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# WORLD CLASS —

## through people, technology and dedication

**A network of ideas**

**Technology — inspired by nature**

**Kongsberg — at your command**

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# DP Performance and Incident Analyses

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# Performance and incident analyses

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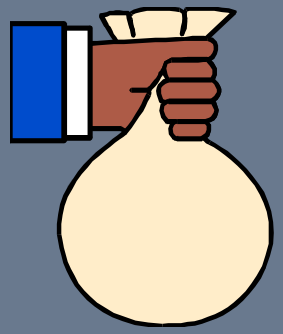
What can be gained ?

- reveal hidden problems
- improve operational procedures, hence
  - reduce operational expenses
  - reduce wear and tear
  - reduce maintenance cost
  - improve operational safety



What do you need ?

- good data recording and retrieval facilities
- may be a good simulator
- good knowledge in hydrodynamics and DP control
- time



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# The analysis context

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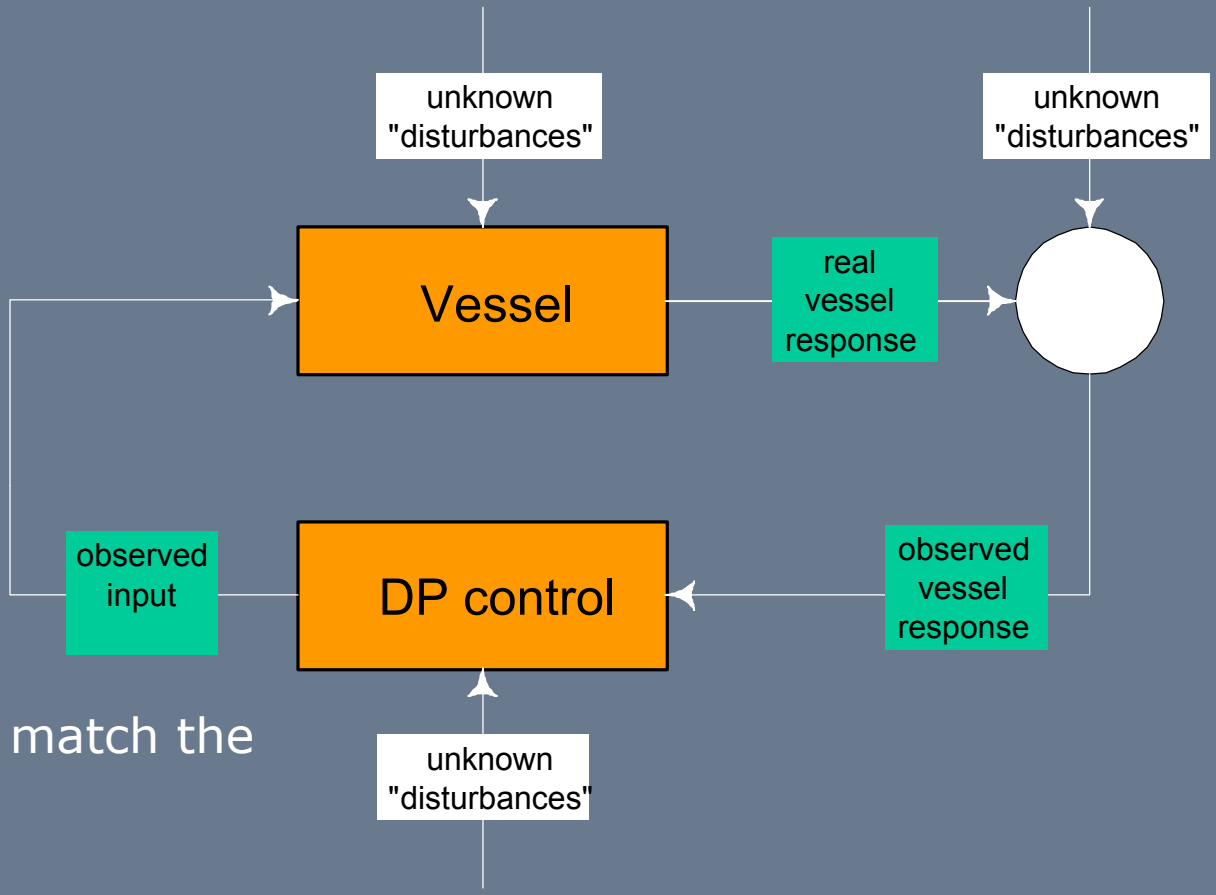
Tricky problem due to feedback structure

Reveal "disturbances"

- formulate hypotheses
- test hypotheses against observations and knowledge
- test hypotheses against simulations




Many hypotheses may match the observations

# Data logging

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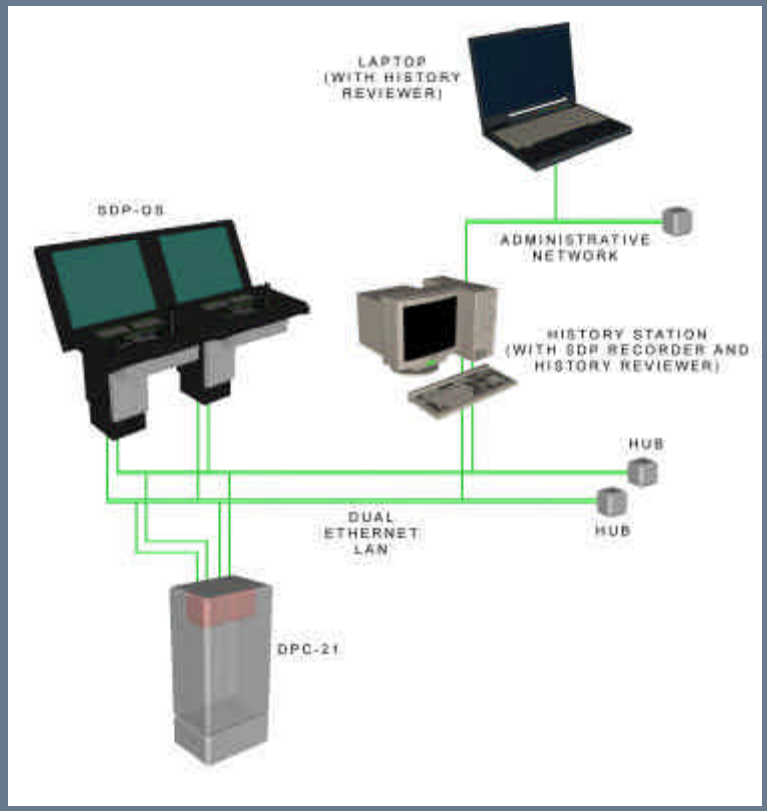
## Dedicated History Station

- Data Recorder
  - simultaneous logging sessions
  - template library - logging purpose
  - all internal DP variables
  - alarms, warnings, system info
  - operator actions
- History Reviewer
  - access to time series database
  - access to event database with filtering
  - time series and event synchronisation
  - bookmarks
- Data Export
  - full export to any external PC
  - ODBC interface (e.g. Excel)



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# History Reviewer

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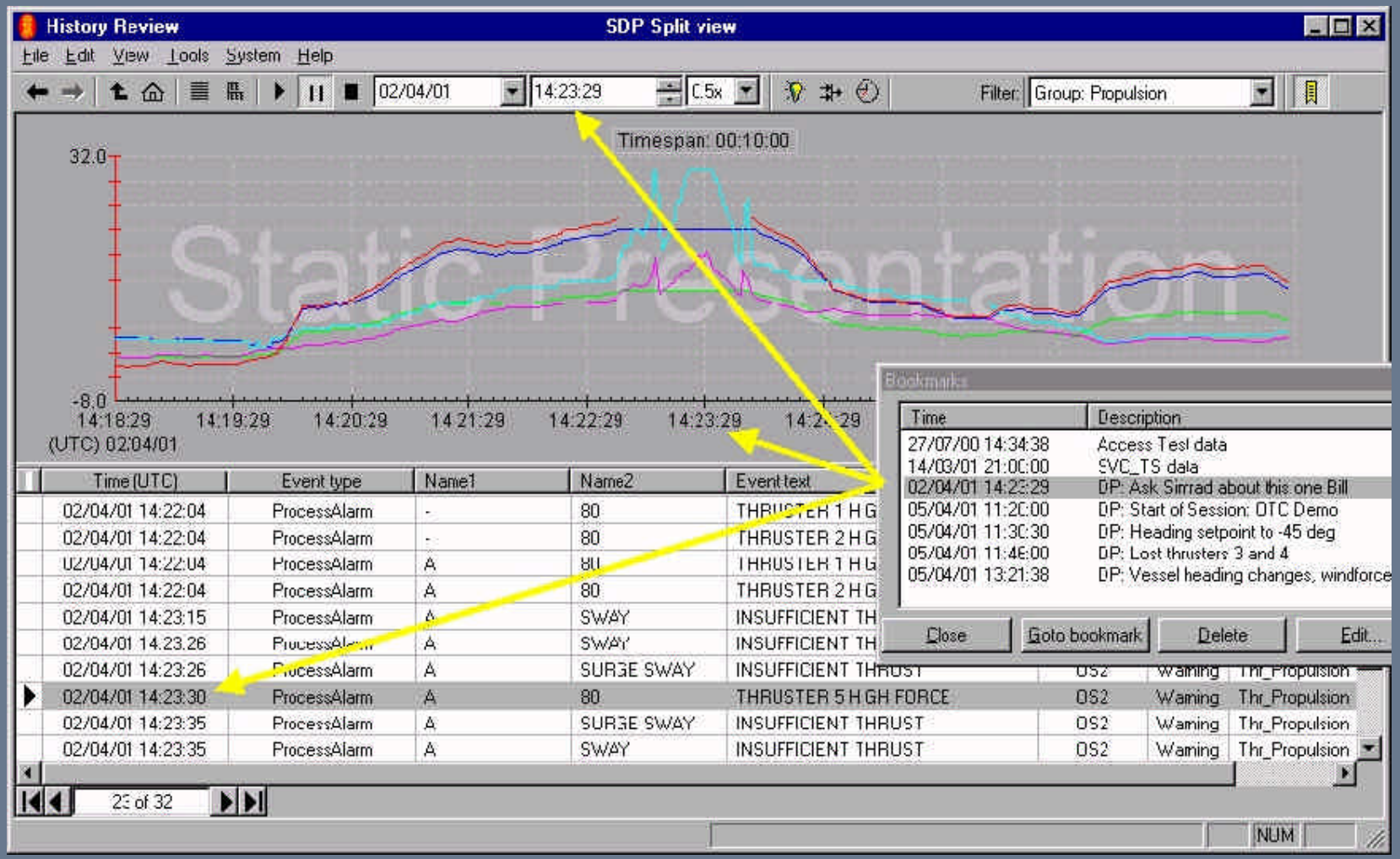




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# Case 1: Badly Tuned Thrusters (1 of 2)

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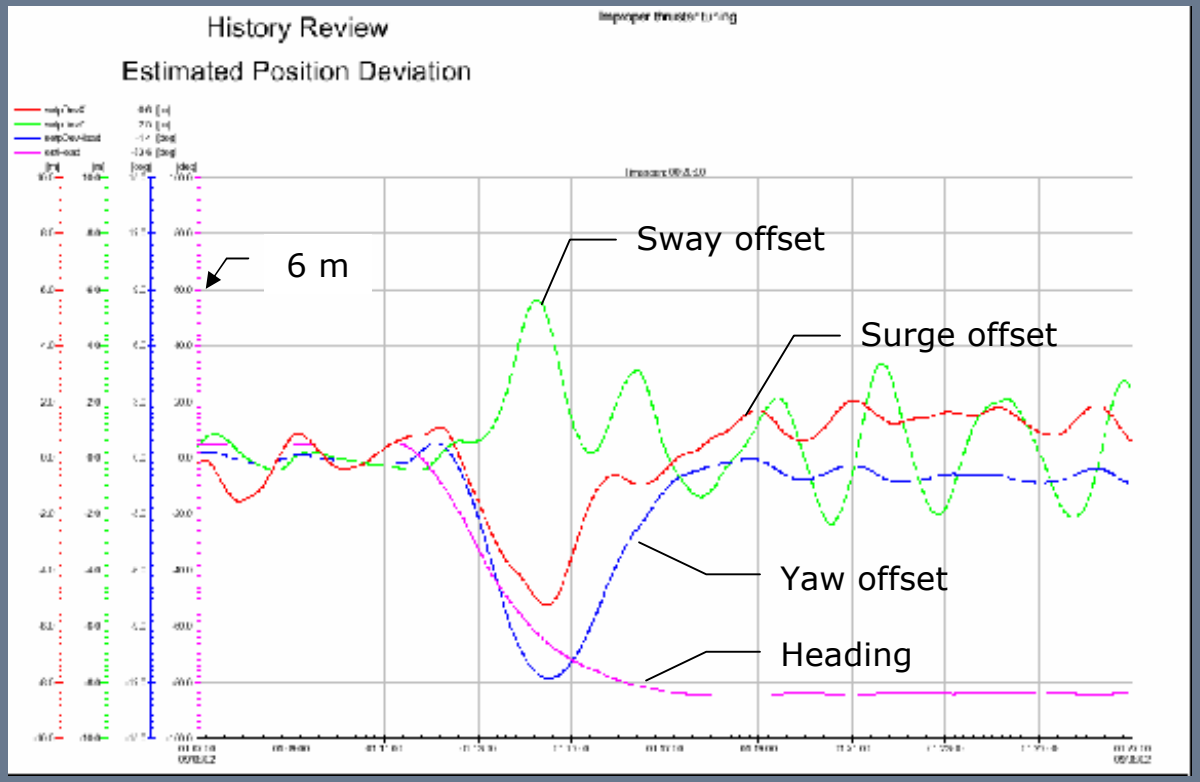
Observations:

- significant excursion during heading change
- DP current speed settled at a different value
- poor station keeping proceeding turn

Possible causes:

- wind modelling error
- current modelling error
- thruster modelling error



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# Case 1: Badly Tuned Thrusters (2 of 2)

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Further observations:

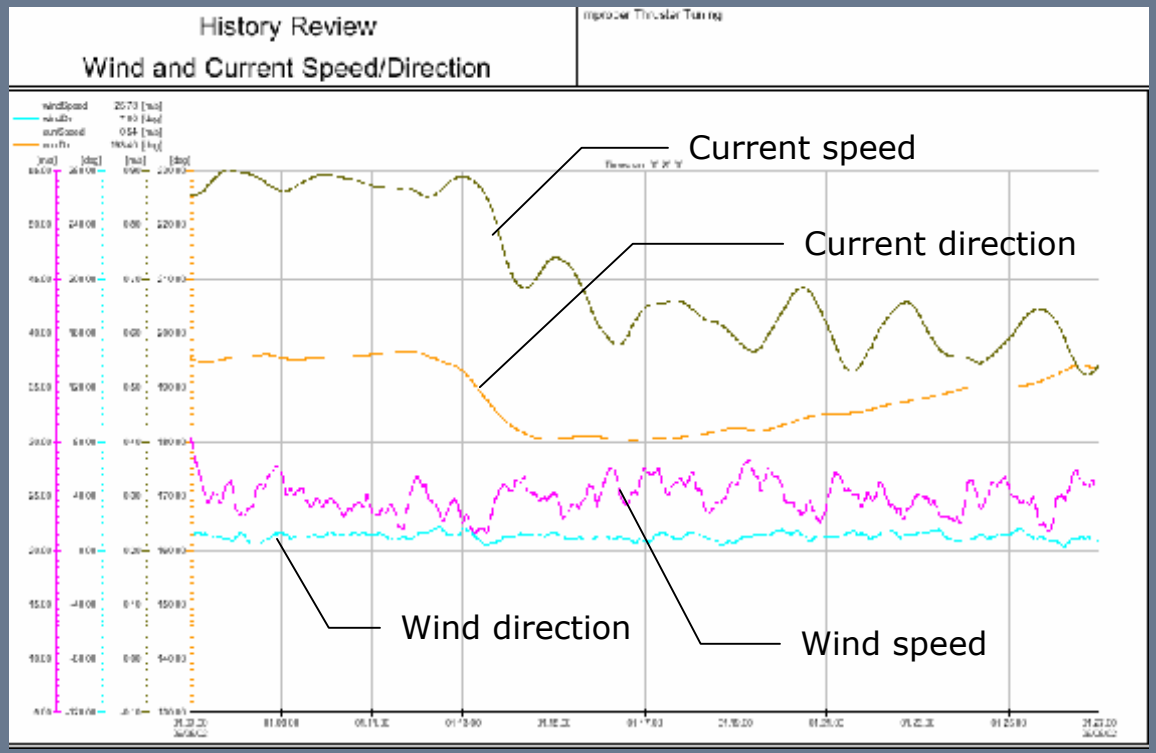
- current direction converges towards old value
- thruster setpoint - feedback matches

Conclusion:

- thruster modelling problem
- evenly distributed

Verification:

- rerun scenario in simulator environment



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# Case 2: Loop Current (1 of 4)

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Current:

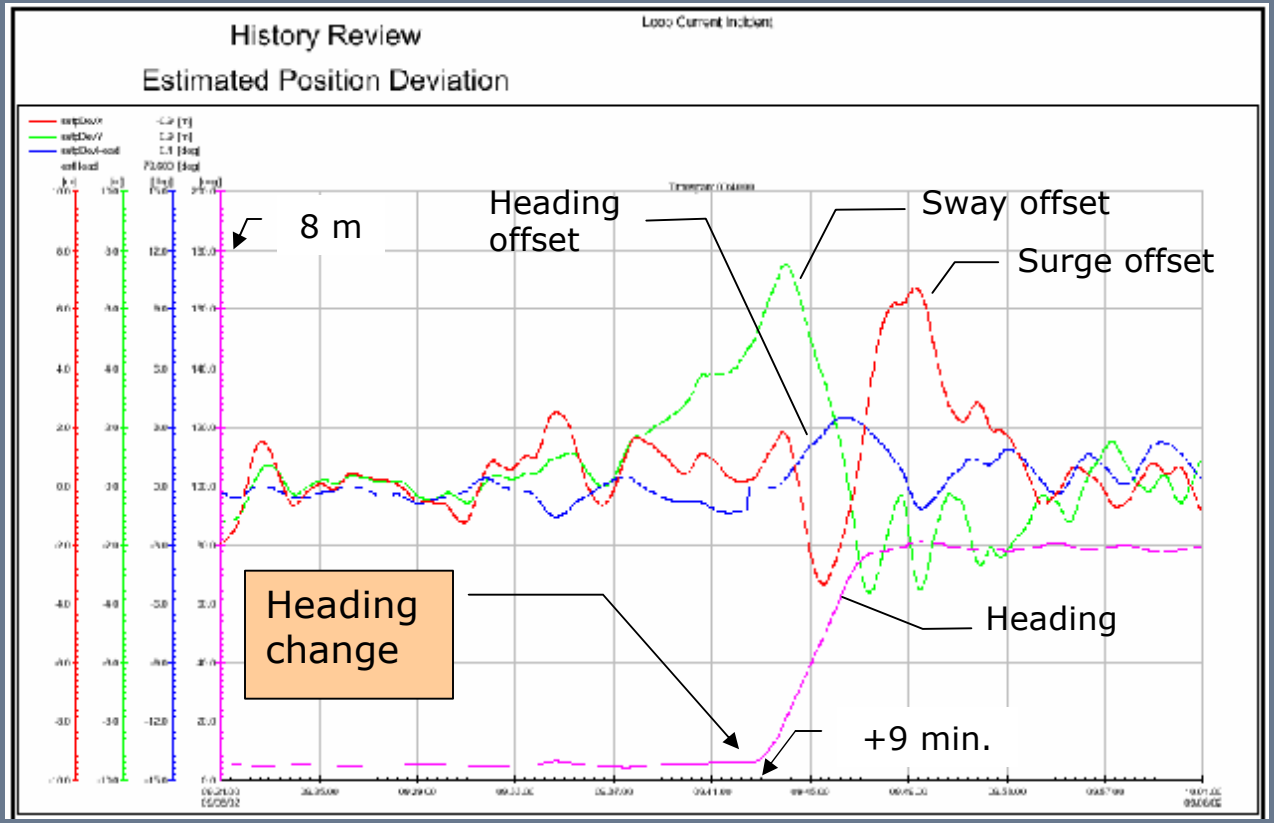
speed: 0.2 m/s → 1.5 m/s

dir: 10° → 90°

over 15 min. period

Heading changed after 9 minutes

Reasonable operator response ?



# Case 2: Loop Current (2 of 4)

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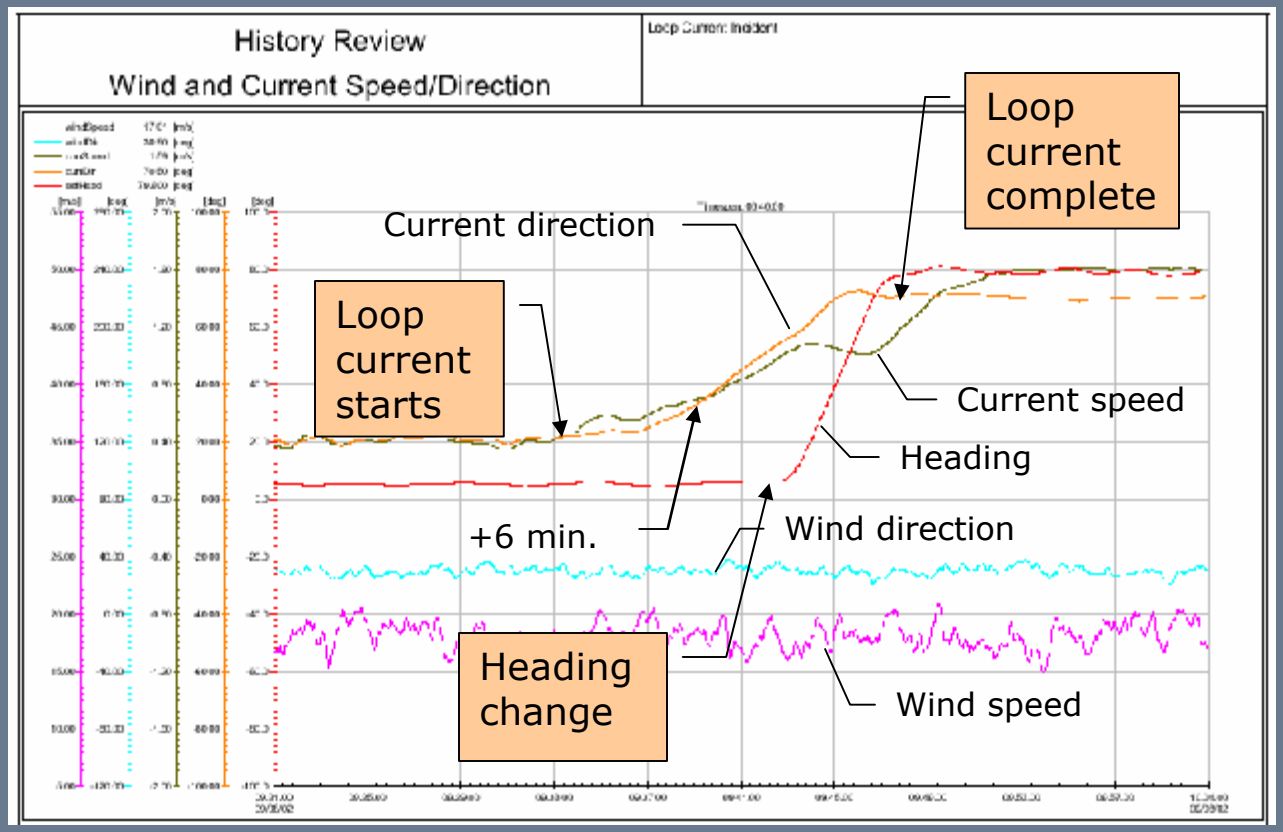
Observations:

- Current estimated quite accurately during build up
- Not sufficient to avoid excursion
- Significant change in current after 6 minutes



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# Case 2: Loop Current (3 of 4)

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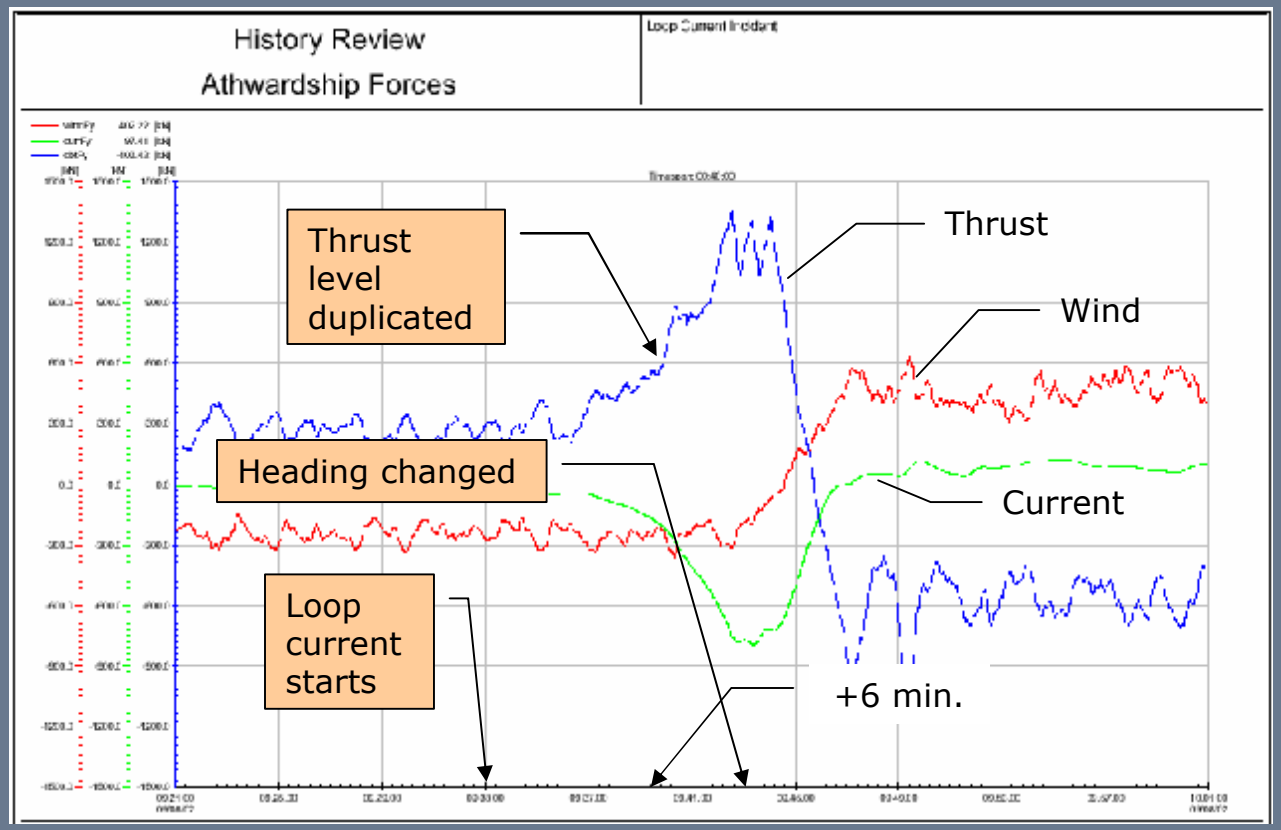
Observations:

— Thrust level duplicated within 6 minutes

Lateral forces



# Case 2: Loop Current (4 of 4)

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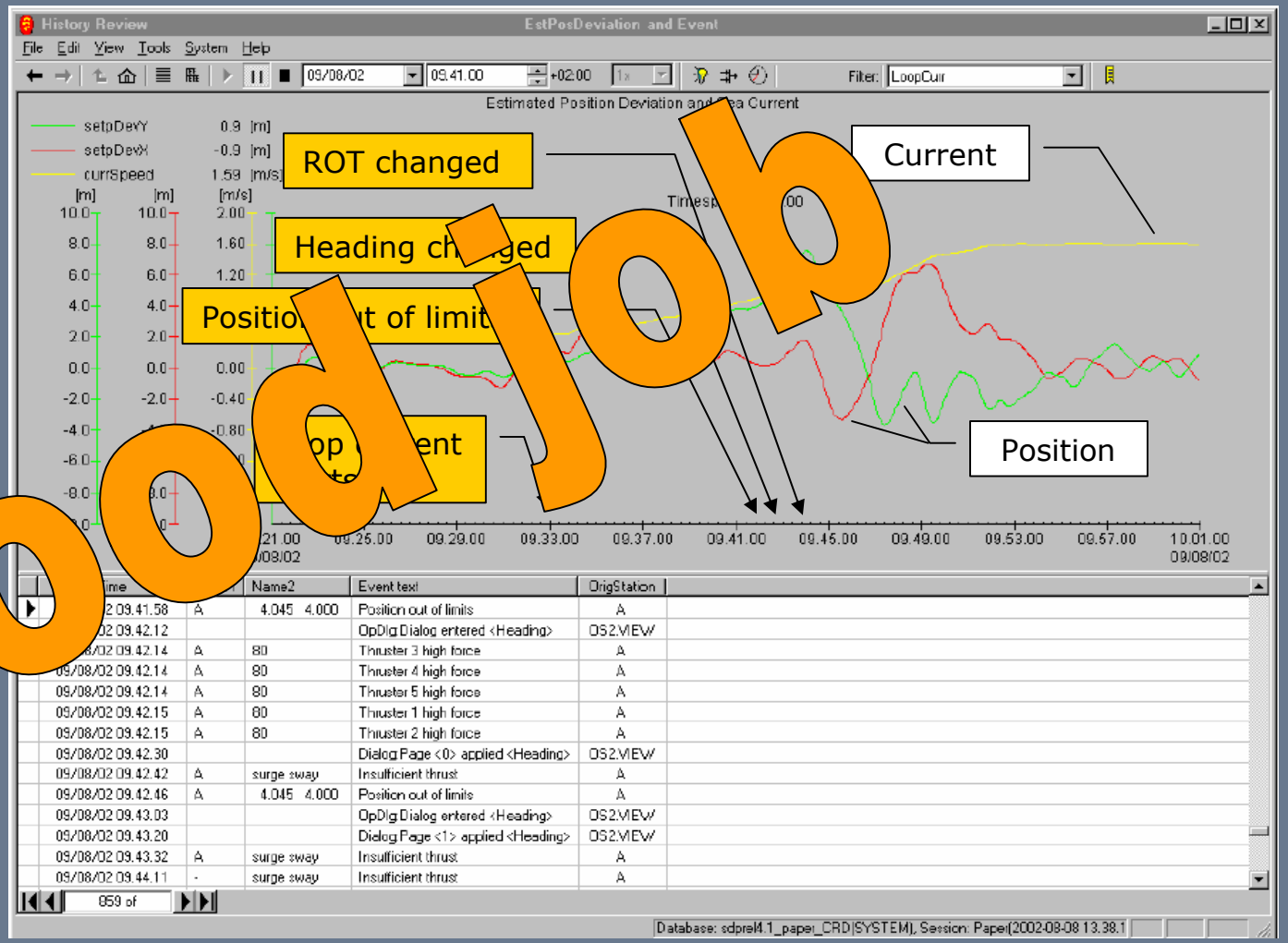
## History

Time since loop current start

- ✓ +8:58 Position out of limits warning
- ✓ +9:12 Prepare to change heading
- ✓ +9:14 High thrust warning
- ✓ +9:30 Heading change commanded
- ✓ +9:42 Ins cient st alarm
- ✓ +9:46 Positi limits alarm
- ✓ +10:03 Prepare to change ROT
- ✓ +10:20 ROT change commanded



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# Case 3: Reference System Problem (1 of 3)

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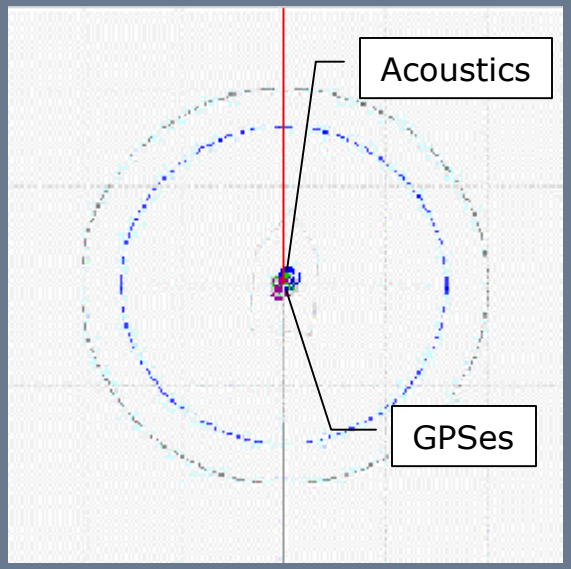
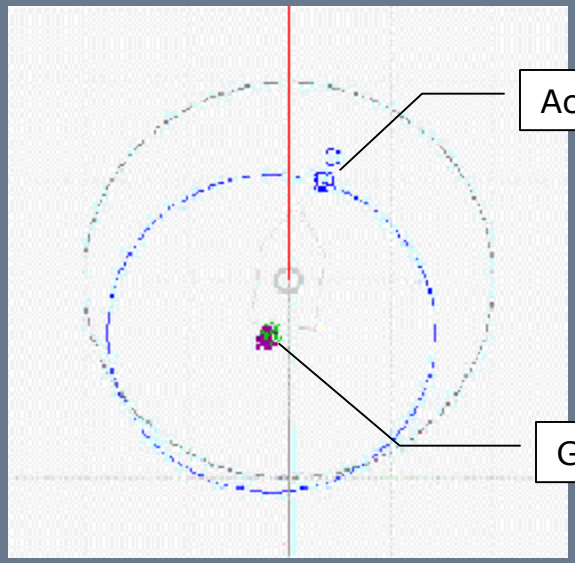
Observations:

- 2 x GPS and acoustics in use
- reference system drifting apart (estimated position in between)
- operator deselects GPSes

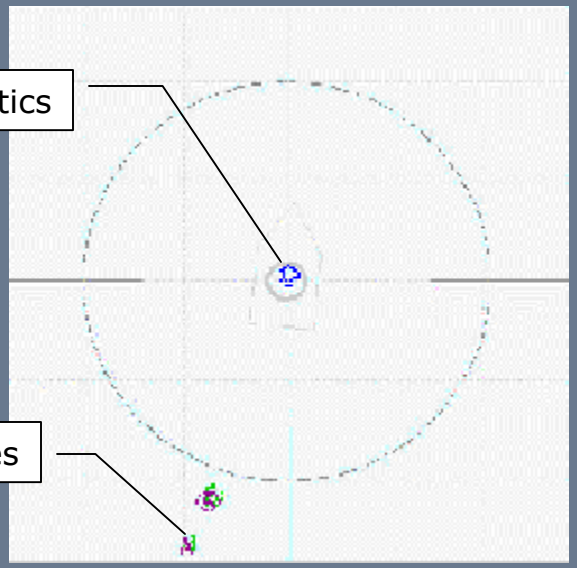
Initially




After a while




Finally



# Case 3: Reference System Problem (2 of 3)

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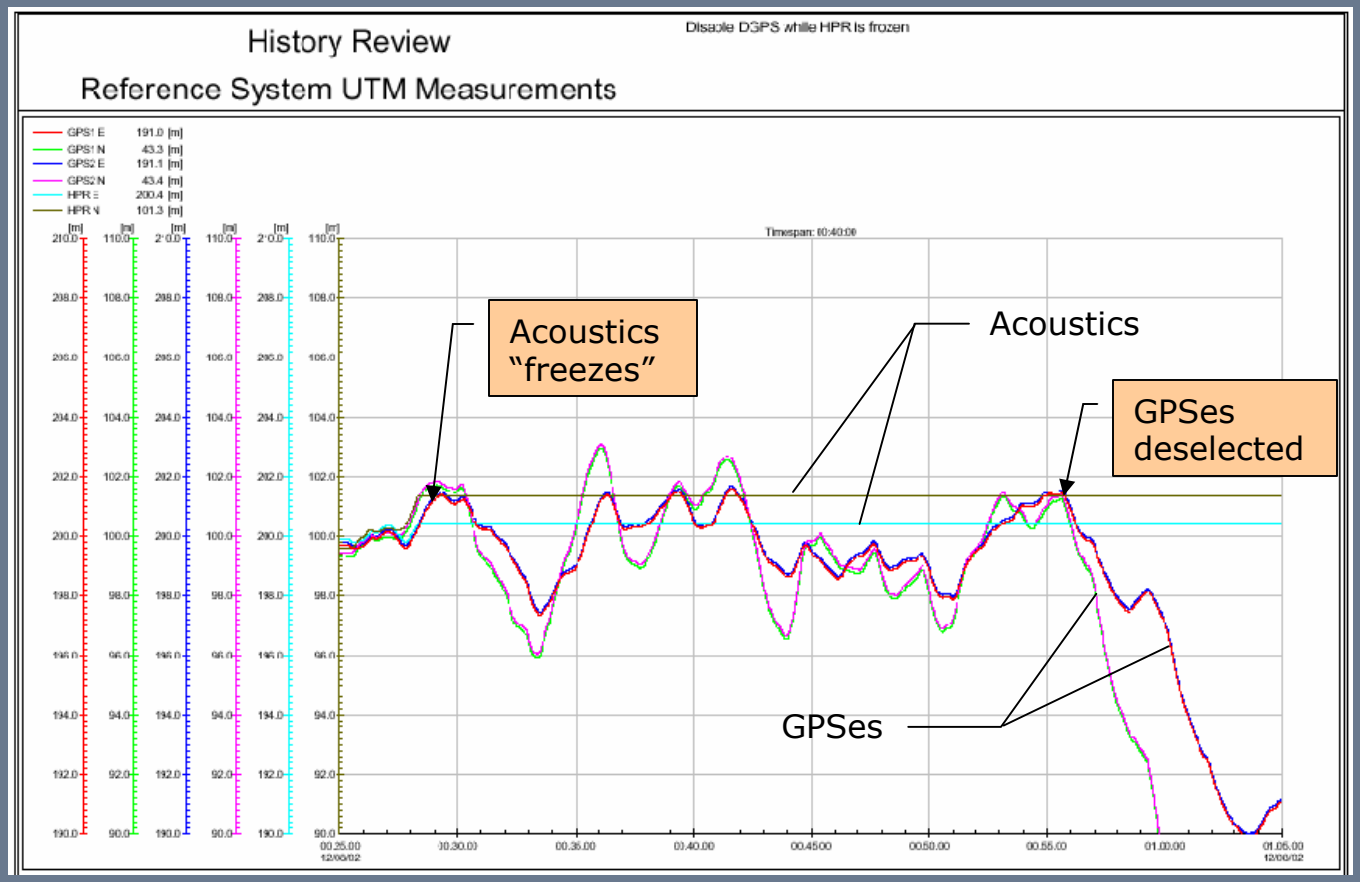
Hypotheses:

- ionospheric disturbances
- transponder dragging
- acoustics locked to vessel born target
- GPSes "frozen"

Operator decision

- scintillation
- GPSes deselcetd



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# Case 3: Reference System Problem (3 of 3)

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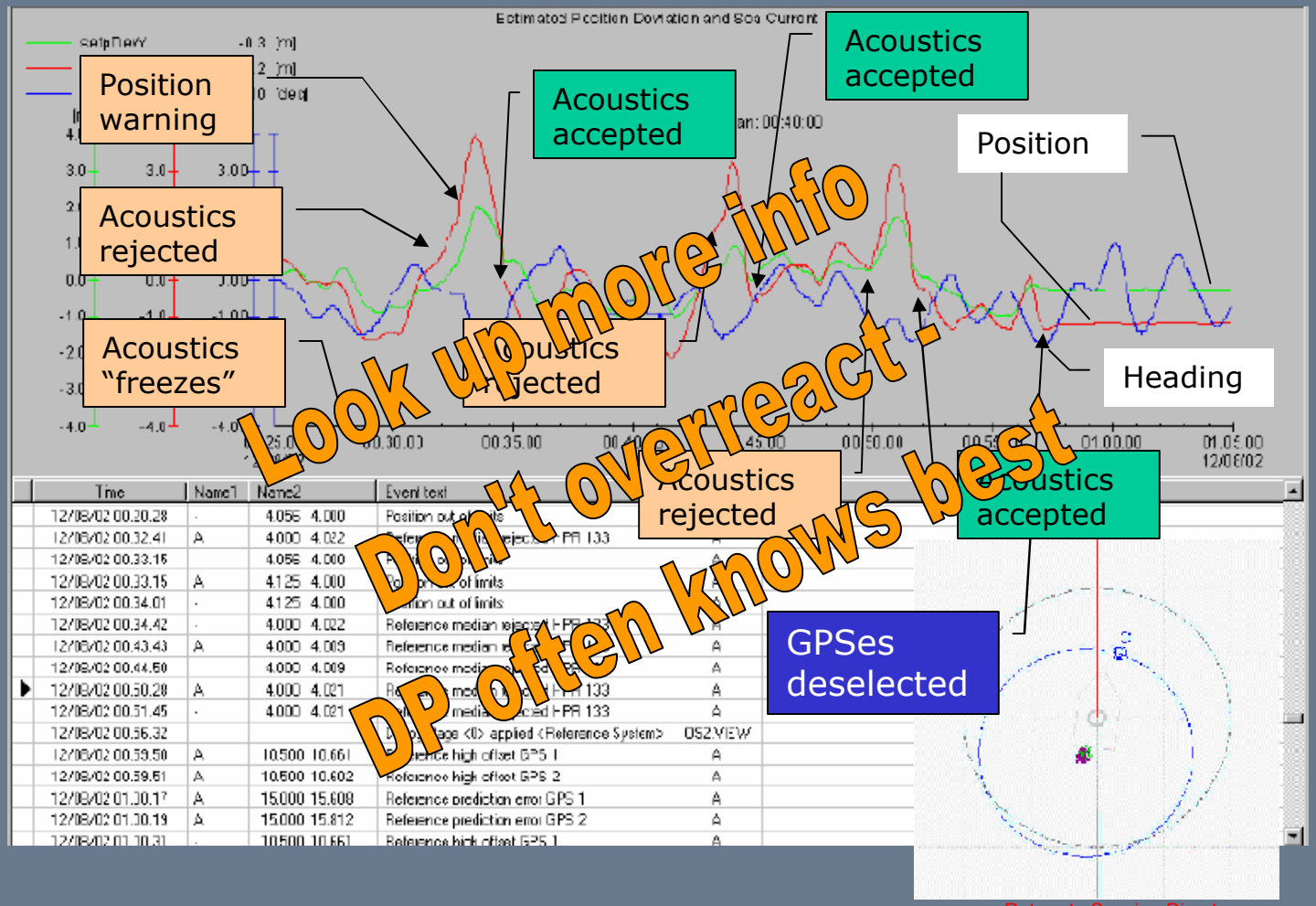
## History

Time since "freeze"

- +4:41 acoustics reject
- +5:15 position out of limits warning ON
- +6:01 position out of limits warning OFF
- +6:42 acoustics accept
- +15:43 acoustics reject
- +16:50 acoustics accept
- +22:03 acoustics reject
- +23:20 acoustics accept
- +28:32 GPS deselected



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# Concluding Remarks

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There is a large potential in utilising results from performance analyses economy- and safety wise

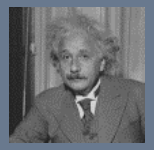
- — tuning DP system to fit for purpose
- — improving operational procedures

Hydro dynamic- and DP control knowledge necessary

Data recording and analysis tools mandatory

Simulation tools advantageous

Tank you for your attention



It’s no drawback being a genius



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