New DP Position Reference System for Shallow Water DP Operations

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Agenda

- Introduction
- Problem statement / Opportunity
- Solution
- Field Data
- Conclusions / Next Steps
- Questions

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Introduction

Introduction

My Background

- Working in marine sector with focus on under water acoustics for 25 years
- Developed the HPT USBL Positioning system
- Led the product development of Syrinx DVL which is now a key component in SPRINT-Nav Products

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Sonardyne by numbers

370
Sonardyne employees worldwide

50
The number of years Sonardyne has been in operation

70+
The number of countries where we operate

156,000
Total square footage of our facilities

80%
Percentage of products we export

100%
Deep water fields where Sonardyne technology is used

24/7
Support any time you need it

12,000 m
How deep our equipment can operate

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Problem statement

Problem statement

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Diversity is Required for Safe Navigation of Surface Vessels

Laser

?

Can we add to the toolbox?

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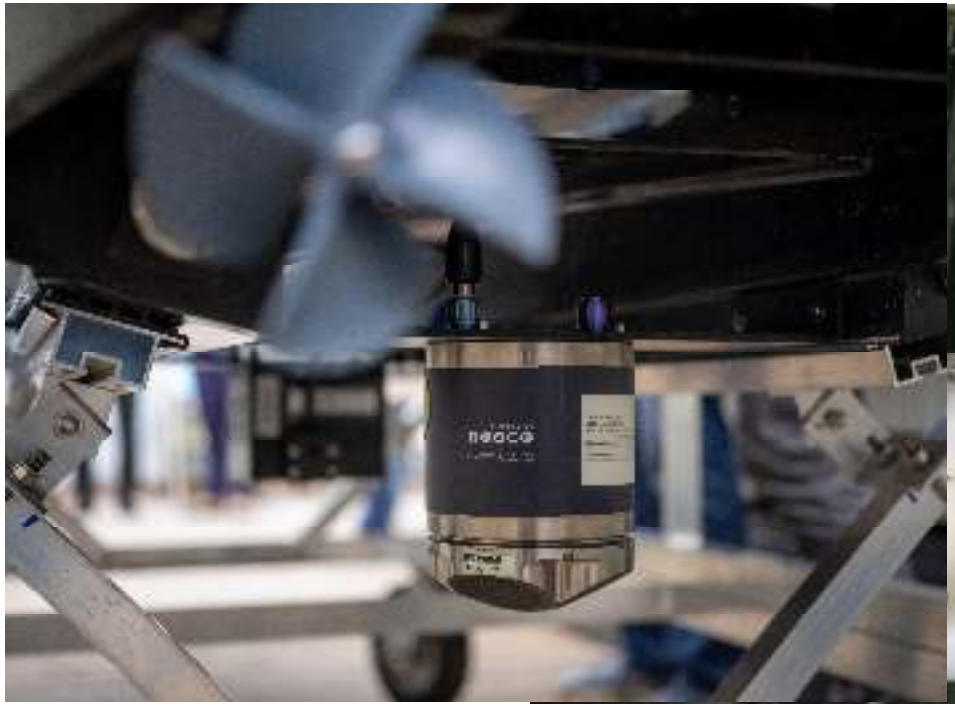
Solution

Solution: use tried and tested off the shelf product for this application



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SPRINT-Nav

SPRINT
INS

Syrinx
DVL

+

=

SPRINT-Nav

Combined
INS, DVL & depth

All-in-one

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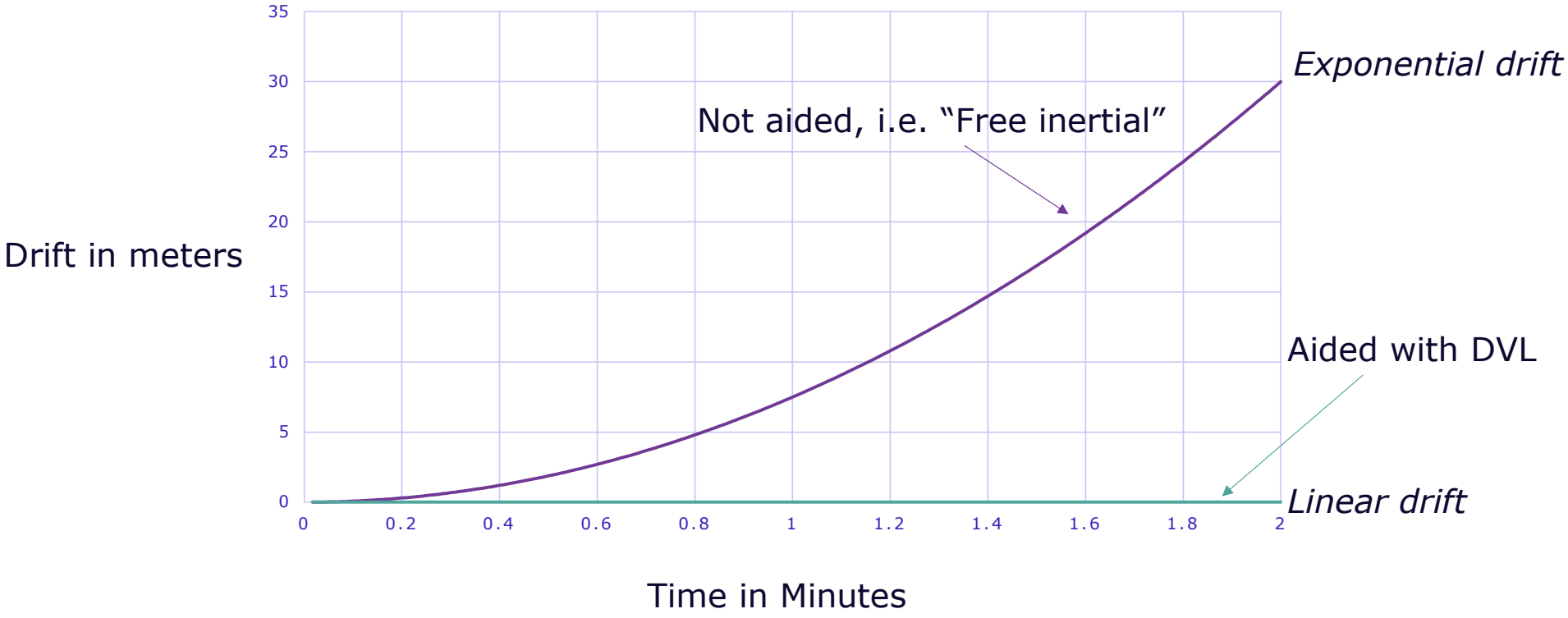
Why use DVL?

Typical real world "average" quality FOG based inertial system



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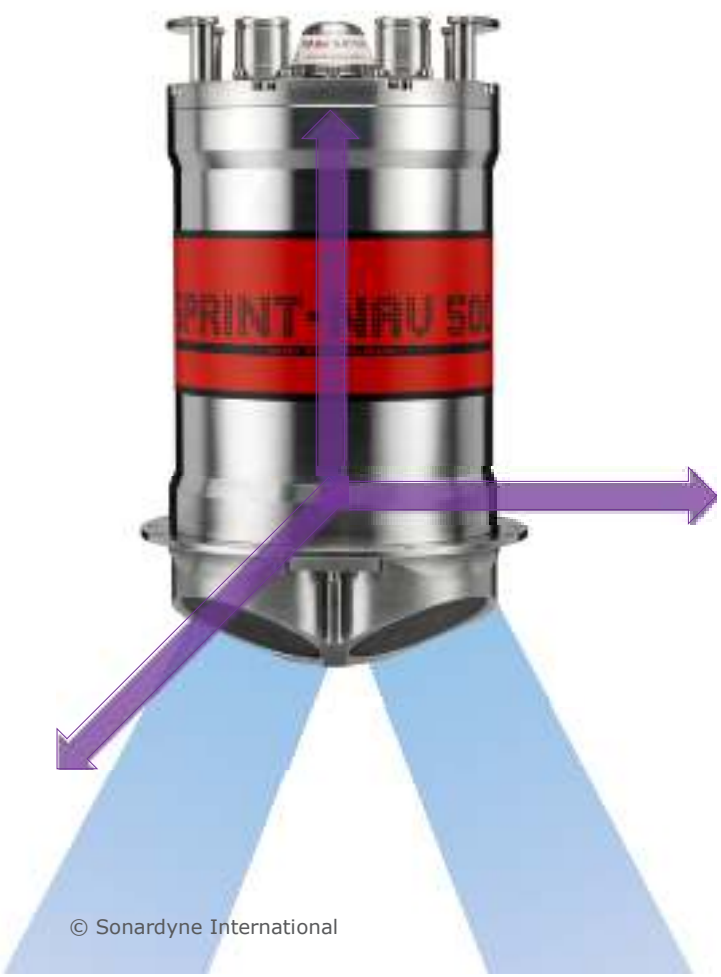
SPRINT-Nav / SPRINT-Nav Mini



- True North AHRS alignment
- Mechanically aligned acoustic-inertial-depth and tightly coupled for improved performance and flexible deployment options
- Perfect timing between sensors
- Improved outputs from hybrid performance means better accuracy and precision for all outputs
- Beam level aiding for better performance and robustness even in difficult seabed conditions
- Up to 200m altitude
- Water current monitoring

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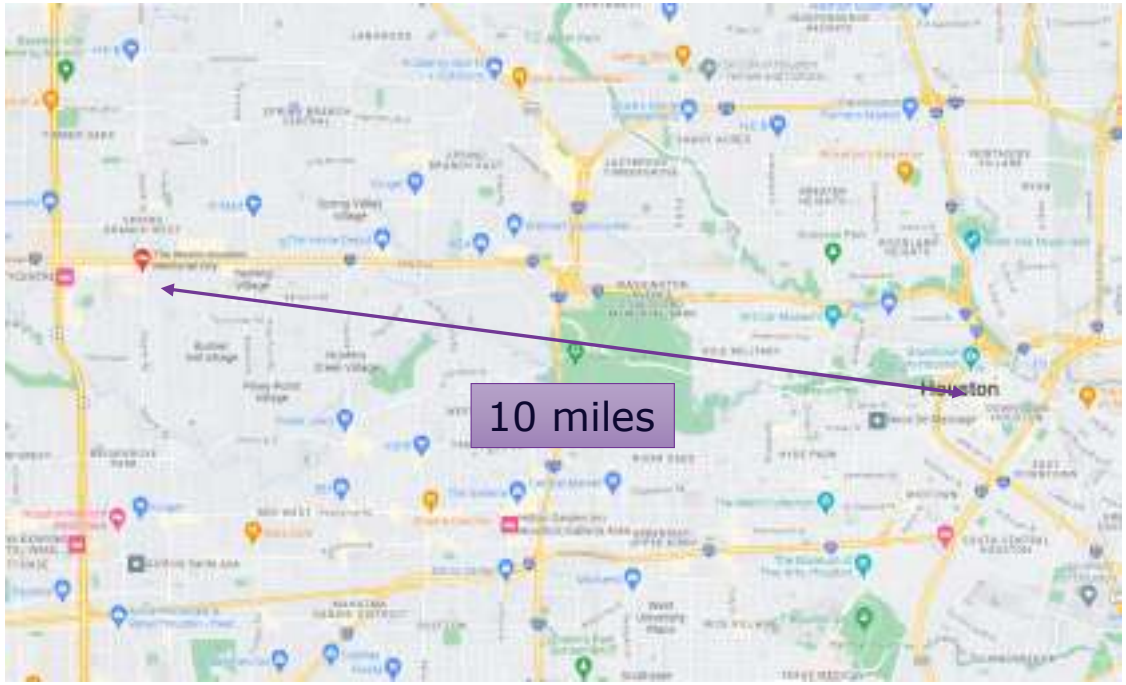
Downtown Houston to hotel

- SPRINT-Nav navigation
  - 6m from intended destination
- SPRINT-Nav Mini navigation
  - 48m from intended destination

- Distance Traveled vs Survey



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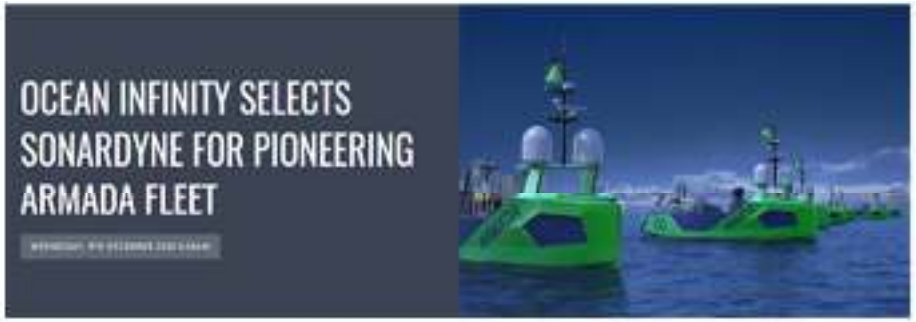
Diversity is Required for Safe Navigation of Autonomous Vessels



"Our expert team of robotics specialists selected Sonardyne as the clear choice for our robotics ships, to provide underwater navigation, tracking, control and communications", Dan Hook, Managing Director, Ocean Infinity

"The integration of Sonardyne's positioning system into our unique remote inspection offering, which combines the Blue Essence USV with the Blue Volta inspection eROV, is key in supporting Fugro's strategy to lead the development of remote and autonomous solutions", Ivar de Josselin de Jong, Global Solution Director for Remote Inspection at Fugro

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Summary of problem

- Not about proving performance of SPRINT-Nav
- About validating it for shallow water DP applications

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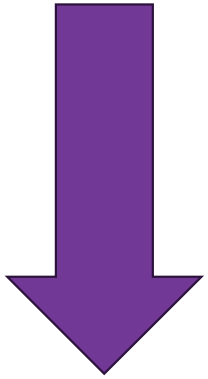
Field trials

DP Trials

- Data processing
- Testing at our UK facility in Plymouth
  - SPRINT-Nav 500
  - SPRINT-Nav Mini
- DP trials offshore using SPRINT-Nav
- DP trials offshore using SPRINT-Nav mini



Go slow:

Build confidence for use in shallow water DP operations

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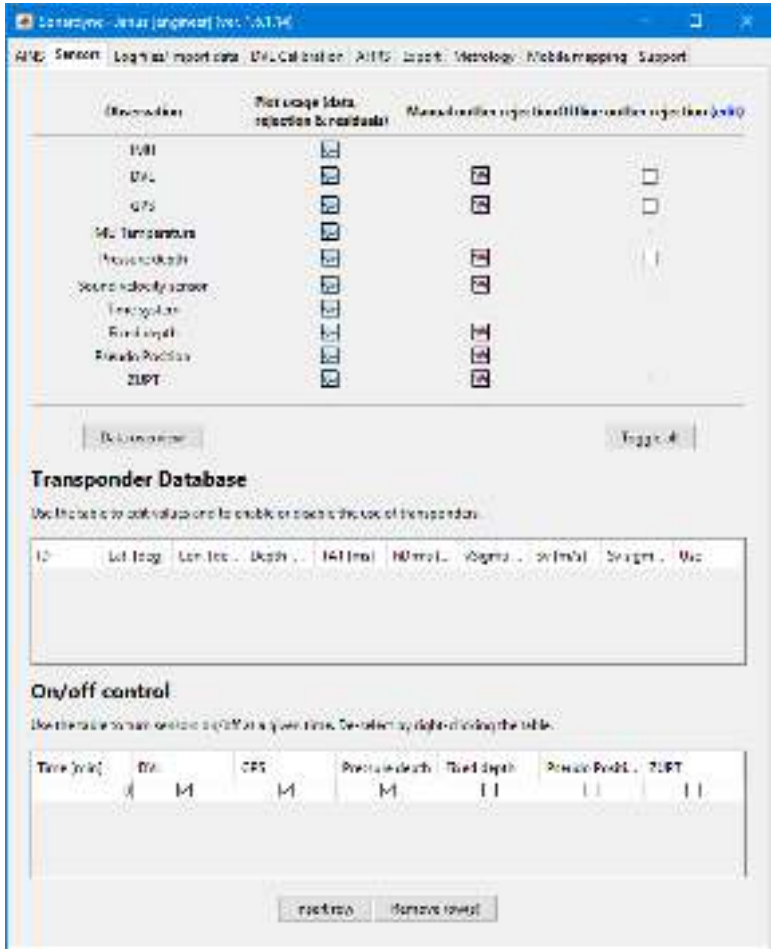
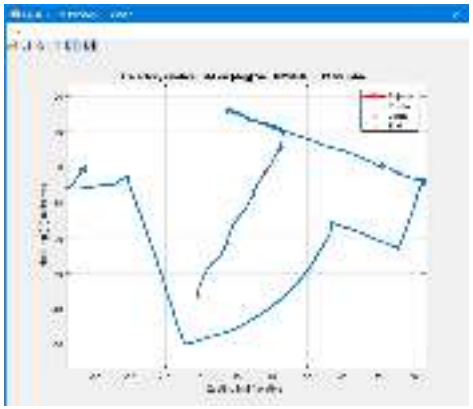
JDH0

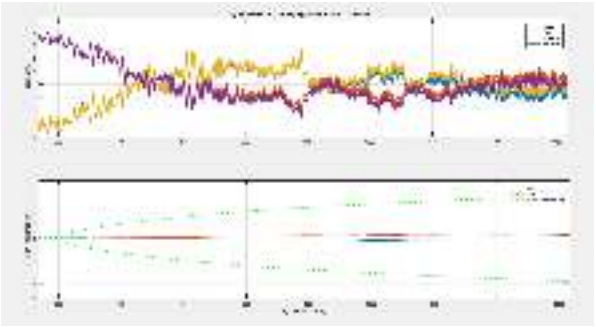
Data Processing – Janus Software



Navigation output



Navigation output



- **Real time** or post processed data
- SPRINT-Nav units log data internally
- Re-Processing allows higher performance for survey use, i.e. visual image re-construction

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Slide 18

JDH0 [@Edmund J. Ceurstemont] just be very clear that your plots are showing realtime data - not post processed.
John D. Houlder, 2023-09-18T08:27:41.372

Testing at Sonardyne Facility in Plymouth, UK.

- SPRINT-Nav deployed on pole
- Test run for 3 days to observe position difference

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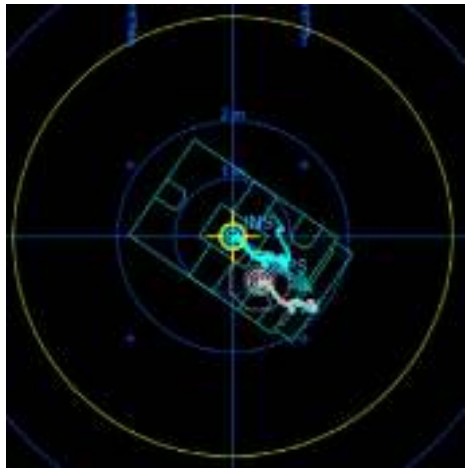
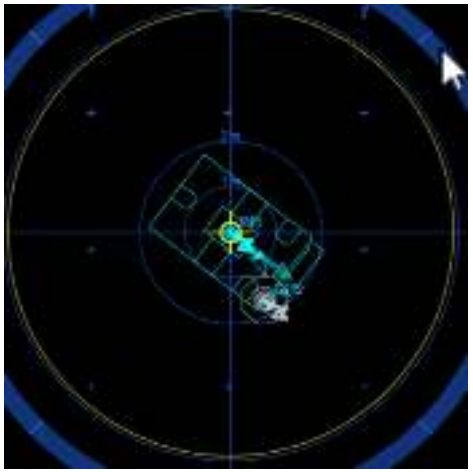
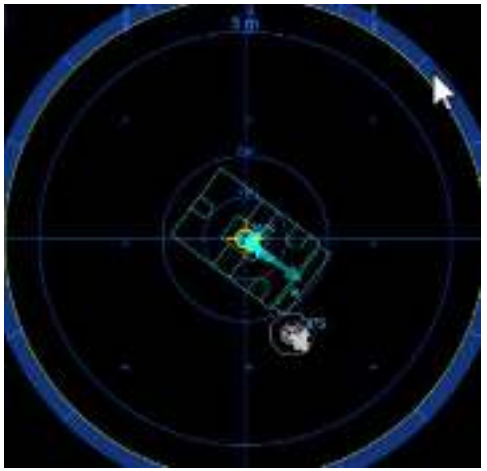
SPRINT-Nav 500 Data







24 Hours

48 Hours

72 Hours

Drift of 2.6m from GNSS RTK reference in 3 days

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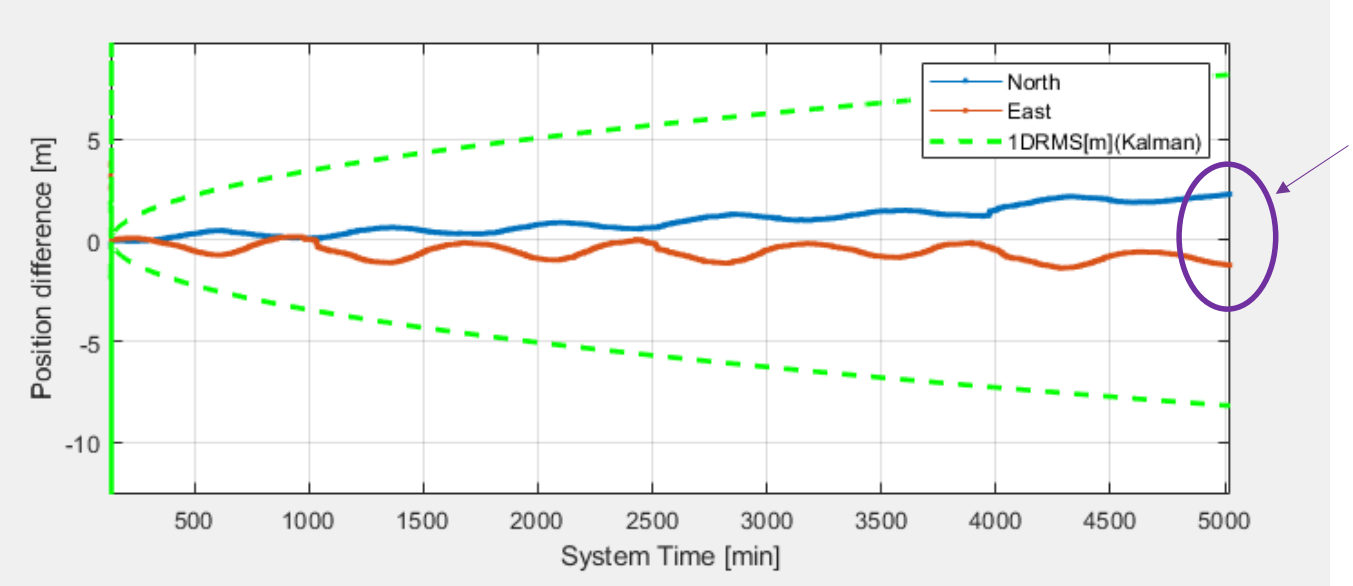
SPRINT-Nav 500 Data



Position error under 3m after 80 hours

Time

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SPRINT-Nav Mini

- SPRINT-Nav Mini on pole
- 27m water depth
- Over a 24 hour period

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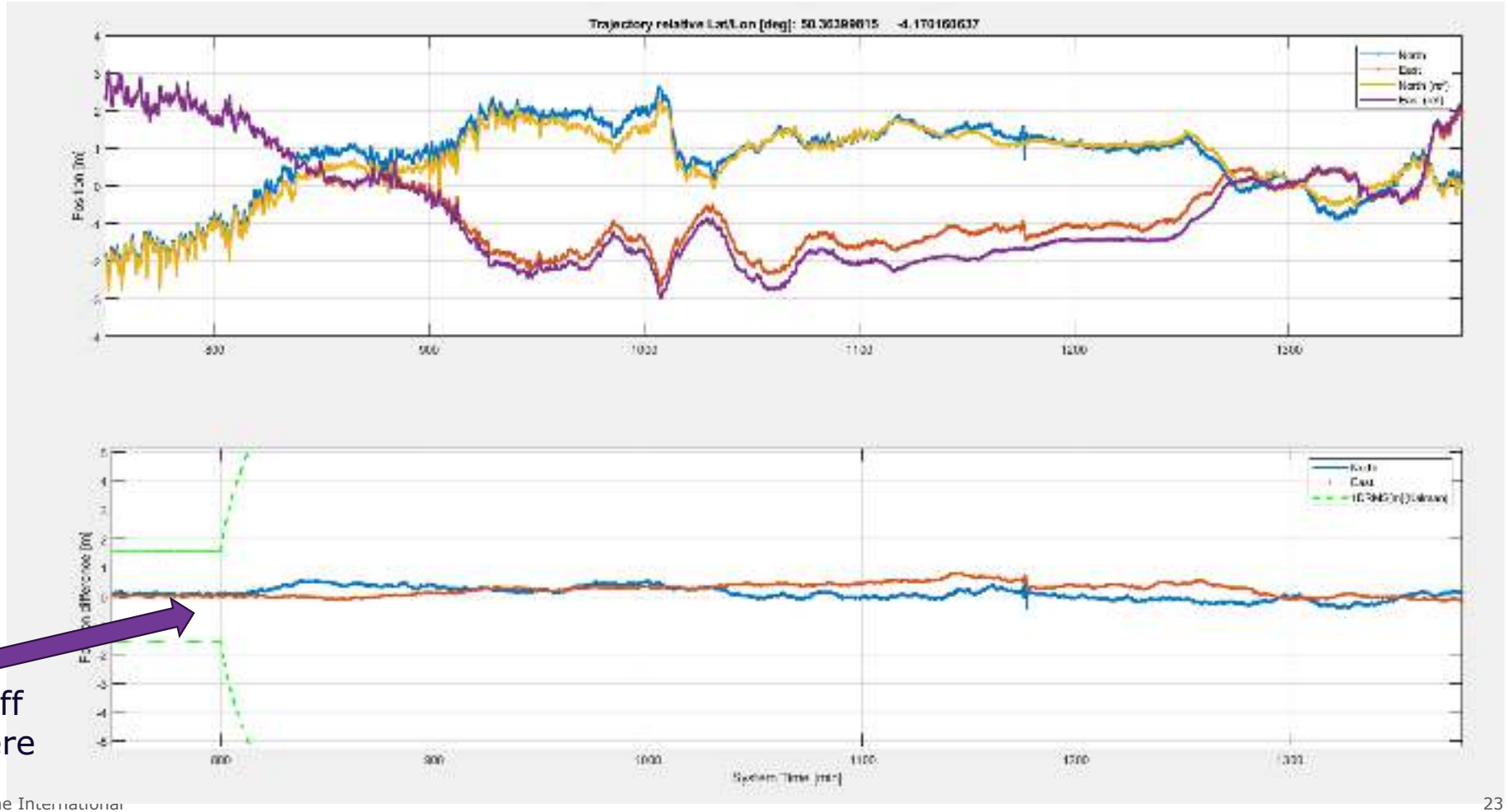
Slide 22

JDH0 Video didn't work for me "Cannot play media" just a warning 😉
John D. Houlder, 2023-09-18T08:29:34.103

SPRINT-Nav Mini



Turned off GNSS here

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JDH0

Water Current / ADCP

- Water current opposed to “DP current”
- Knowledge of the underwater forces
- ROV deployment safety

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Slide 24

JDH0 Worth drawing on the is it safe to deploy my ROV use case.
John D. Houlder, 2023-09-18T08:30:35.307

Water Current

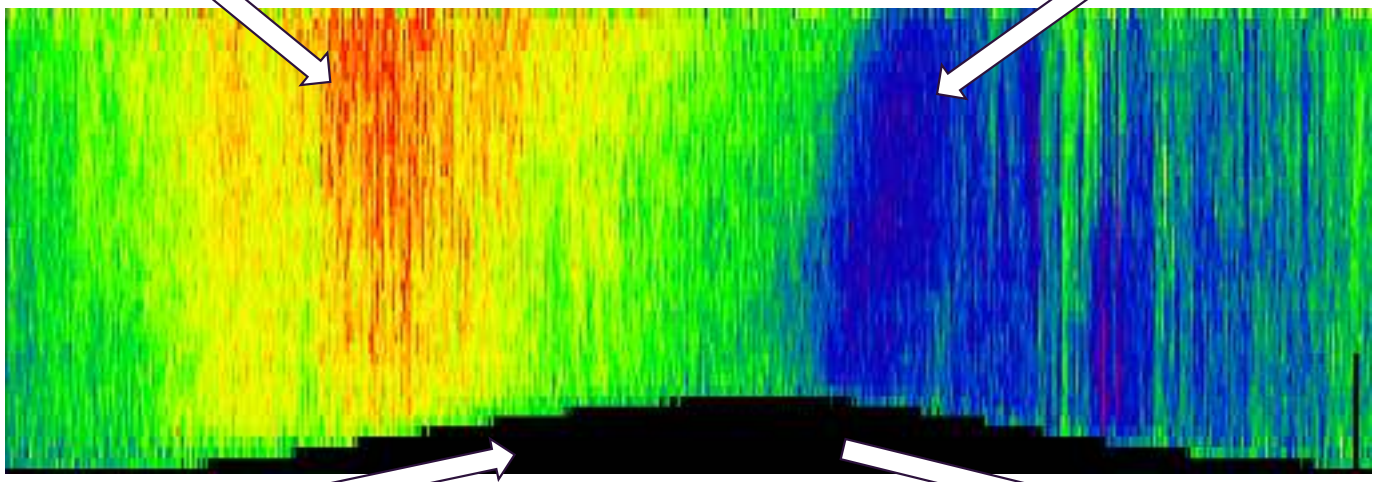
Water velocity peaks at over 0.5m/s

Water velocity peaks at less than -0.5m/s

4m

Distance

27m



Tide falling

Tide rising

4:00 pm

4:00 am

Time

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Offshore Data

Trials – Customer SPRINT-Nav Mini

Testing as part of commissioning phase

- 140m, 15000t Cargo vessel.
- Position reference passed to DP desk for monitoring

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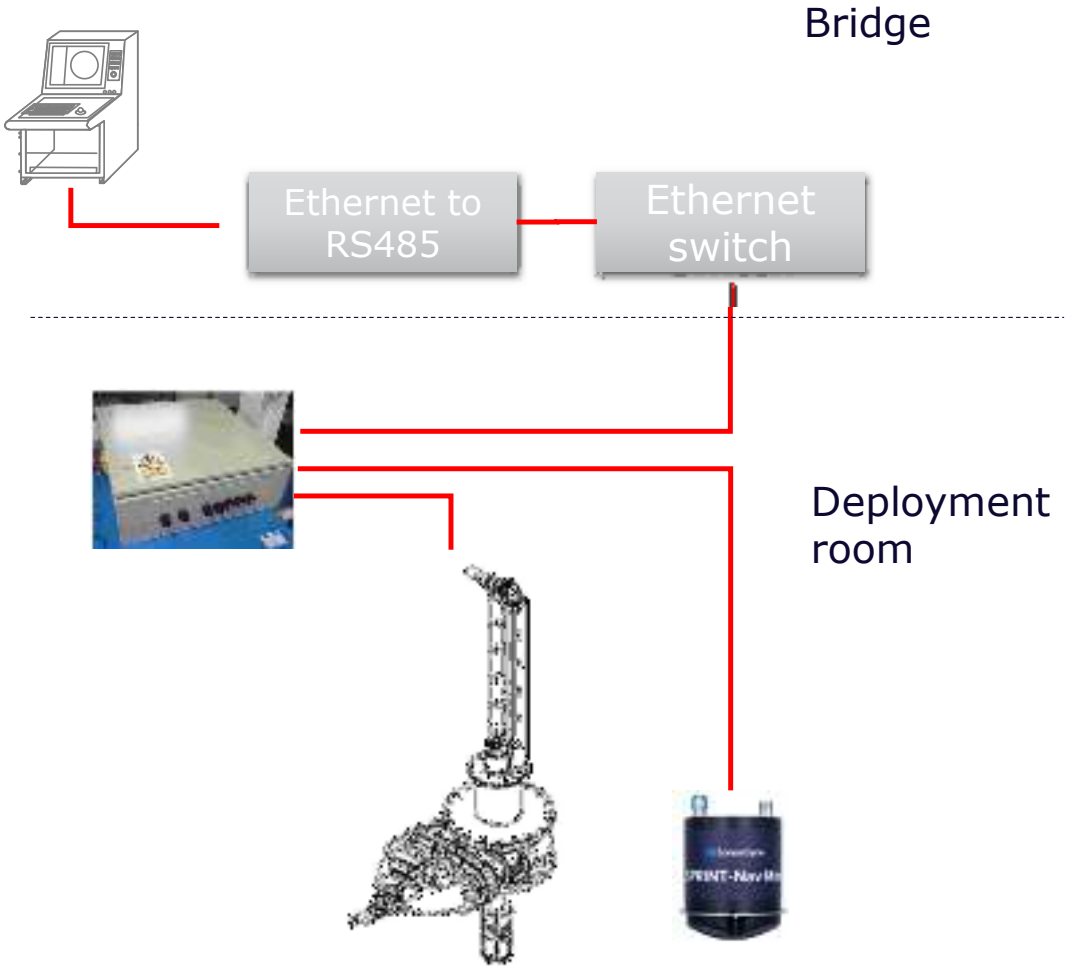
Trials – Customer SPRINT-Nav Mini

Setup

- SPRINT-Nav mini deployed on custom made pole
- Off the shelf Software on SPRINT-Nav Mini
- Output fed to DP via Ethernet to Serial converter
- Sound Velocity and GNSS sensors used as references to assess system performance



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SPRINT-Nav Mini vessel data

- Live monitoring of performance against GNSS reference
- SV sensor to evaluate / demonstrate performance

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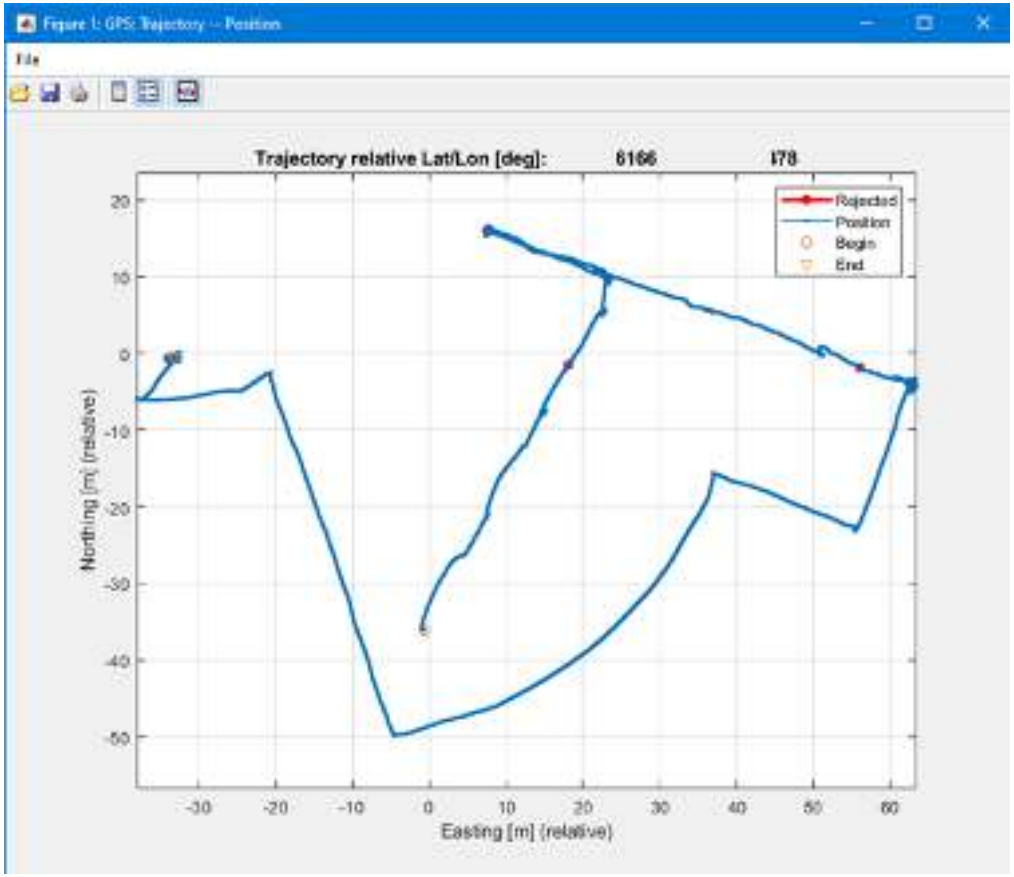
SPRINT-Nav Mini vessel data

Data

- Vessel not always operational on DP
- Half a dozen operational movements logged and analyzed – such as one to the right
- SPRINT-Nav Logs all data



Vessel Trajectory

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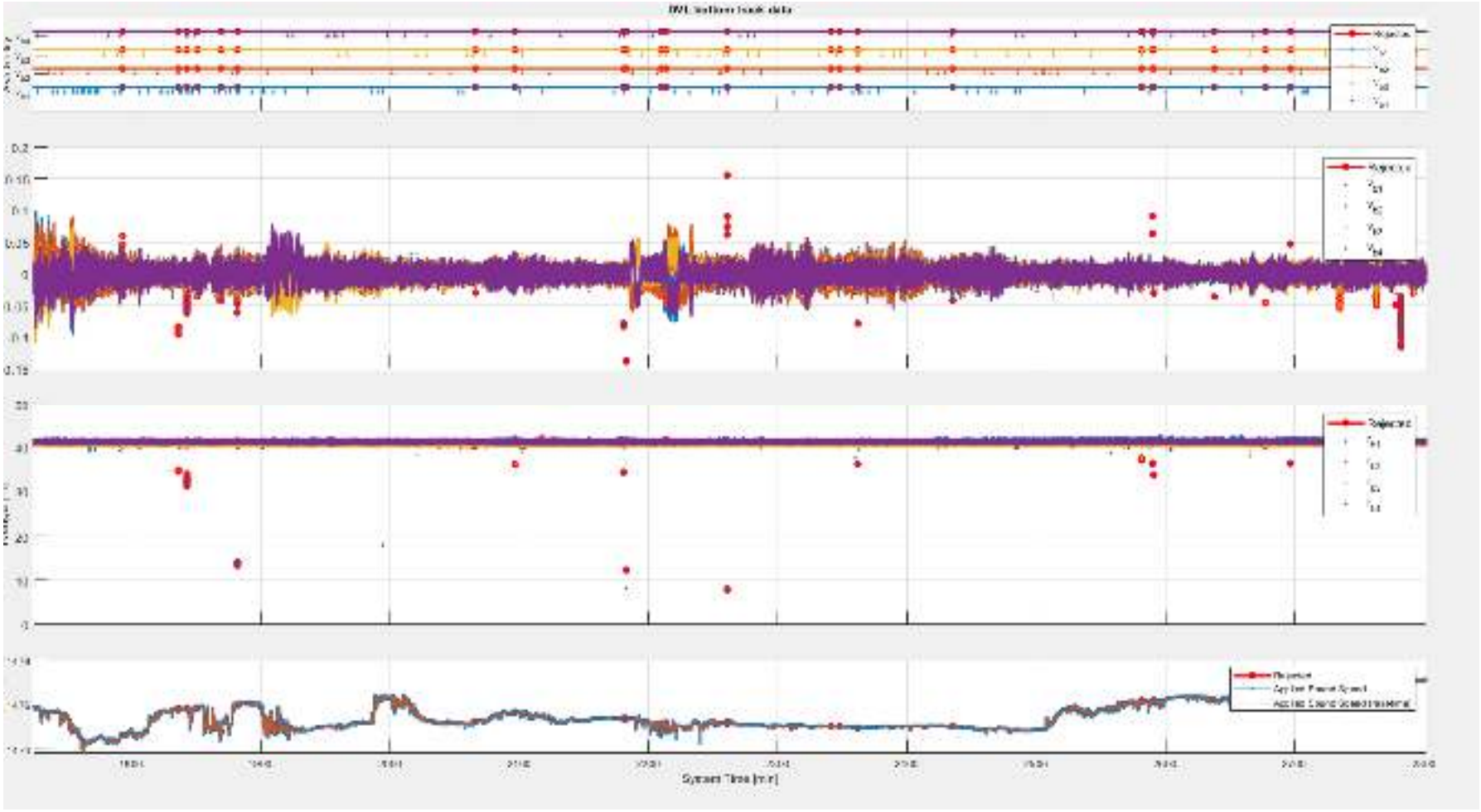
SPRINT-Nav Mini vessel data



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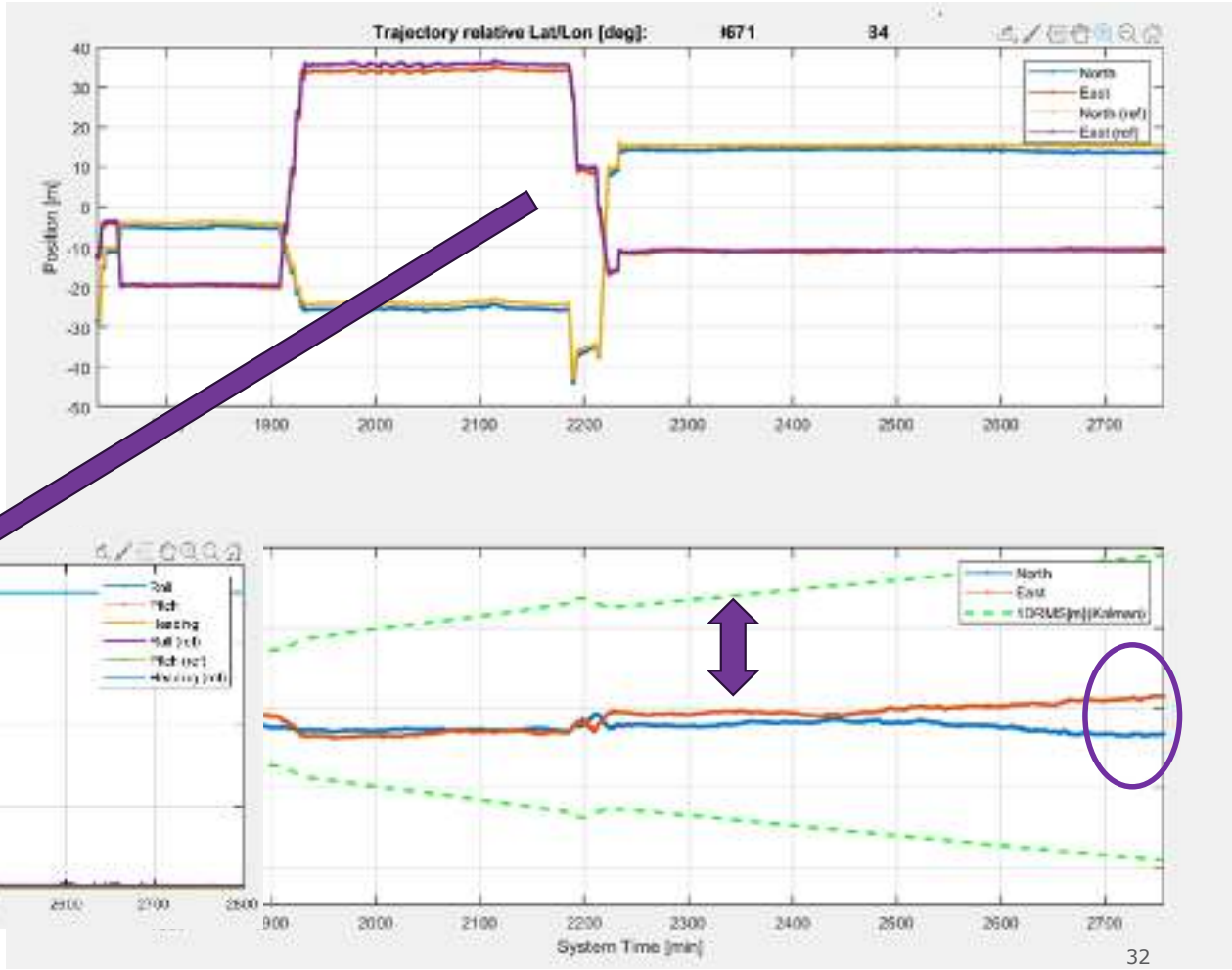
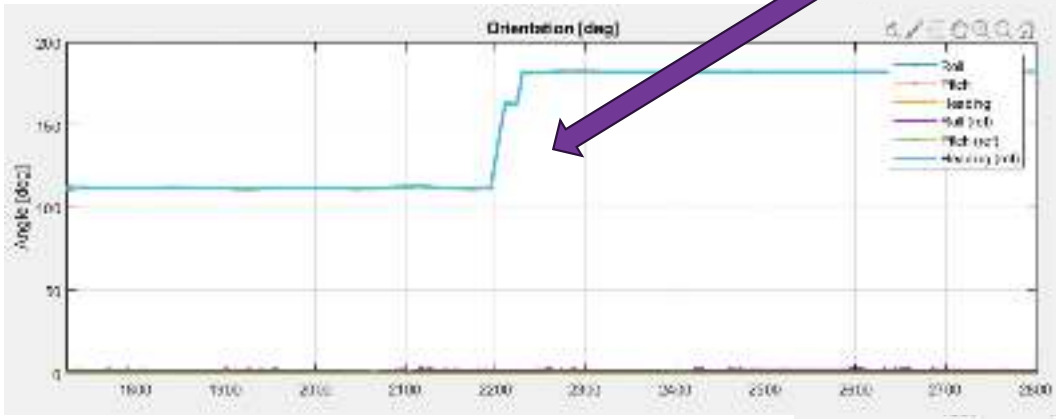
Trials – Customer SPRINT-Nav Mini (Vessel B)

- 15 hour operation <1m error in position
- Note: Conservative error estimate





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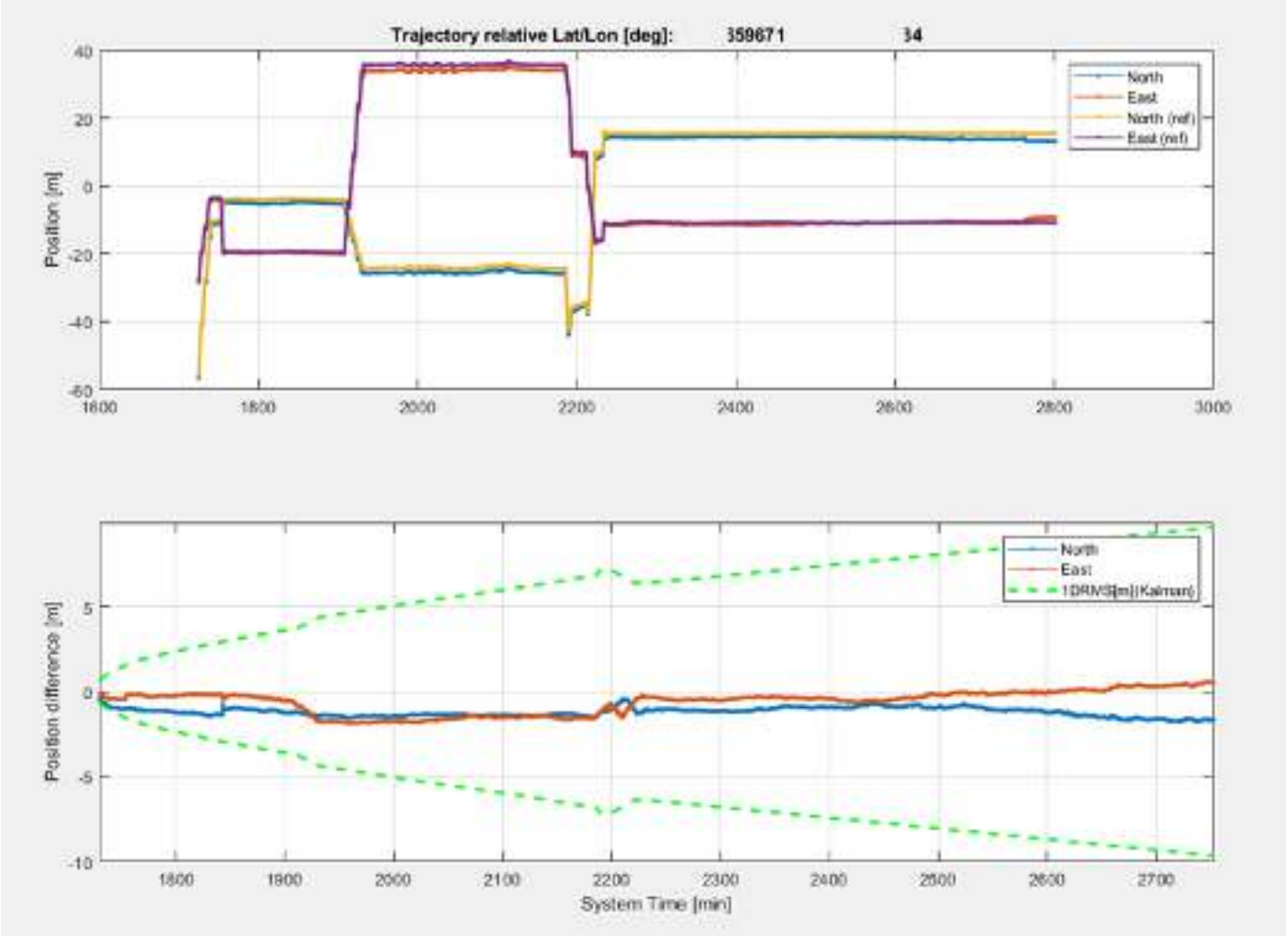
Trials – Customer SPRINT-Nav Mini

Without SV.

Processed the data with Derived SV

No noticeable difference



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Conclusions

Validation of use for DP applications

- Integrity – our report SD is conservative
- Worst case error observed was 1.0m in 12 hour with SPRINT-Nav Mini
- System resilient to vessel heading changes and general operational movements.
- System able to provide current profiling data along side navigation output.
- System will operate in water depths up to 200m

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Thank you for your time today

Any questions?

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