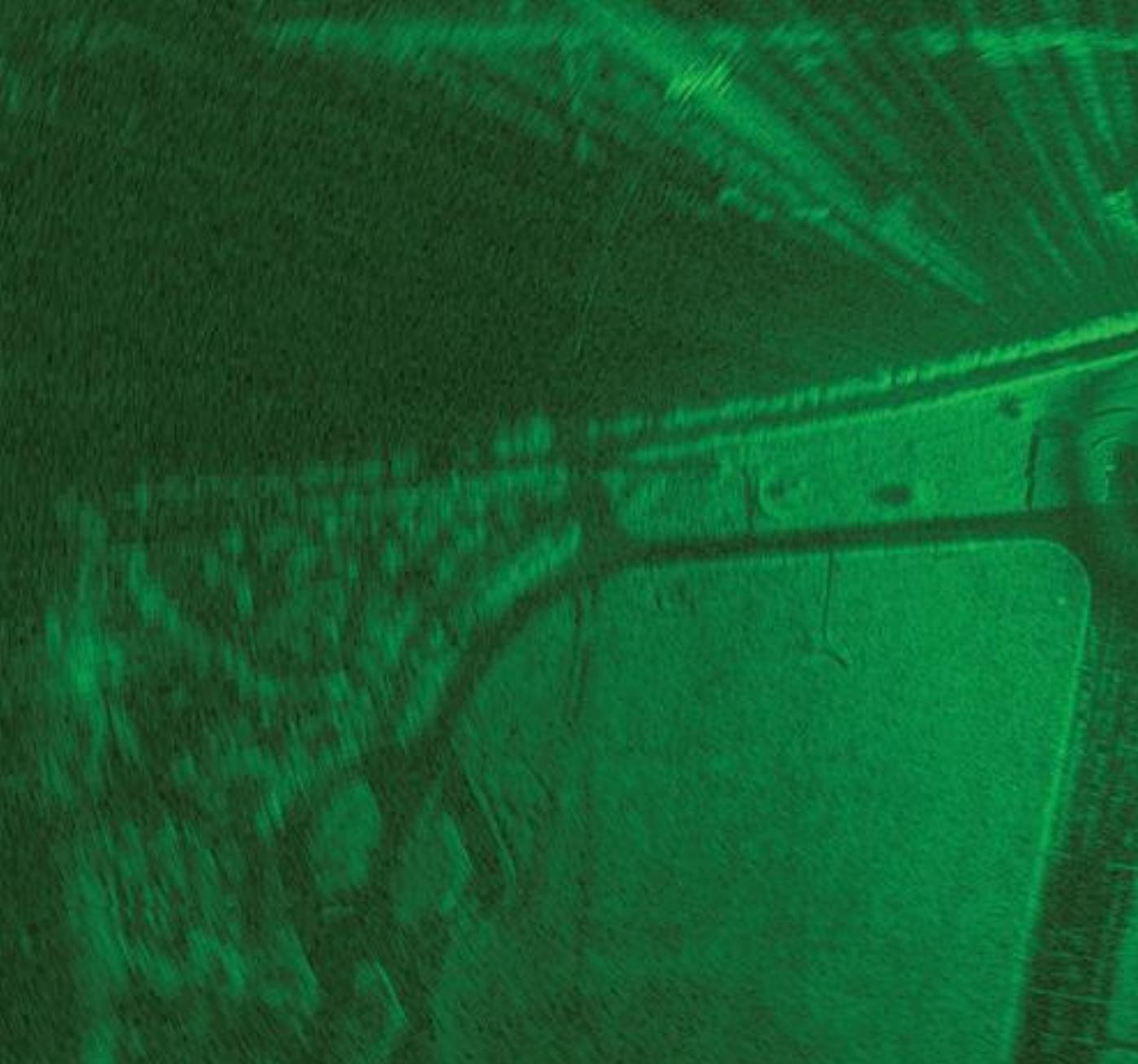
Wrap up

Introduction to Navtech



25 Years of Industrial
Radar Experience

-  Based in Oxford UK, with regional partnerships
-  Over 5500 Radars Deployed, 90+ Security, 60+ Highways, 40+ Industrial
-  In-House Engineering (70%), 100% design, manufacture, deliver and support
-  Work with 20+ Universities Globally
-  Part of Halma plc Technology Group



How we got here?



1998 - 1999

Navtech Founded by Steve Clark & Phil Avery
Paper Accepted in ICRA1998
Spin out of Sydney Uni

2000 - 2002

Focus on industrial automation
3D mechanical radar created
Update Rate Azi - 2.5Hz
Update Rate Ele - 0.15Hz

2003 - 2006

2nd Darpa Challenge (SandStorm)
W-Series Launched

2007 - 2014

Radar Navigation System at Port Brisbane & Port Botany
I-Series Launched
Range 200m
Update 2Hz
Range Res 30cm

2014 - 2020

CIR/CTS launched
Partnership with ORI
Partnership with Oxa
Oxford Radar Robotcar Dataset & Mulran Published
ROS1 Driver Released

2020 - 2024

RAS3 Launched
RAS6 Launched
ROS2 Driver Released
Partnership with Toronto Radiate, Boreas & OORD & OSDAR23 & Radar Doppler Data Set Published



RAS3: Small Form, Powerful Output

Optimized for challenging and harsh environments, RAS3 delivers unparalleled radar performance in space and weight-constrained applications.



Features:

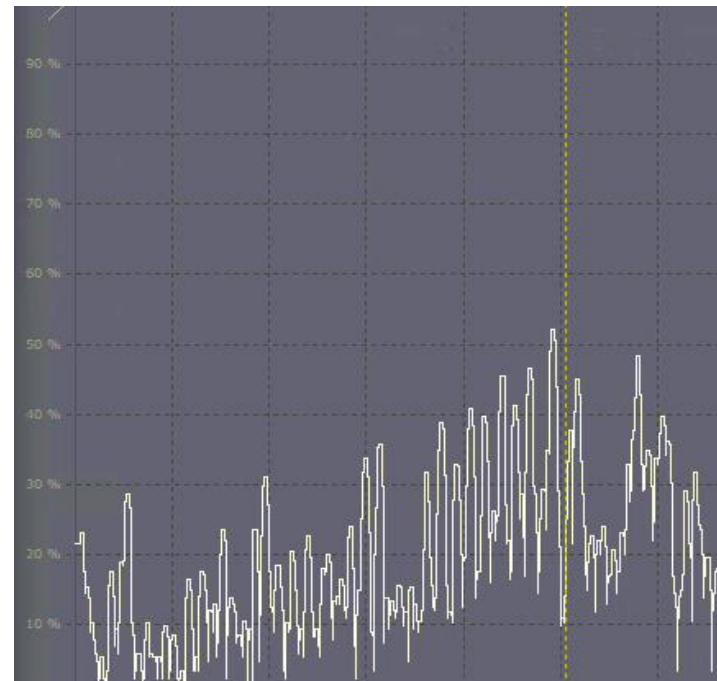
- All-weather performance
- Compact & Ruggedized Design
- 360° field of view
- Medium range of 300m
- Narrow 2.8° beam
- 10Hz refresh mode
- PTP time sync
- Open SDK with raw data access

Lessons Learnt

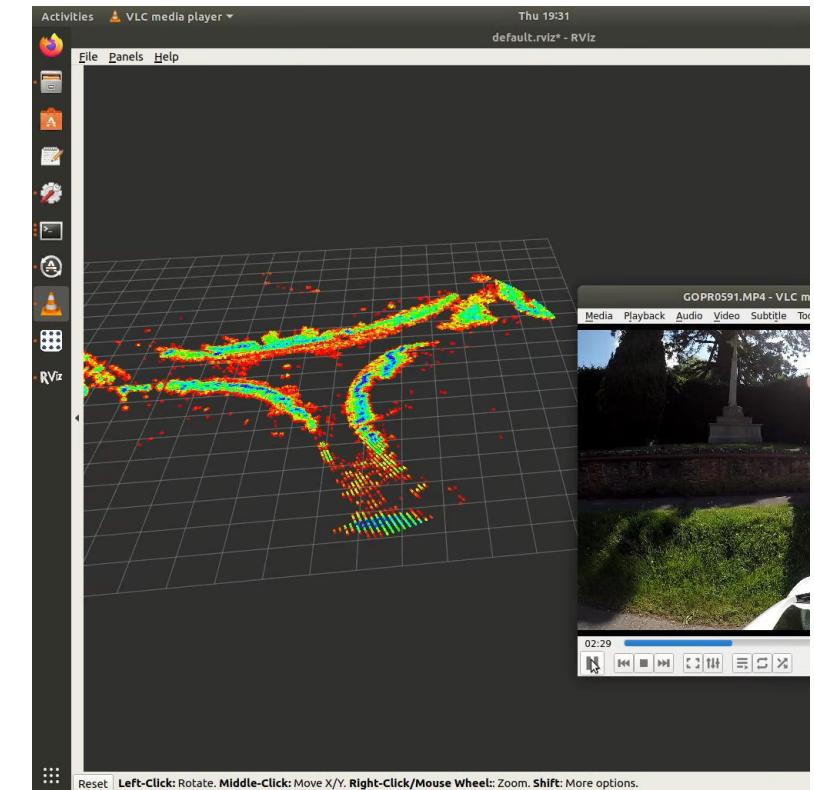
Performance



Testing

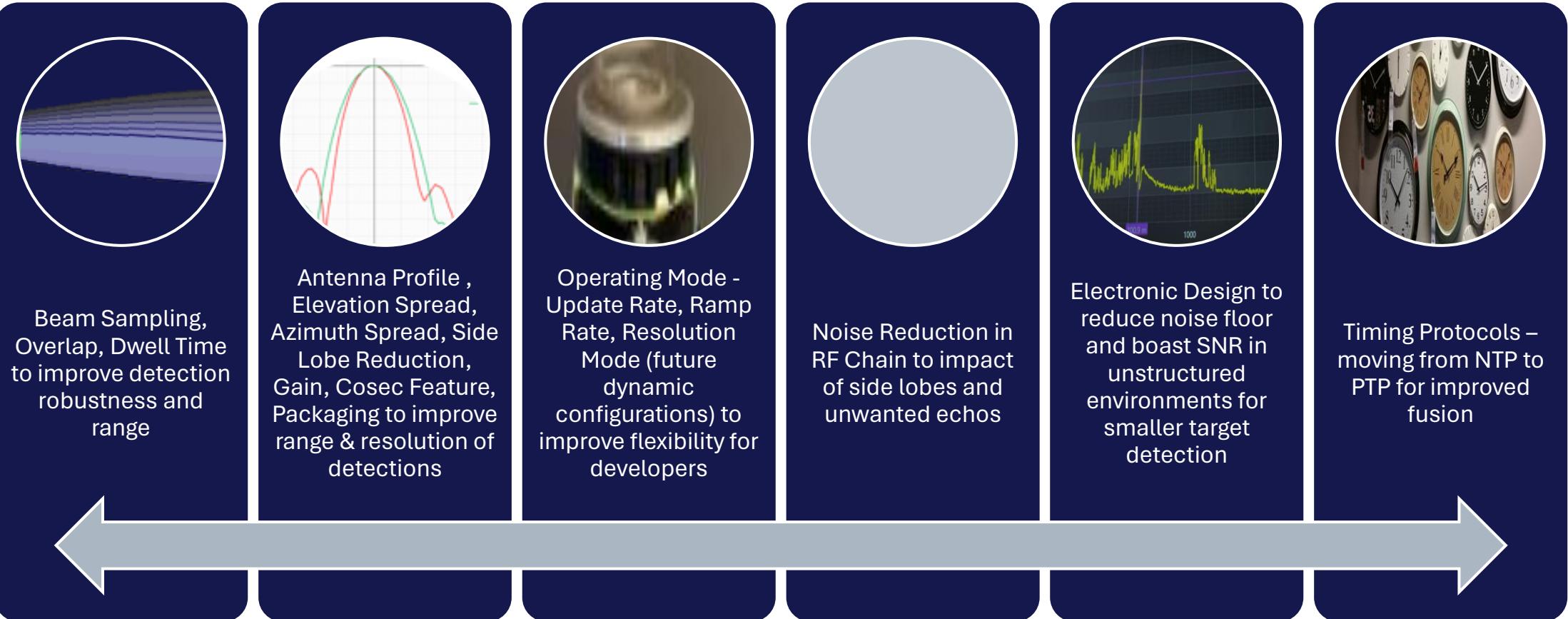


Integration



Lessons Learnt

Managing Performance trade offs



Lessons Learnt

You can never test too much



Oven Testing



Marine Compass
Testing



Ingress Testing



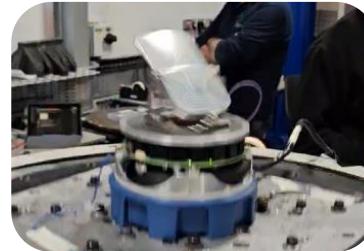
EMC Testing



Range Testing



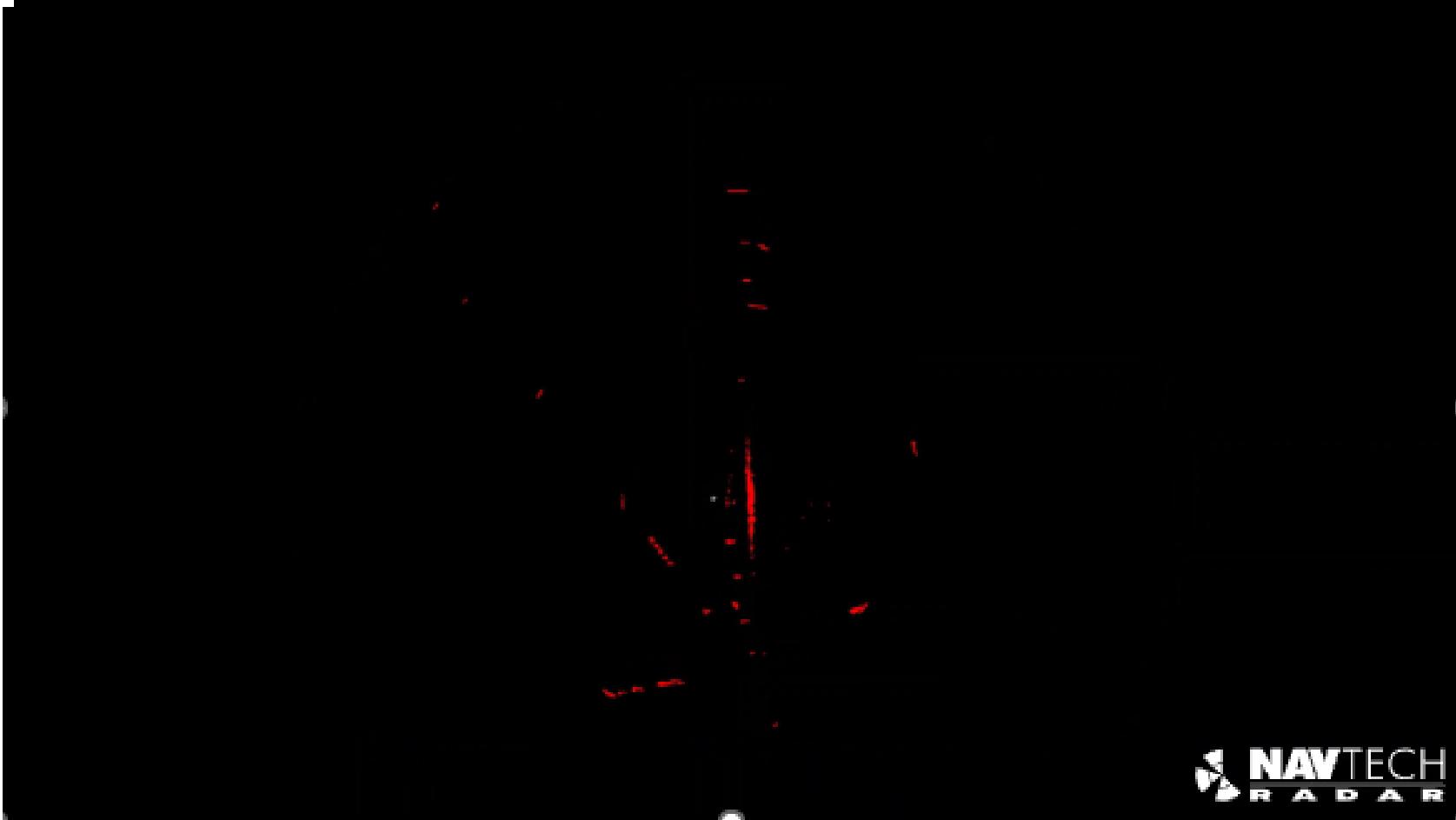
Pressure Testing



Shock and
Vibration

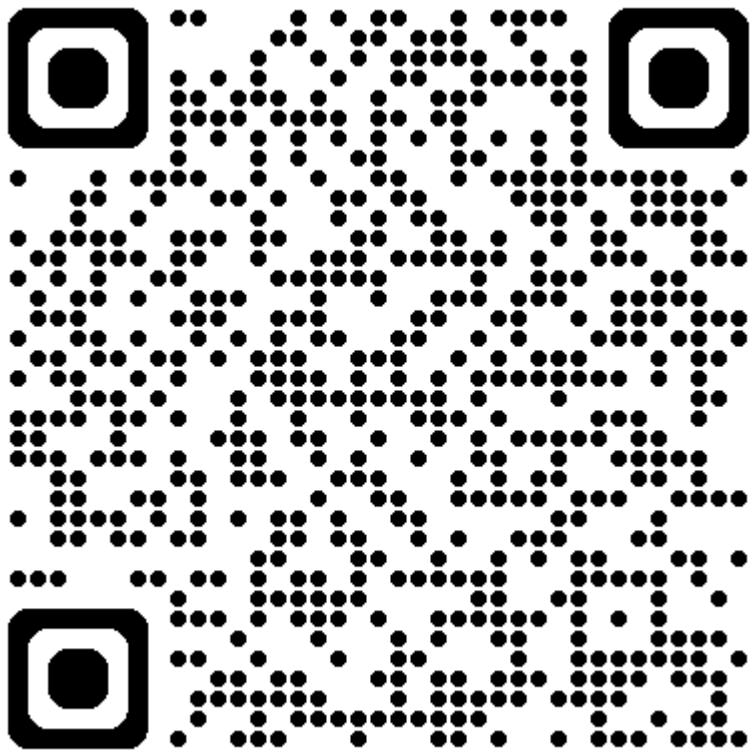
Lessons Learnt

Simplify Integration and Enable Flexibility

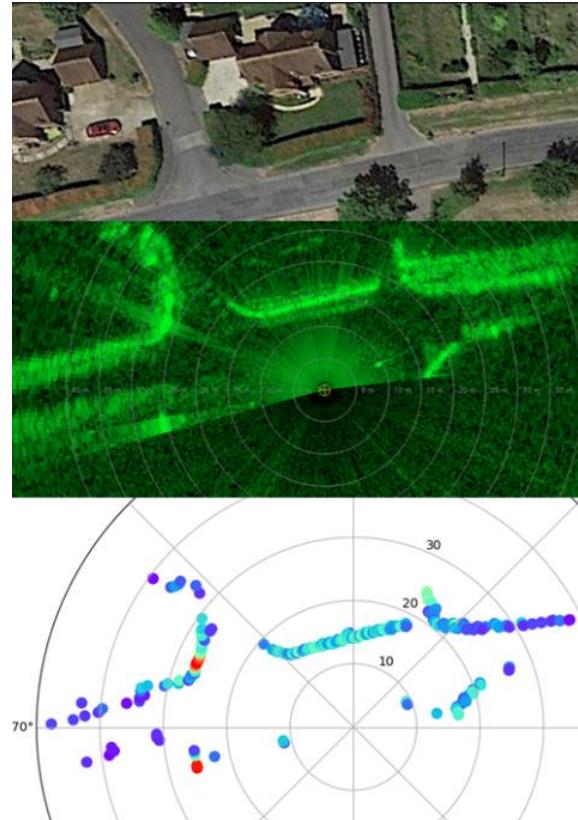


Lessons Learnt

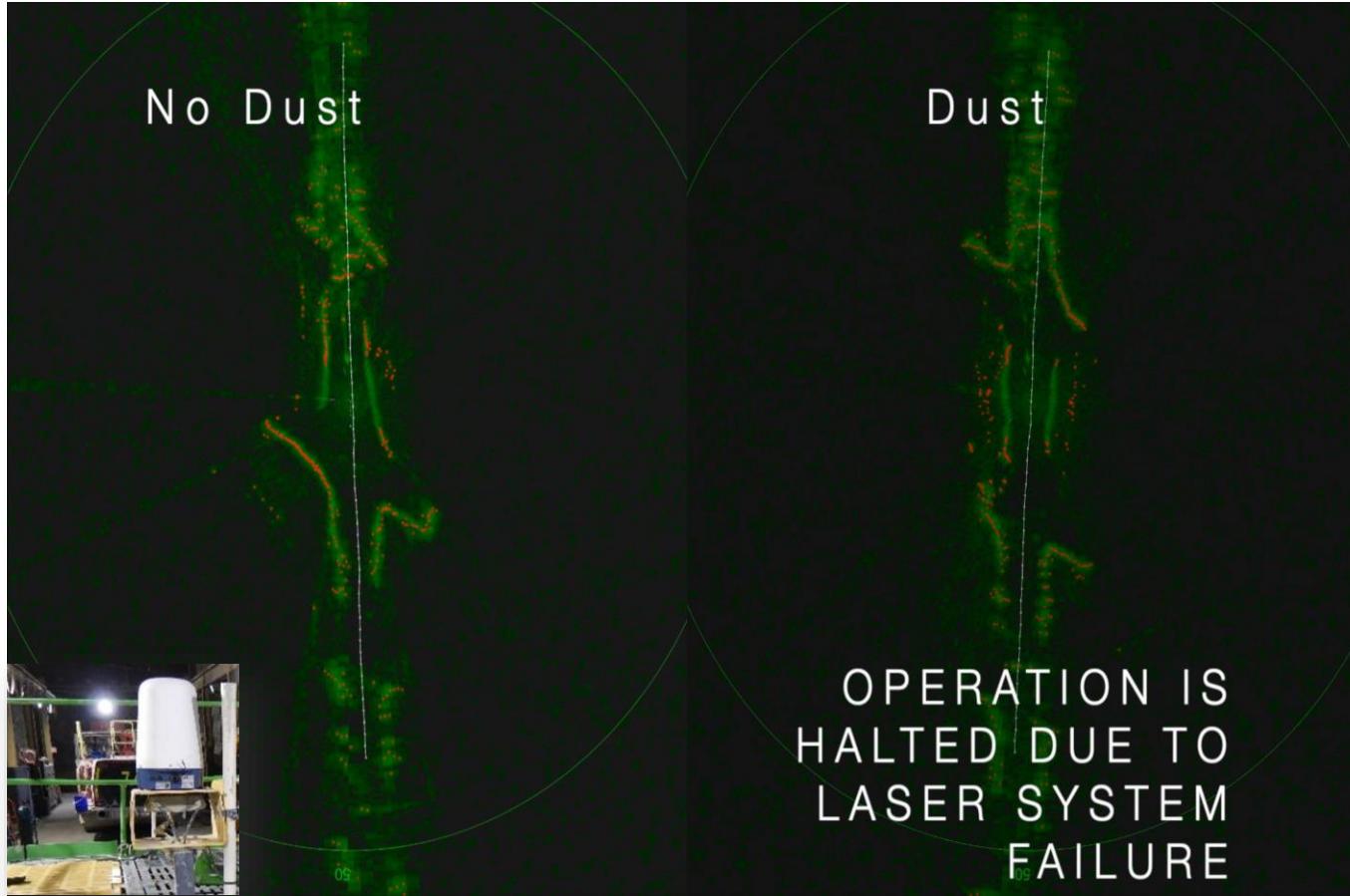
Simplify Integration and Enable Flexibility



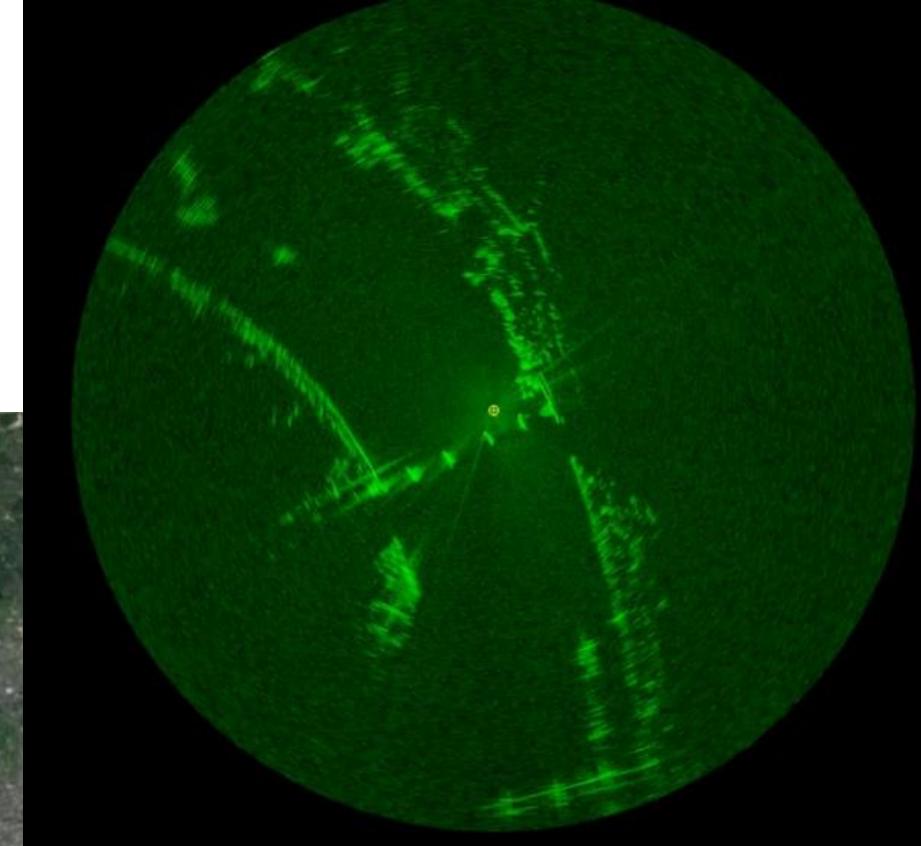
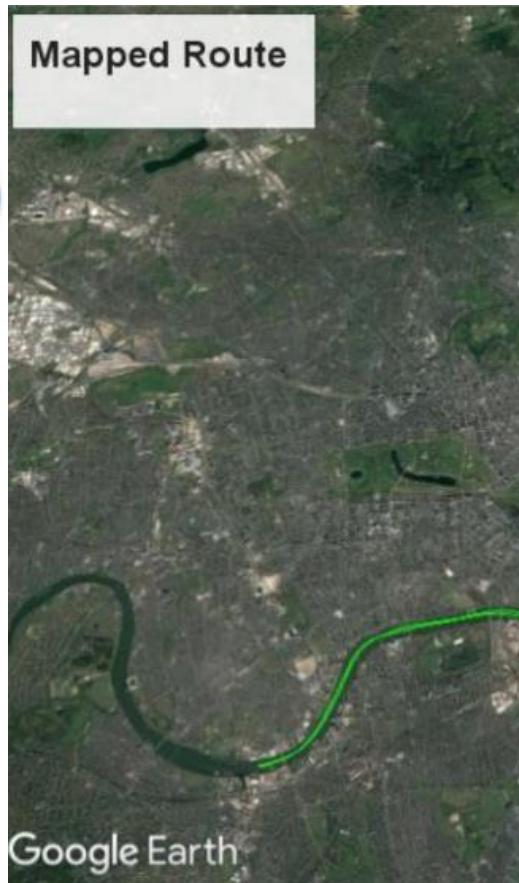
[navtechradar / iasdk-public](https://navtechradar.github.io/iasdk-public) — Bitbucket



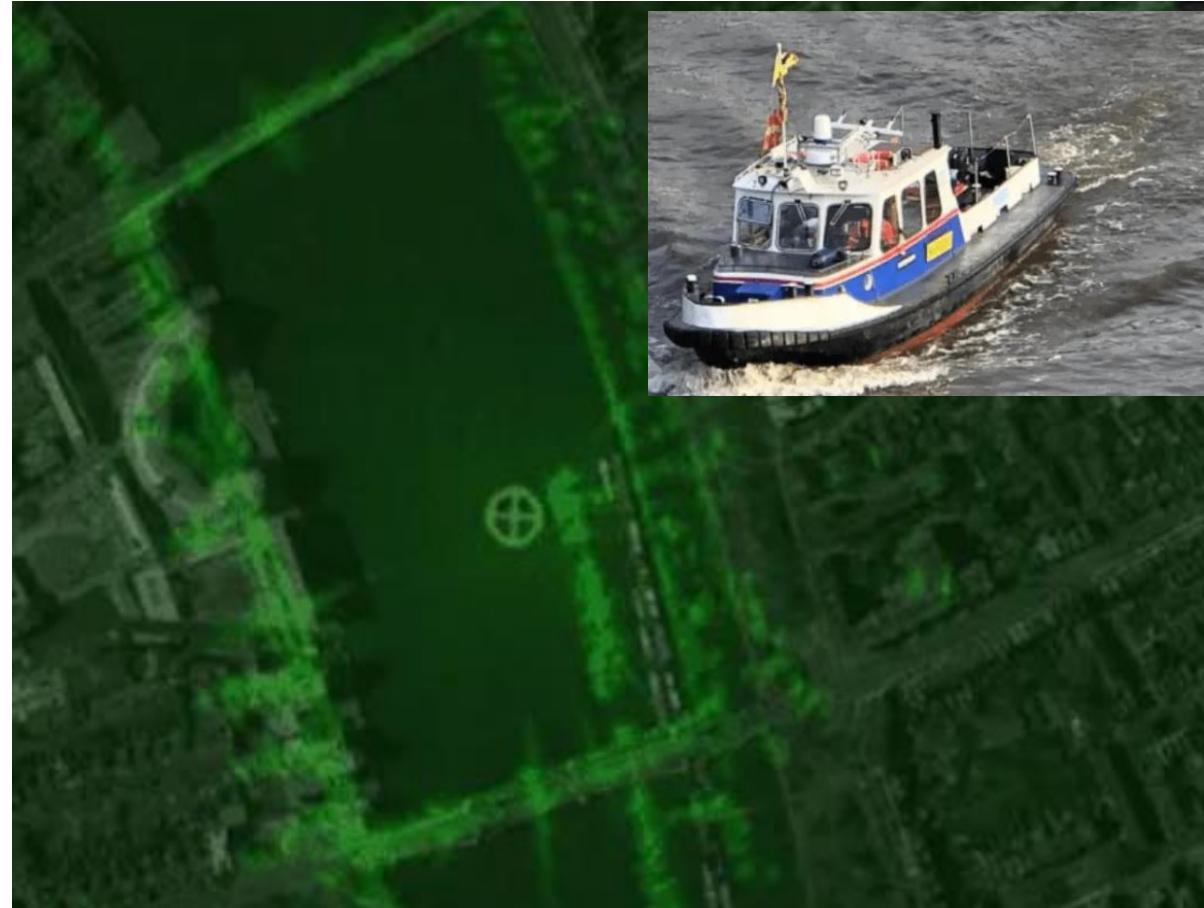
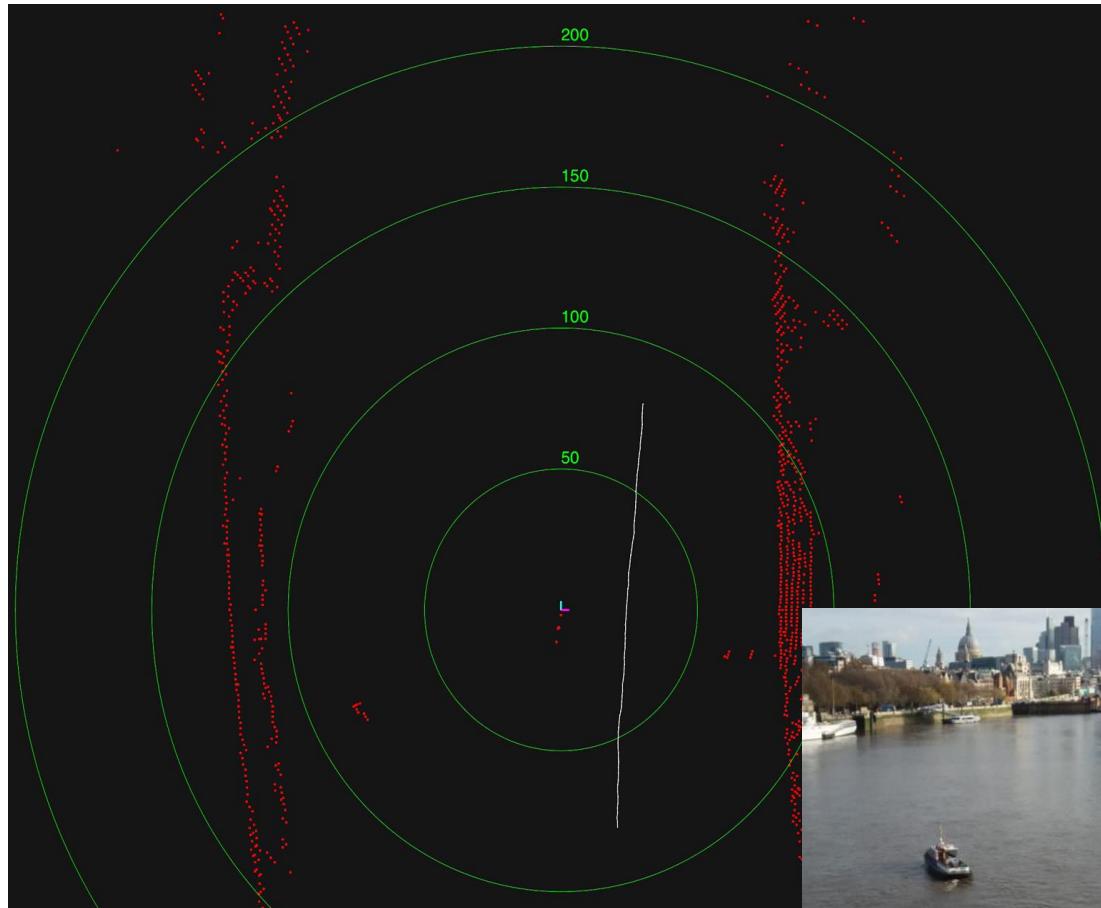
Applications Beyond Underground Loaders – Mining



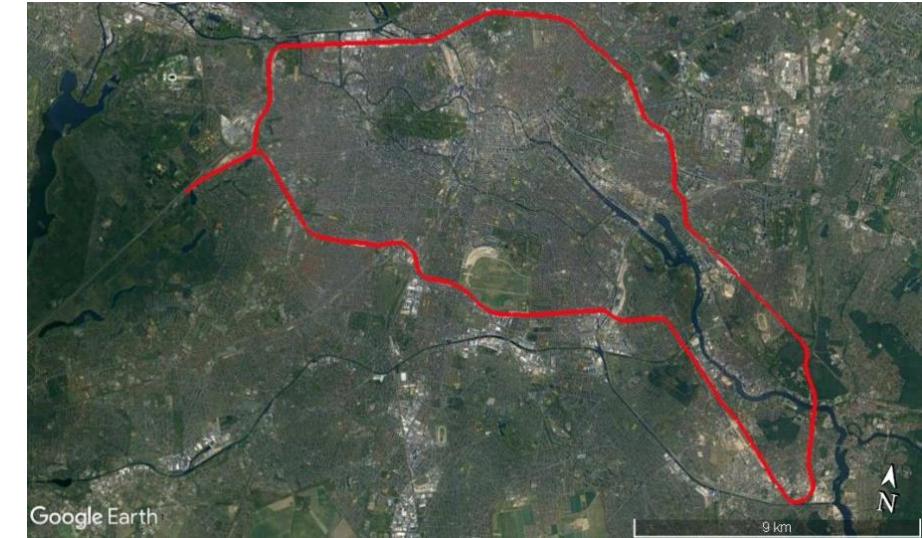
Applications Beyond Marine GPS Denied Navigation– Marine



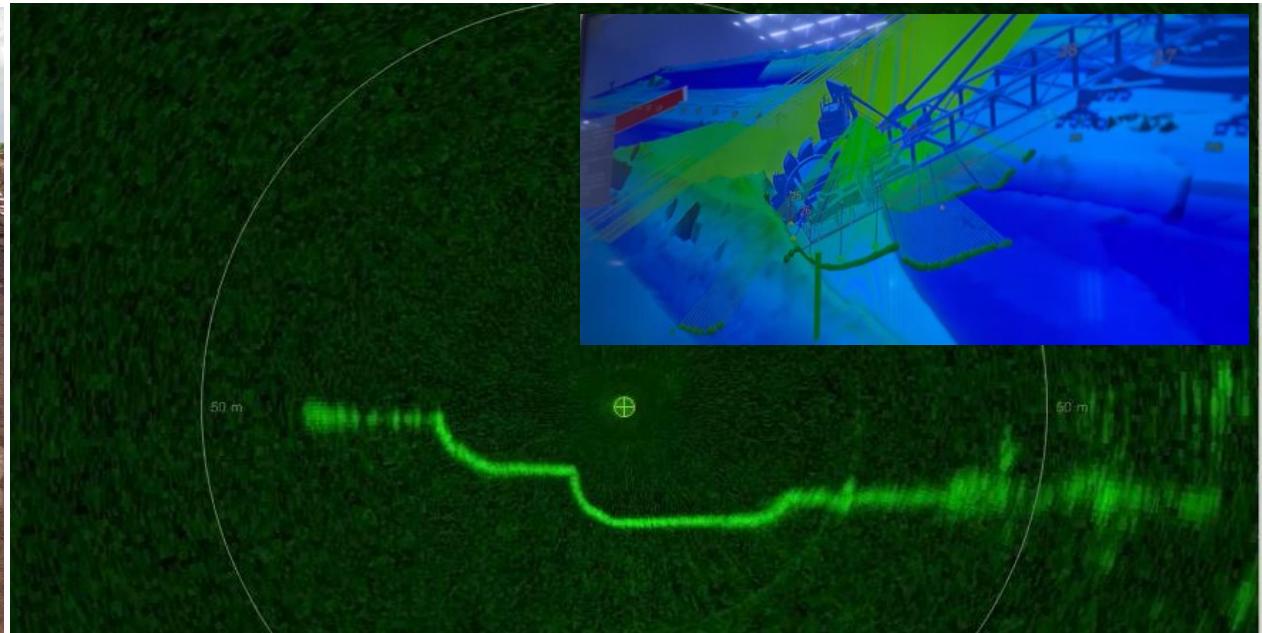
Applications Beyond Marine GPS Denied Navigation – Marine



Applications Beyond Rail Navigation



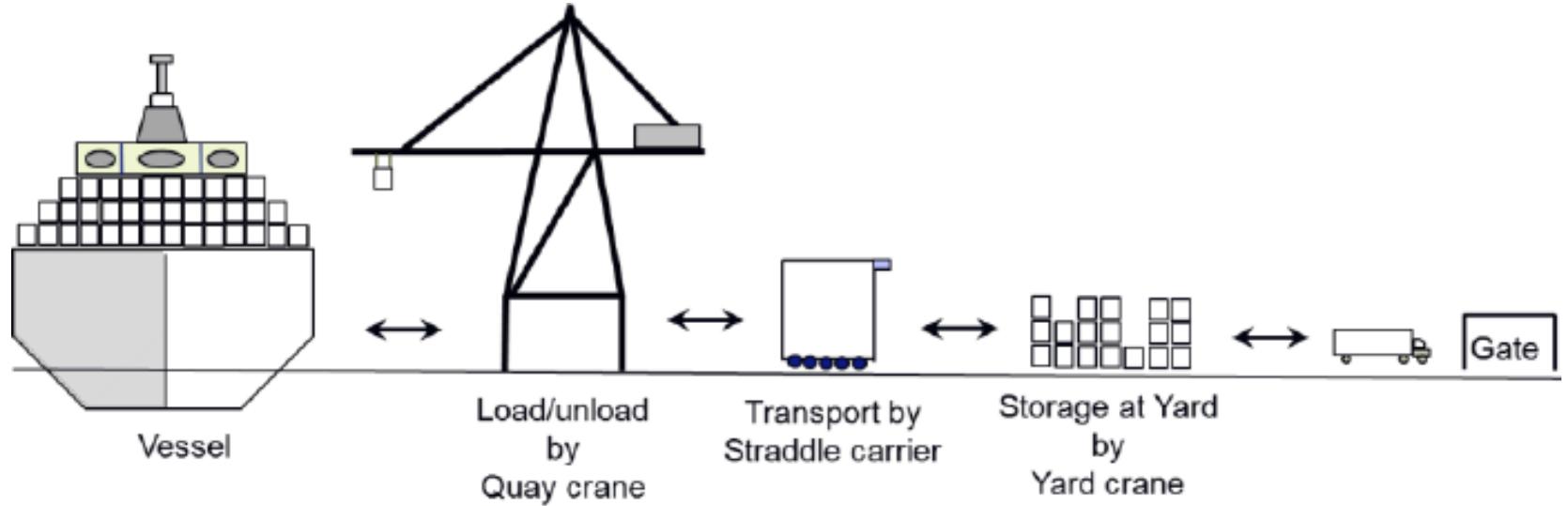
Applications Beyond Bulk Handling – Mining





One Radar Many Applications

Case Study: Background & Challenge





Case Study Solution

- Mmwave Radar Navigation Solution based on Static Targets
- Achieves <5cm Accuracy throughout port
- 1 Radar unit per straddle carrier
- Maintenance & Cleaning free solution for 10 year design life

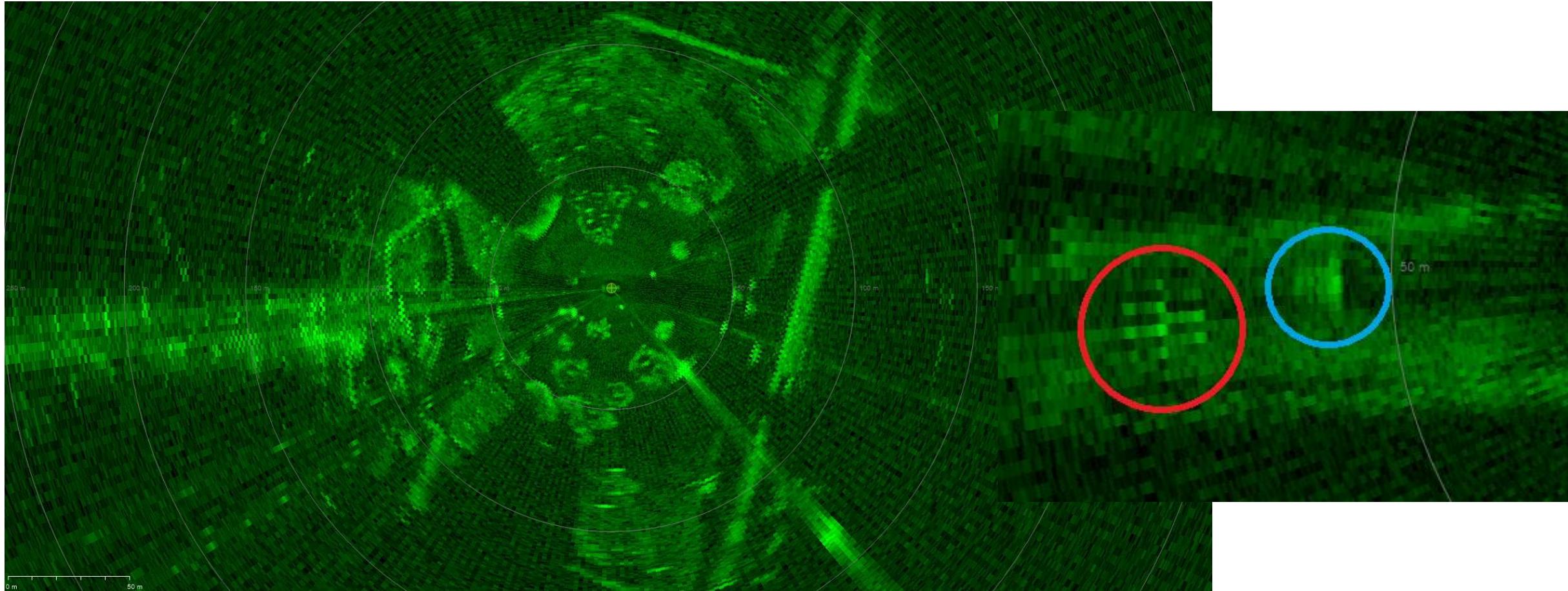


Case Study Benefits

- Impact and Success of Radar Implementation
- Uninterrupted Operation in All Weather Conditions
- Achieving Automation Milestones in Port Operations
- Environmental and Operational Efficiency Gains

Future Radar Technology

Experimental Doppler Mode



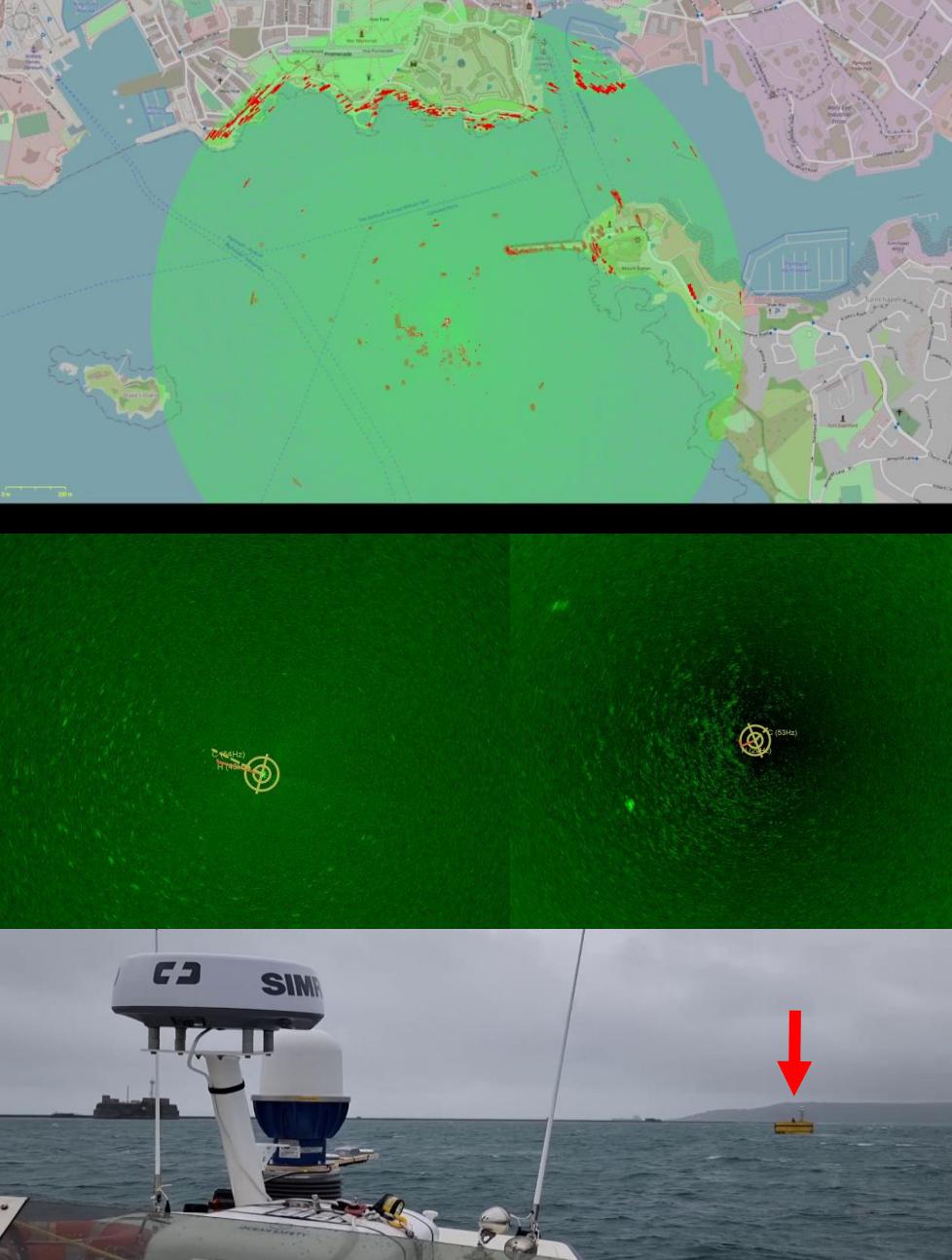
Future Radar Technology

Marine Optimised Radar

Specs:

- Instrumented Range: 1000 - 1500m
- Update Rate: 2Hz
- Range Intensity correction: $1/r^4$ Filter
- Beamwidth (azimuth): 1.8°
- Beamwidth (elevation): $+/- 8^\circ$ (16° total)

Prototypes Ready Oct24





Why Partner with Us?

- Navtech as Your Technology Partner
- Radar Expertise Tailored for Industrial Autonomy
- Emphasis on Collaborative Innovation and Open Development – feed our roadmap
- Proven Track Record of Successful Technology Partnerships with Universities

Join the eco system of researchers....



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