

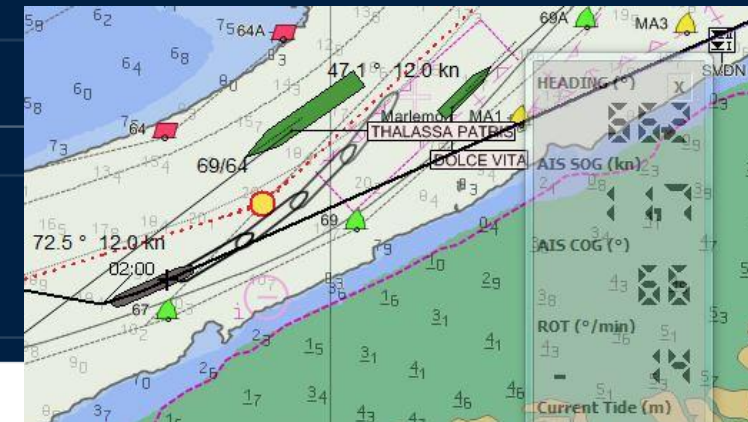
Docking Systems evolving.....

Sensor Monitoring...

“Clever tools, increasing situational awareness!”

Xander Janssen, pilot

Loodswezen regio Scheldemonden



Chapters

1. Dutch Pilots on the river Schelde
2. SNMS & SNMS-Lite history
3. Original design not for Antwerp!
4. ISPO-Certified Region River Scheldt since 2014
5. New Sensors
6. Guidelines and Additional Information to the ISPO 7, Pilot Operations 7.5, Portable Pilot Unit
7. So what's my point? Where is the improvement?
8. Quality of Data
9. Sensor monitoring
10. Testing



1. Dutch Pilots River Schelde

- **160 Dutch Pilots**
 - 125 sea-river pilots (from sea to Antwerp locks, quays and all (Dutch) ports and terminals along the river)
 - 35 sea-canal pilots (from sea to Terneuzen-Ghent canal and all it's ports and quays).
- **Yearly 32.500 vessels (Scheldevaarders) to Antwerp/Ghent (under Scheldt treaty)**
 - Dutch Pilots: 27,5% (ca. 9.000 vessels)
- **Yearly 10.500 Wetschepen to Vlissingen and Terneuzen (Dutch law)**



1. Dutch Pilots on River Schelde



2. SNMS & SNMS-Lite history

SNMS= Schelde Navigator Marginal Ships (from 2003)

- Software **Qastor, Full Docking Licence**
- Fall 2003-2005, prototype with Marimatech Antenna's
- Fall 2005-2011, working to specs 5x **ADX** units (development from 2004)
- From fall 2011- now, 8x **ADX-XR** (some minor upgrades to wifi range)
- From fall 2015-now 1x **ADX-XM** (DUKC, full motion research unit!)
- From 2016-now, 4x **ADX-DUO** (2017 updated to long WIFI range, Docking Lite)



Very accurate sensors

SNMS-Lite= 'Lite software version' used with AIS Pilot Plug connector (from 2001)

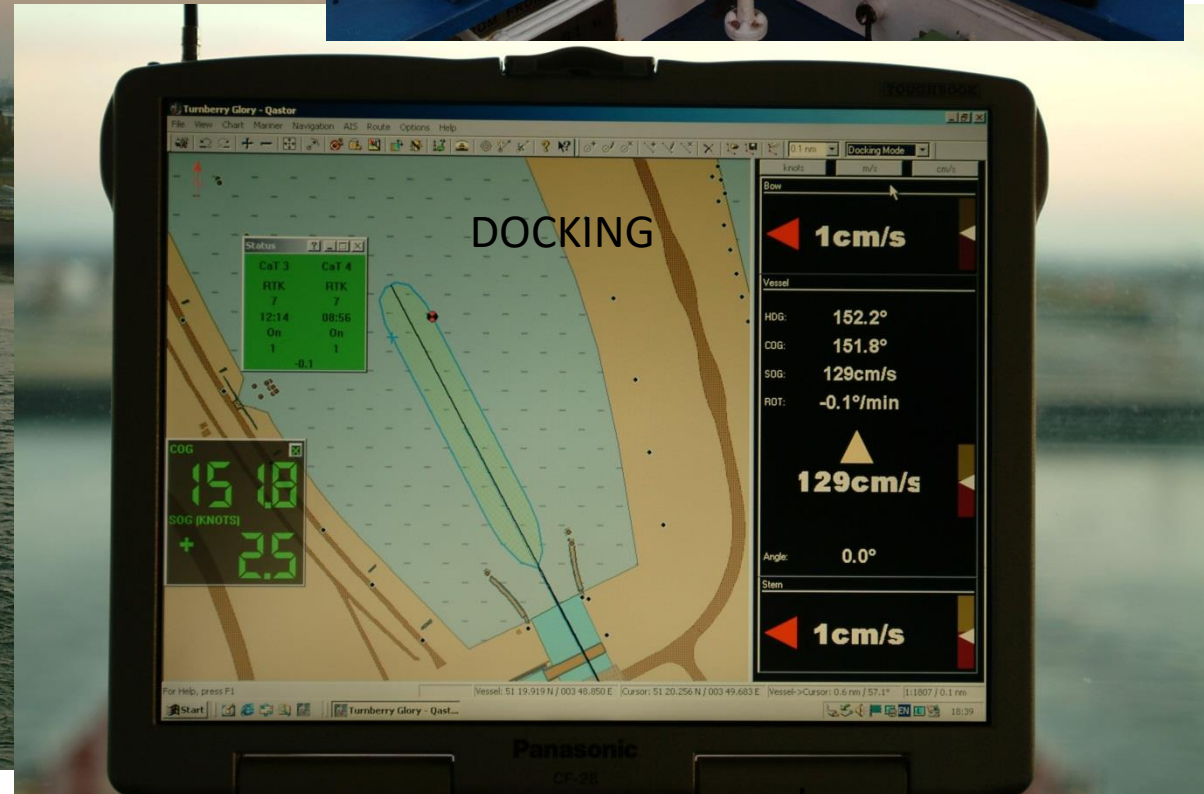
- Software **Qastor, Lite licence**
- 2003-AIS Pilot Plug Connector (since 2015, 3rd version, type ADNav **ADQ2 with ROT sensor**)
- 2006-VTS image (radar-AIS image from VTS)



AIS + Extra ROT sensor

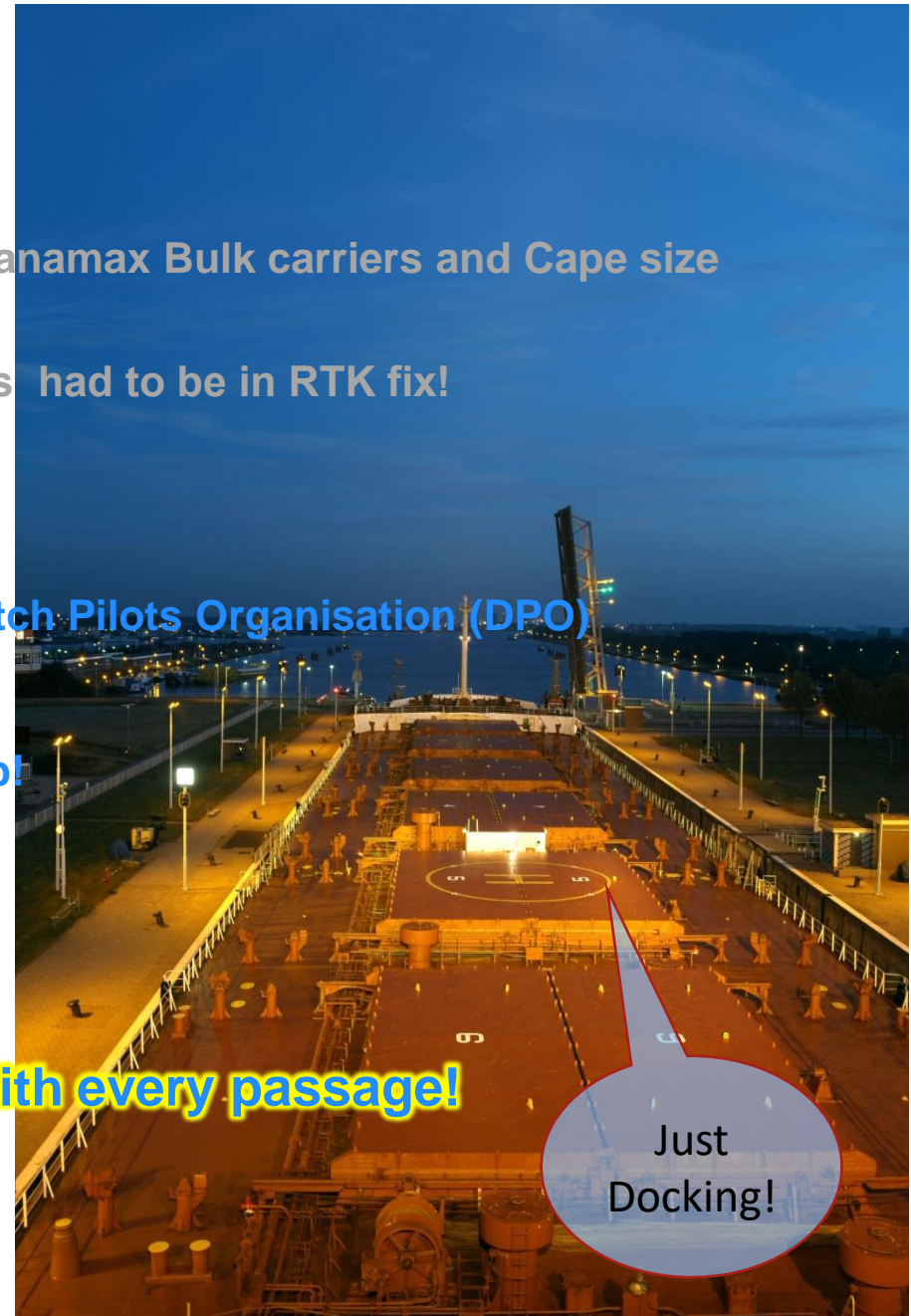
The evolution of the 'tools' are user driven by the pilots in close cooperation with QPS and AD Navigation

Prototype testing in Terneuzen, 2003



3. Original design not for Antwerp!

- **Fall 2003:** First units designed for lock approach in Terneuzen with Panamax Bulk carriers and Cape size Bulk carriers and Tankers in Flushing.
- Units were unstable and not performing to their specs! Two antenna's had to be in RTK fix!
- **Fall 2005** the first ADX units performing to spec were delivered to Dutch Pilots Organisation (DPO)
- **Fall 2006** we started testing/using the first generation ADX in Antwerp!
- From 2006 **Traffic of large ships on the river increased enormously!!**
- From 2009 the first ULCC's arrived in Antwerp. **ADX obligatory with every passage!**



GAME CHANGER:

MSC Beatrice 2009 - 366m 14000teu

‘Not only Docking is a demanding job, navigating a ULCC on the river (and meeting them) is a different ball game now...’

DOCKING



Just Docking!

	200 < 300	300 < 360	360+
2008	4732	756	0
2009	4228	676	60
2010	4594	764	144
2011	4684	820	234
2012	4582	692	244
2013	4510	744	254
2014	4432	658	436
2015	4752	646	716
2016	4814	530	1030
2017	1888	296	454

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MarineTraffic.com

MSC DANIT 2009 – 366m / 51.20

ADX version 1

DOCKING

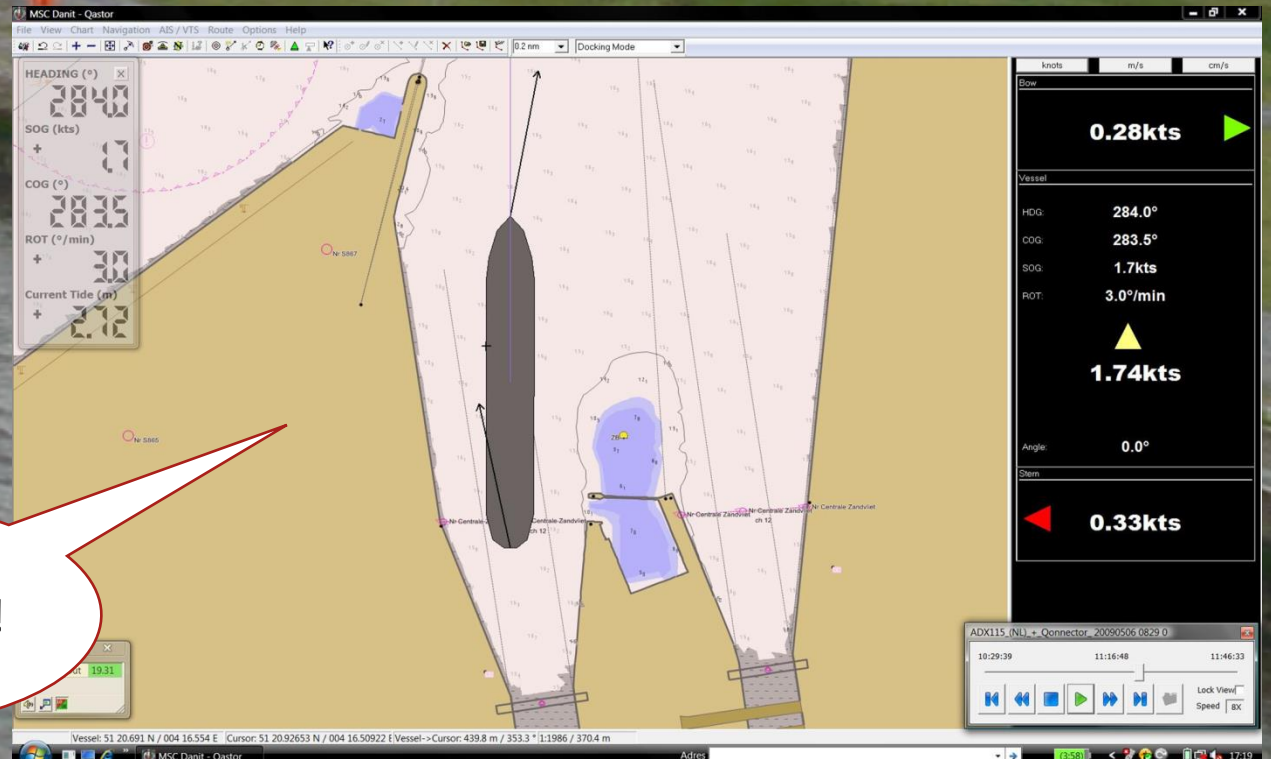
Just Docking!



MSC DANIT 2009 – 366m / 51.20

‘Where your eyes can fool you’DOCKING

Just Docking!



4. ISPO-Certified Region River Scheldt since 2014

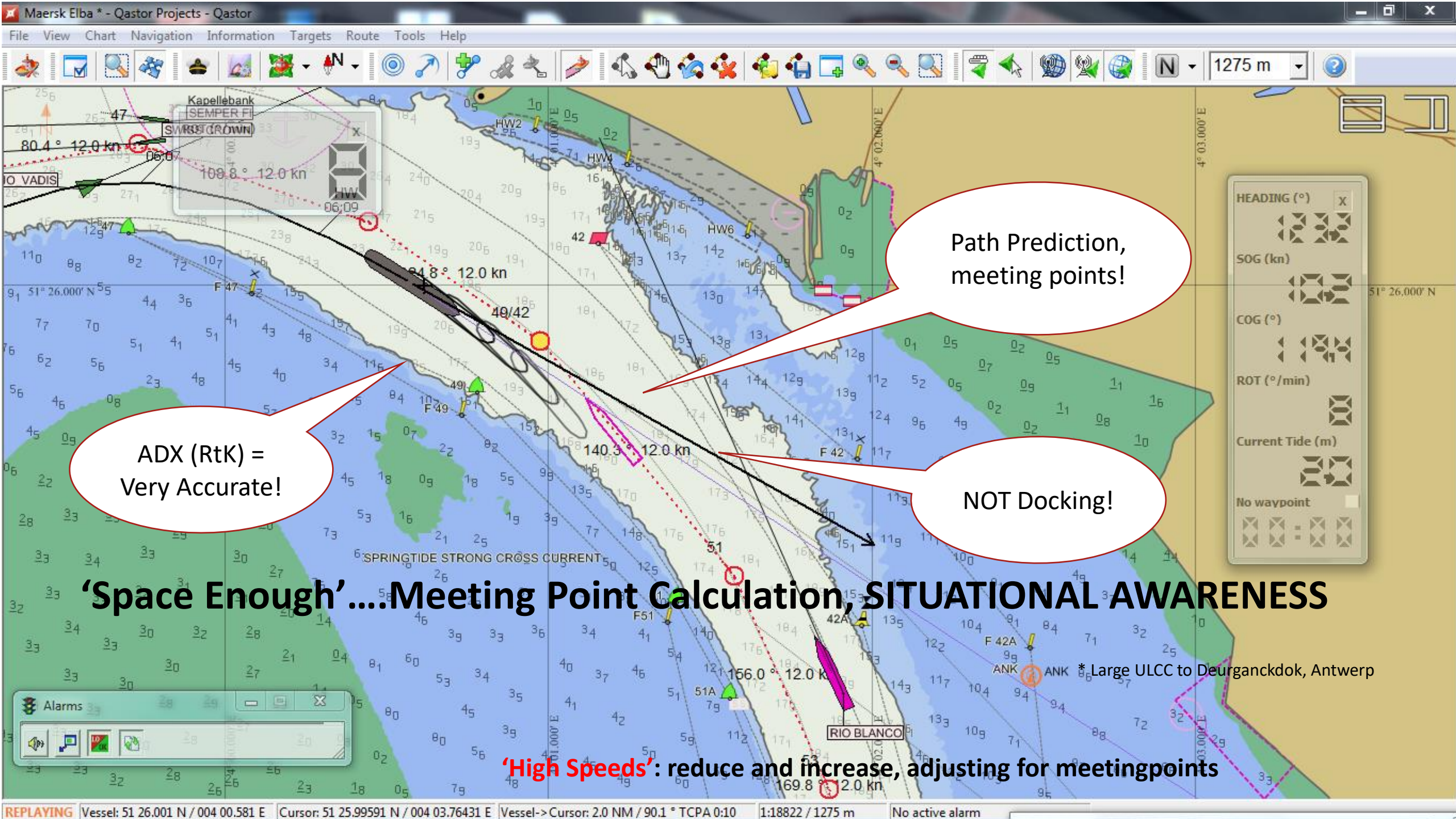
Scheldemonden ISPO Handbook:

Chapter 4 Aid to Navigation, based on experience with soft- and hardware used by pilots since 2001/2003

- 4.1 Pilot always has **'checked and good working tools'**
- 4.1 References: ISPO handbook 7.5 PPU, ISM chapter7, 2.14 and chapter 3, 3.3, internal paper on use of Qastor-Lite
- 4.1 Process: **aid to build, check and add to situational awareness of the pilot, manual.**
- 4.2 SNMS-Lite: ENC availability and updating
- 4.2 SNMS-Lite: **Hard- and Software support, reporting and feedback on system malfunction (pilot vs ICT)**
- 4.2 SNMS: ENC availability and updating
- 4.2 SNMS: **System maintenance**
- 4.2 SNMS: **Hard- and Software support, reporting and feedback on system malfunction (pilot vs ICT)**

Regional ENC's are very good! Support and cooperation is near perfect!

Updating can be a little better!



ADX (RtK) =
Very Accurate!

Path Prediction,
meeting points!

NOT Docking!

'Space Enough'...Meeting Point Calculation, SITUATIONAL AWARENESS

'High Speeds': reduce and increase, adjusting for meetingpoints

* Large ULCC to Deurganckdok, Antwerp

Smooth and Contolled turns, easy on the rudder angle!!

For Path Prediction very good learning tool!

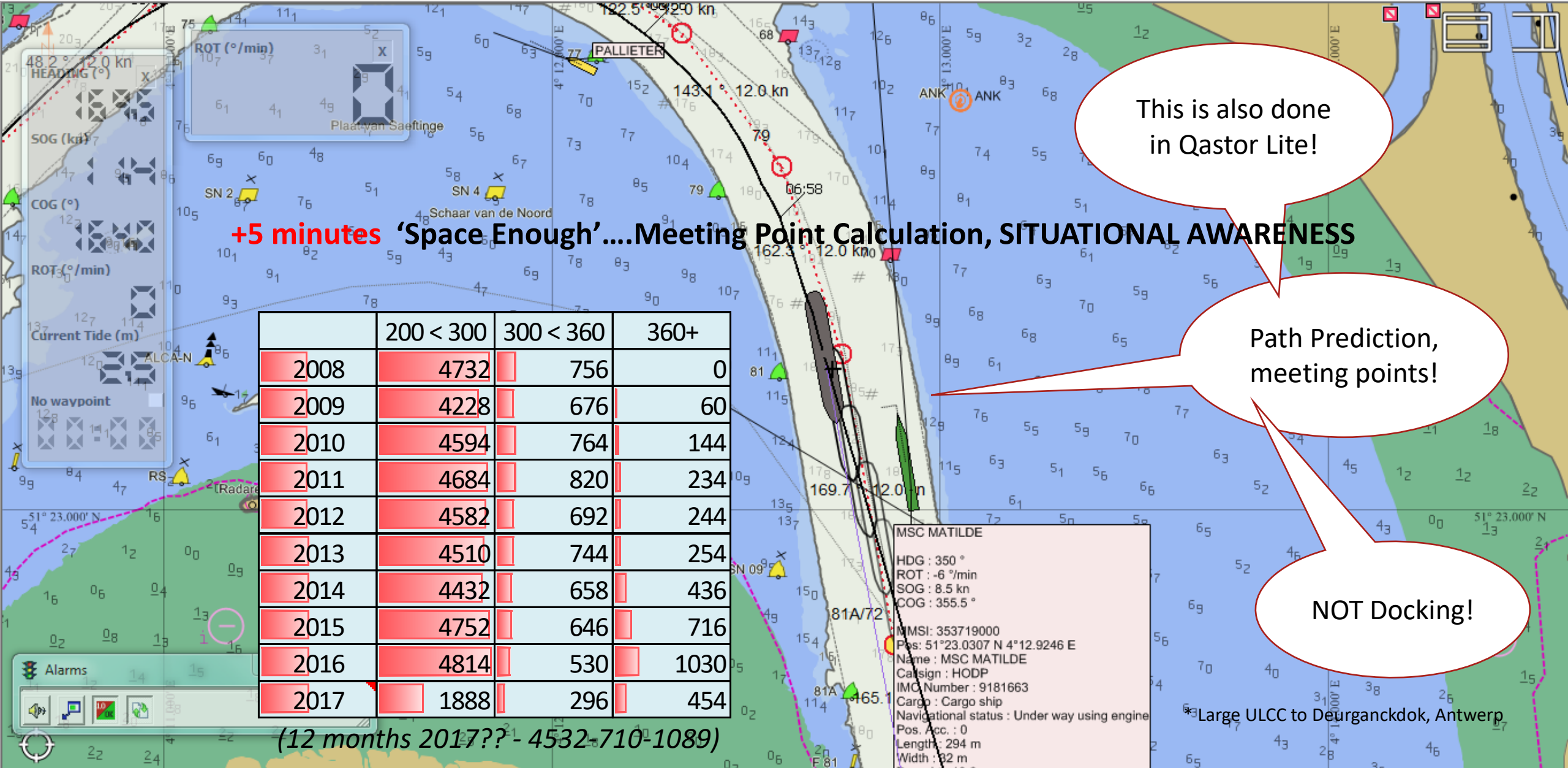
ROT vs Speed!!

+2knts flood tide, ROT vs SPEED, PATH PREDICTION, hard to keep green side of the fairway when coming out of the turn, ROT!!

'Be Alone'.....Meeting Point Calculation, SITUATIONAL AWARENESS

PATH PREDICTION; very important 'what is the quality of my data and sensors'

* Large ULCC to Deurganckdok, Antwerp



This is also done in Qastor Lite!

+5 minutes 'Space Enough' ... Meeting Point Calculation, SITUATIONAL AWARENESS

Path Prediction, meeting points!

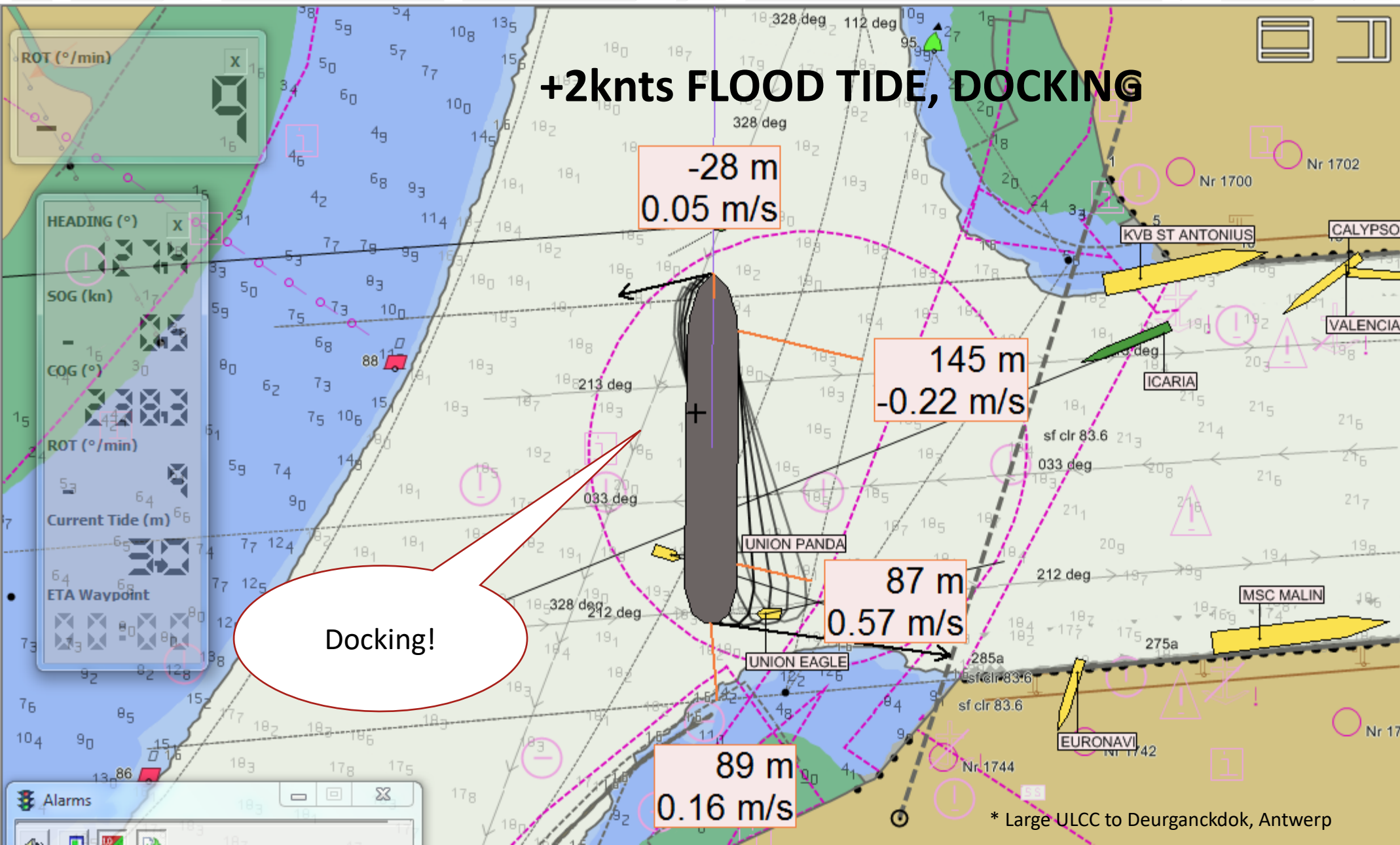
NOT Docking!

	200 < 300	300 < 360	360+
2008	4732	756	0
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2014	4432	658	436
2015	4752	646	716
2016	4814	530	1030
2017	1888	296	454

(12 months 2017?? - 4532-710-1089)

MSC MATILDE
 HDG : 350 °
 ROT : -6 °/min
 SOG : 8.5 kn
 COG : 355.5 °
 MMSI : 353719000
 Pos : 51°23.0307 N 4°12.9246 E
 Name : MSC MATILDE
 Callsign : HODP
 IMO Number : 9181663
 Cargo : Cargo ship
 Navigational status : Under way using engine
 Pos. Acc. : 0
 Length : 294 m
 Width : 32 m

*Large ULCC to Deurganckdok, Antwerp



+2knts FLOOD TIDE, DOCKING

-28 m
0.05 m/s

145 m
-0.22 m/s

87 m
0.57 m/s

89 m
0.16 m/s

Docking!

knots m/s

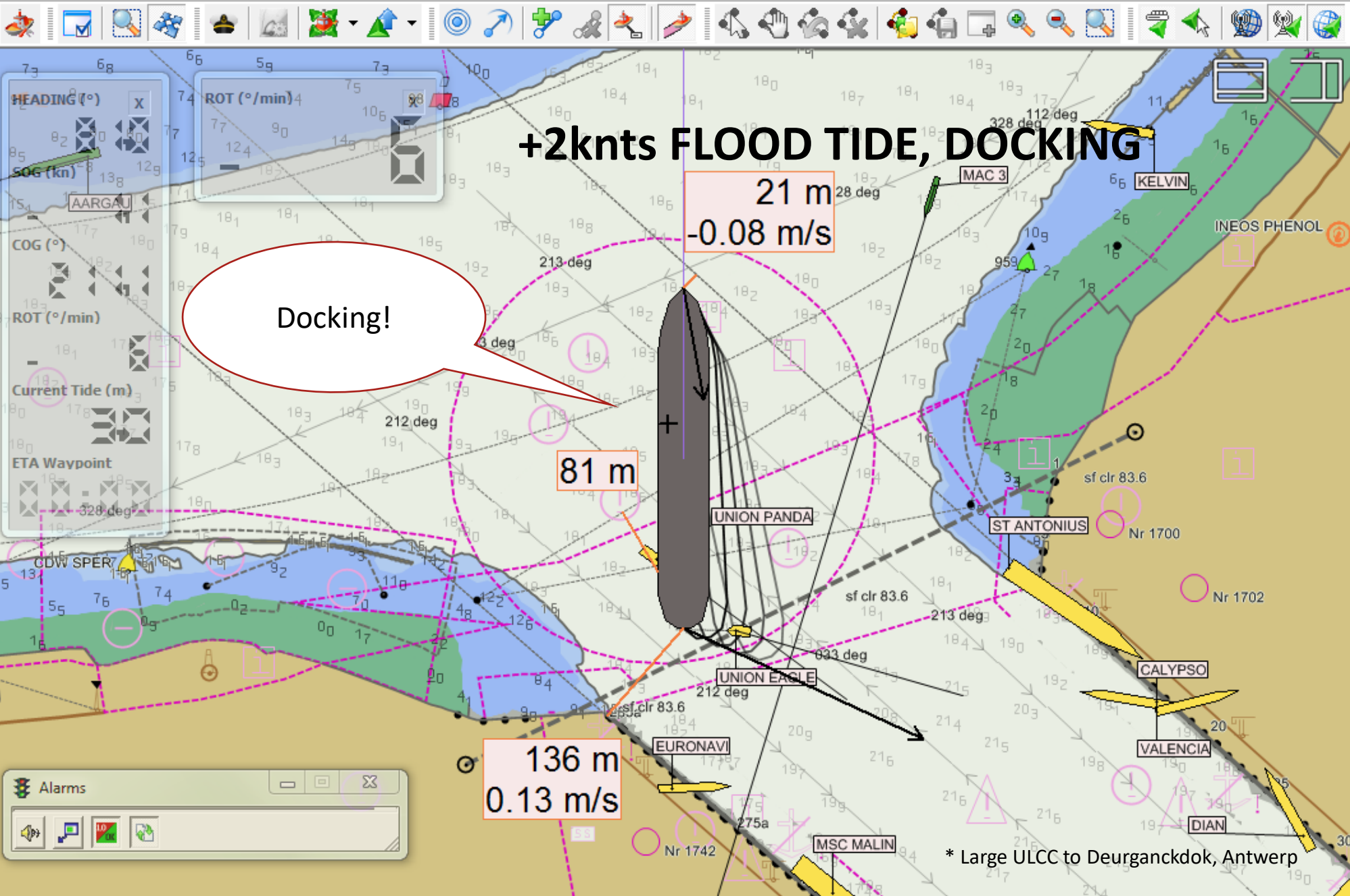
Bow		
Dist Port (m)	BDAT (m)	
0	0	
	XTE	
	0,0	
		0,30m/s

Vessel		
HDG:	127.4°	
COG:	238.3°	
SOG:	-0.5 kn	
ROT:	-9°/min	
		0,09m/s

Angle:	-85,8°
--------	--------

Stern		
Dist Port (m)	XTE (cbl)	
0	0,0	
		0,76m/s

* Large ULCC to Deurganckdok, Antwerp



+2knts FLOOD TIDE, DOCKING

Docking!

21 m
-0.08 m/s

81 m

136 m
0.13 m/s

* Large ULCC to Deurganckdok, Antwerp

	knots	m/s	cm/s
Bow			
Dist Port (m)	BDAT (m)	Dist Stbd (m)	
0	0	0	
XTE		0,0	
		0,07m/s	▶
Vessel			
HDG:	081.0°		
COG:	211.1°		
SOG:	-1.1 kn		
ROT:	-6°/min		
		0,37m/s	▼
Angle:	47,8°		
Stern			
Dist Port (m)	XTE (cbl)	Dist Stbd (m)	
81	0,0	0	
		0,77m/s	▶

5. New Sensors..... ('and Sensor Monitoring to be developed!')

1. ADQ2 (AIS + ROT)



2015

+ 'depending' Path Prediction?

3. ADX DUO (Heading + ROT + DGNSS + AIS)

2016



+ Docking Lite

2. ADQ2 + ADQ3 (AIS + ROT + (D)GNSS?)

2017



+ Path Prediction!

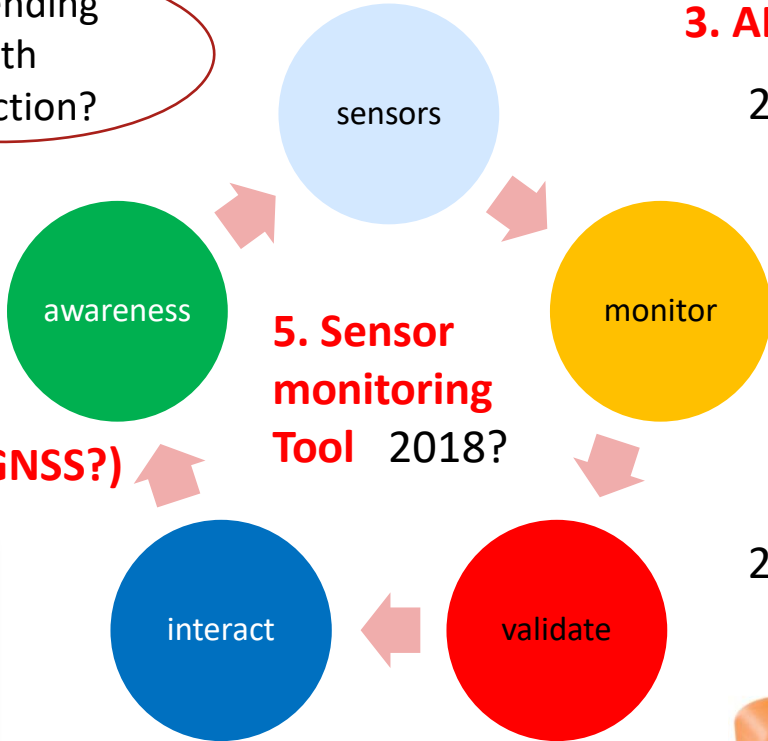
+ 'maybe' Docking 'Lite Lite' in RtK!!

2011



+ Docking

4. ADX-XR (Heading + ROT + RTK-GPS + AIS)



5. Sensor monitoring Tool 2018?

"All sensors developed in close cooperation with AD Navigation!"

6. Guidelines and Additional Information to the ISPO 7, Pilot Operations 7.5, Portable Pilot Unit (PPU)

7.5 Portable Pilot Unit (PPU)

7.5.a The pilot organisation should establish and maintain procedures for the safe usage of PPU systems during the pilotage passage. These procedures should take into consideration - but should not be restricted to – the following:

- Maritime pilot training, qualification and complementary certification scheme;
- Operation and utilisation
- Harmonisation and integration of VTS/VTM port base system
- Alarms, failures and effects
- Maintenance and repairs
- System test and acceptance protocols
- Updating software

Training on the Job

Very important for
Situational
Awareness!!
Passage Planning &
Meeting Points!

Awareness! Sensor
Monitoring!!

Optimize Design!
System Monitoring!



Guidelines and Additional Information to the ISPO 7, Pilot Operations 7.5 Portable Pilot Unit (PPU)

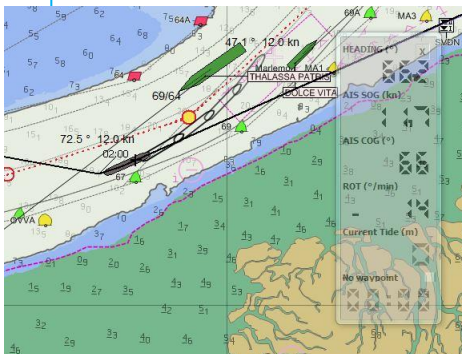
7.5.b The PPU should at all times be considered as a computer based **specific system** for the maritime pilot and an **aid for the maritime pilot** when carrying out his work at the pilotage passage.

7.5.c Where it is determined that a PPU should be used during a pilotage passage, a **training program** should be established to ensure that maritime pilots are trained, qualified and/or certified in its use.

This training program should also include a **contingency plan dealing with equipment failure and replacement of PPU systems.**

**Design clever equipment / monitoring and connect to the user!
Know and separate user failure from equipment failure!**

The particular PPU systems adopted and in use by a pilot organization **should be as uniform as possible in order to improve standardisation of equipment, training and procedures in a consistent way.**



Training on the Job!

**Design together
with manufacturer!!!**

**Use specific range
of sensors and one
piece of software**

Awareness!

Guidelines and Additional Information to the ISPO 7, Pilot Operations 7.5 Portable Pilot Unit (PPU)

7.5.d In spite of the absence of specific regulatory requirements, industry standard and/or guidelines the pilot organization should check the quality assurance system of the manufacturer and/or data supplier of the maritime pilot computer based specific systems in use. This check by the pilot organization does not take away the responsibility of the manufacturer or data supplier. **Checking the PPU system in use should take the following in consideration:**

- Functionality
- Reliability
- Usability
- Efficiency
- Portability
- Maintainability

Awareness! Sensor Monitoring!!

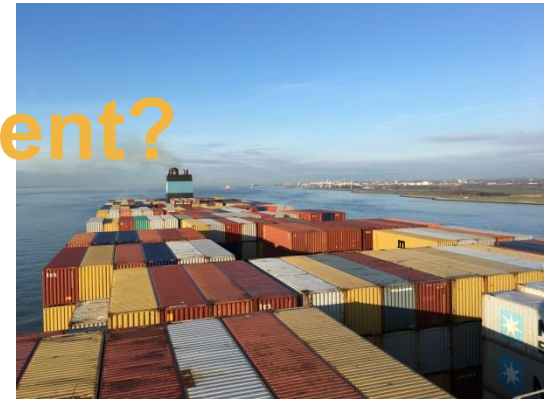
Train the user on the job hand him tools for awareness of system performance!

Optimize Design! System Monitoring!

Design clever system monitoring and failure recognition!

Special attention must be given to the establishment of the necessary procedures in order **to take care of checks for maintenance, repairs, testing, up-dating of hard- and software and/or data.** The pilot organisation should establish a planned maintenance system for periodic and scheduled maintenance checks with logs of usage and faults/failures.

7. So what's my point? Where is the improvement?



- ADX-XR & Qastor (+infrastructure) works great for Docking, 'no discussion here'!

ISPO

- Instruction / Training ('classroom') **OK**
- Functionality & Portability **OK**
- Availability **OK**
- Maintainability **OK**

risk: 'training by ourselves afterwards'?

risk: keep evolving! evolve: monitor technologies!

risk: 'units charged and working'?

risk: 'no hidden errors'? Is the 'user failure' known?

IMPROVEMENT

- User Awareness **improvement**
- 'Learning on the Job' **improvement**
- User errors **improvement**
- Hardware remote support /control **improvement**
- Reporting **improvement**

add: 'not just alarm', tell the user 'what's wrong'..

add: **gradual evolution using different sensors**

fact: **EXPERIENCE has to be rather thorough now!**

evolve: **analyse and support 'on the job'**

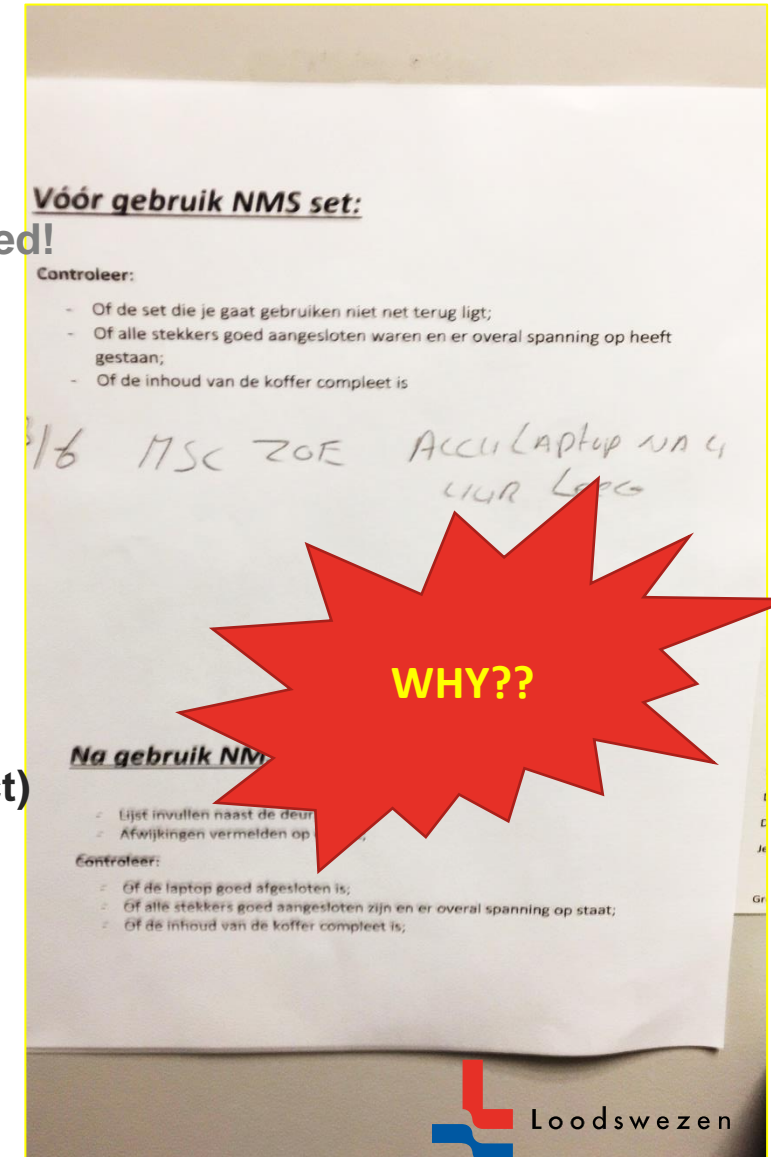
fact: **if the user doesn't report, we don't know!**

7. So what's my point? Where is the improvement?

- Very Experienced user has a near complete tool now!
- Punctual user will report issues and ask for explanation or feedback!
- Self-conscious user will also use the equipment to become more experienced!
- Punctual is what you are and Experienced is what you 'can' become....
- The 'first' is just not very common and the 'second takes time'...

So?

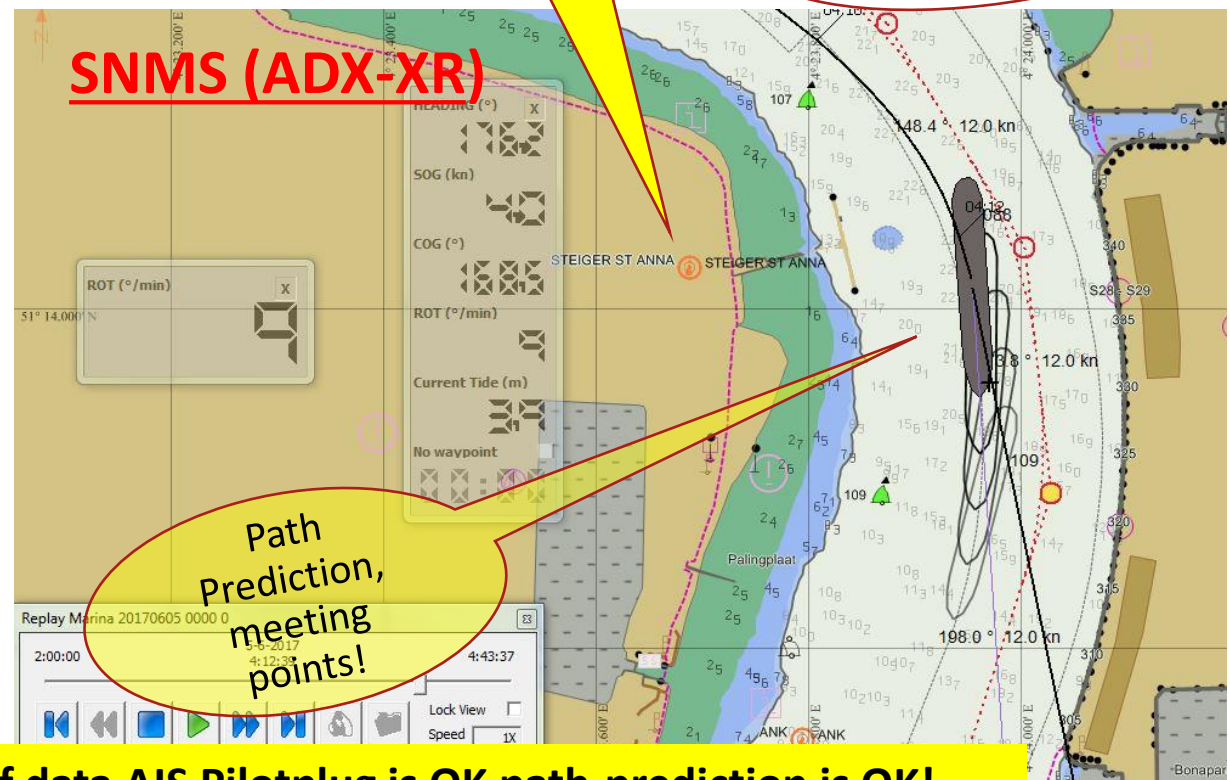
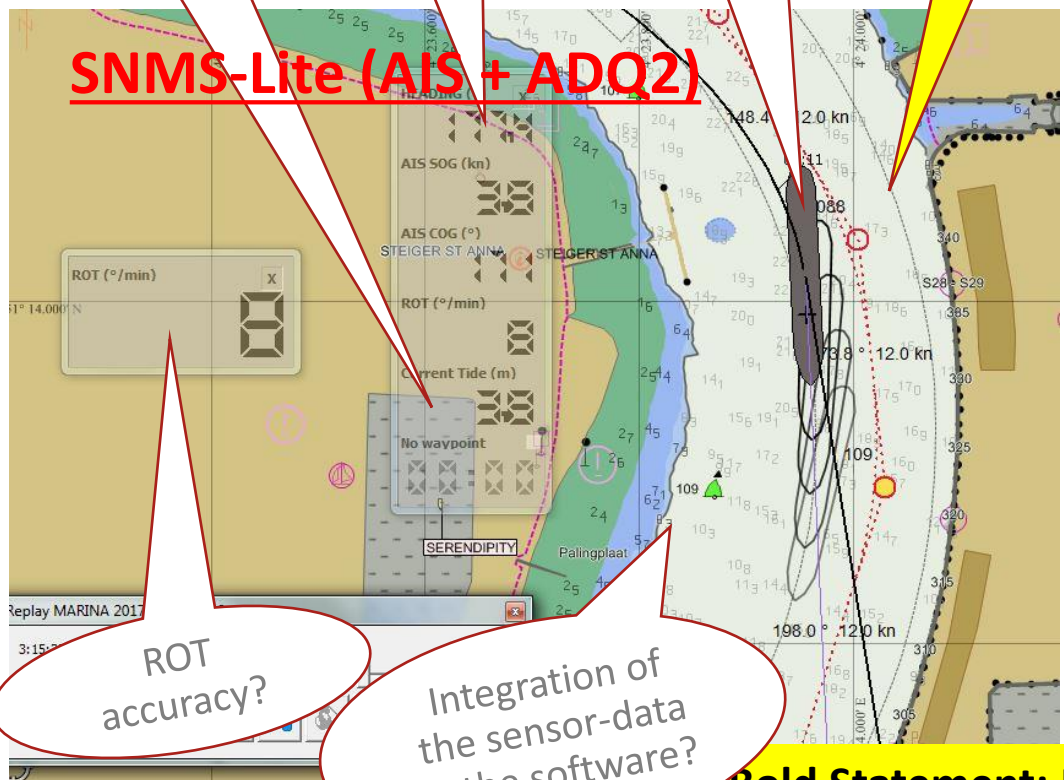
- Hard- and software should be designed to interact with the user!
- Quality of data should be known by the user! (I want to focus on this subject)



8. Quality of data?

- Speed accuracy?
- Heading accuracy?
- Position accuracy?
- Position update?
- No alarms = OK? NO.....

- No alarms = OK? YES if.....
- PODS well placed?
- Offsets POD's OK?
- Shielding Multipath OK?



ROT accuracy?

Integration of the sensor-data in the software?

Path Prediction, meeting points!

Bold Statement: If data AIS Pilotplug is OK path-prediction is OK!

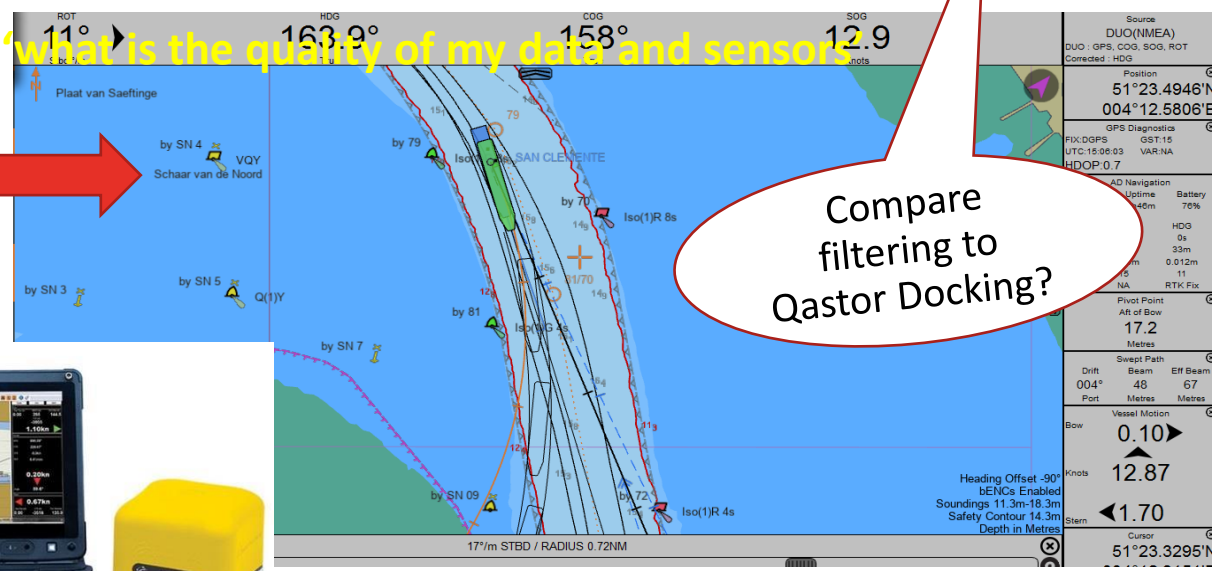
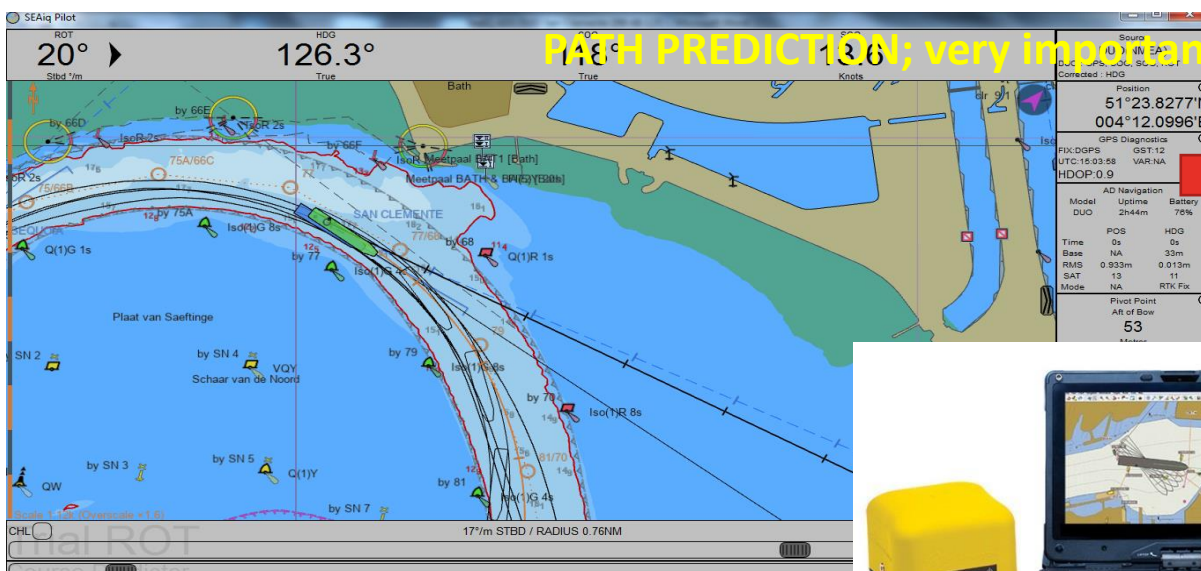
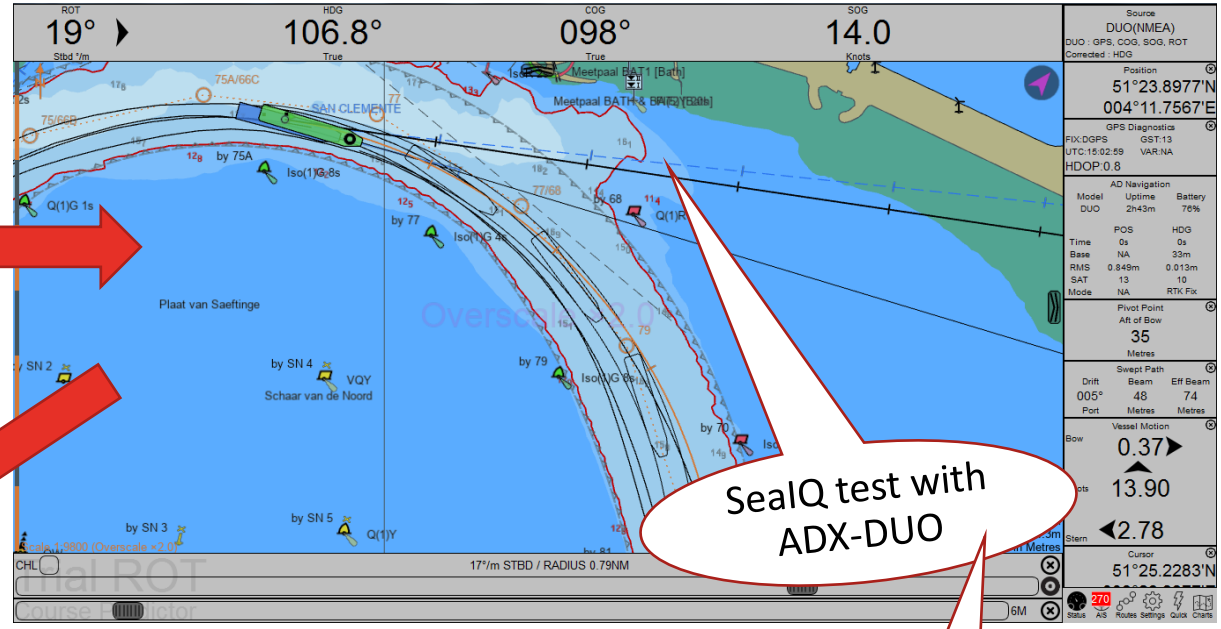
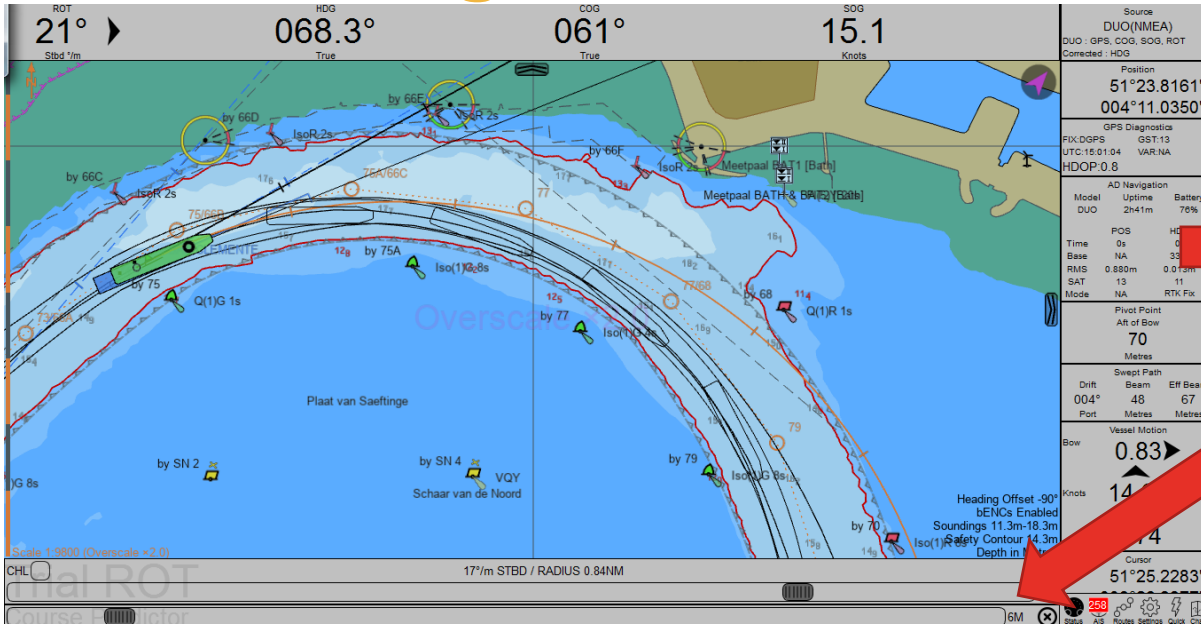
* 240mtr cruise ship to Scheldekaai, Antwerp

9. Sensor Monitoring Tool..... will increase knowledge and awareness!

- Tool to **analyse and validate data from sensors!** (Offline analyses for support department!)
- **Interactive alarm and information** for user about his data quality and sensors!
- Tool will **recognise sensor and optimise** software settings!
- Tool to serve as intermediate between sensors and software, always '**optimal protocol and message (mixed sensors) to software!**'
- **Developed** in conjunction with sensor manufacturer and PPU software builder!
- **Antenna offset input**, monitoring and offset errors by mixed sensor validation (if possible).

- **ADQ2, ADQ2+ADQ3**, validate and analyse data from sensors to inform users about the **quality, failure and faults!**
- **ADX-XR and ADX-DUO**, track and monitor use of unit to pilot and ship. Online **analyses for support department!**
- **ADX-XR** will give warnings about '**user failure**', '**system failure**', '**accuracy**' and '**issues outside influence of user and ADX**' etc. (Due to existing data-connection with shore servers for RtK (LinQup) and possible separate data connection on laptop or smart phone of user, very clever analyses is possible!) Tool can monitor and could report system and user failure, to maintenance and support department.
- **ADX-DUO** will give warnings about '**user failure**', '**system failure**', '**accuracy**' and '**issues outside influence of user and ADX**' etc. Tool will monitor and could report system and user failure, to maintenance and support department if network connection is present on device.

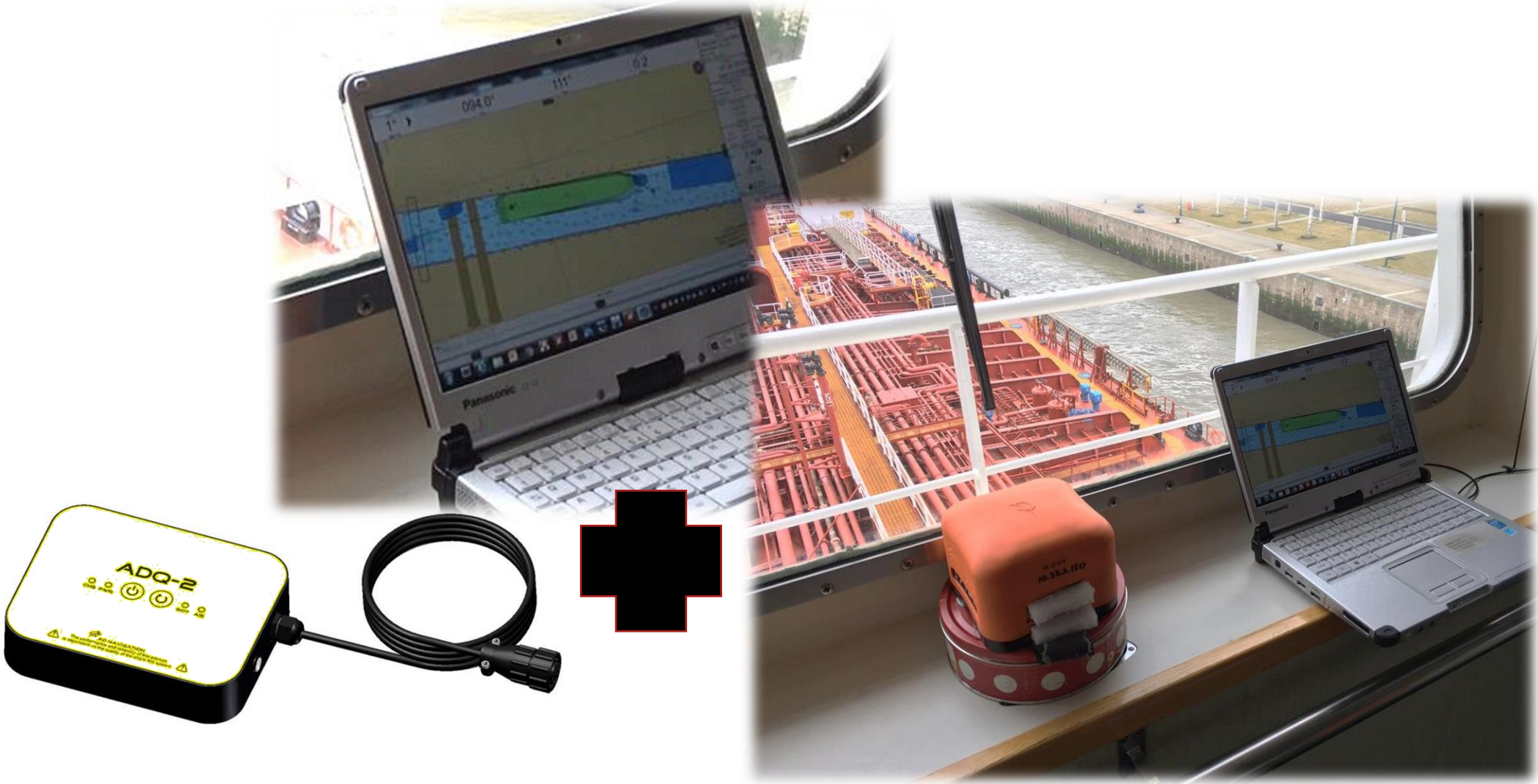
10. Testing..... "Filtering in Qastor Docking could to be an issue with modern receivers!"

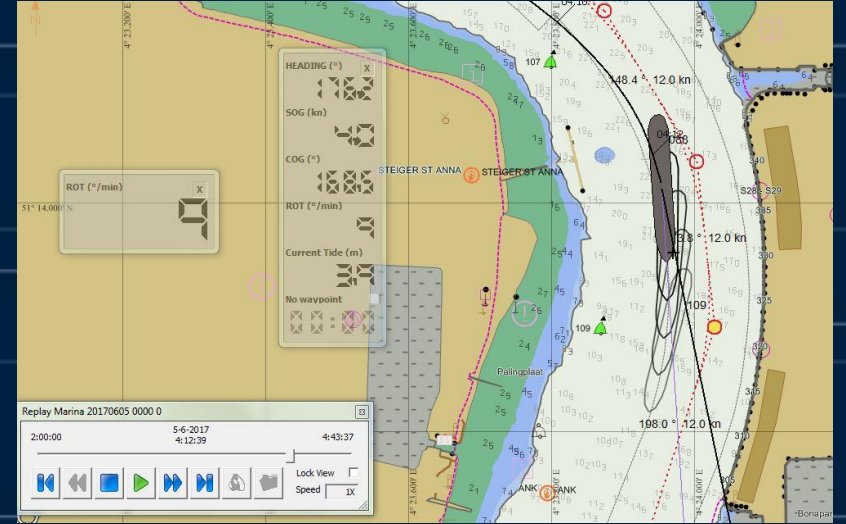


PATH PREDICTION; very important 'what is the quality of my data and sensors'



Testing ADQ3, standalone single (indoor) GPS receiver





TX!