

Remote pilotage: Vision, demands, prerequisites and obstacles

Vesiliikenteen automaation aamupäivä 2.12.2021



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The not so good sides of pilot's work...



... this happens every week...



The most neglected SOLAS requirement?

Both ropes broke when the pilot was climbing down. He fell on the boat deck with the ladders falling on top of him.



“COVID-19 pilots”



”Remote pilots”



Timo Nummi, Kotka (left)
Ville Mattila, Saaristomeri
Joakim Kantola, Kokkola

The Finnish Pilotage Act

The Pilotage Act enables remote pilotage and sets the demands for the new service.

“Pilotage means operations related to the navigation of ships in which the pilot acts as an advisor to the master of the ship and as an expert on the local waters and their navigation.”

“Remote pilotage means an activity where pilots perform their duties without boarding the ship to be piloted;”



Remote pilotage allowed

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Pilot boat (Photo: Jeffrey B. Banke / Shutterstock)

Examples of Prerequisites



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- Different customer segments - *not a service for all.*

Customer segments from safety perspective

"Liner traffic with efficient cargo handling"



"Safety regardless of price"

"Accurately scheduled production of experiences with high safety standards"



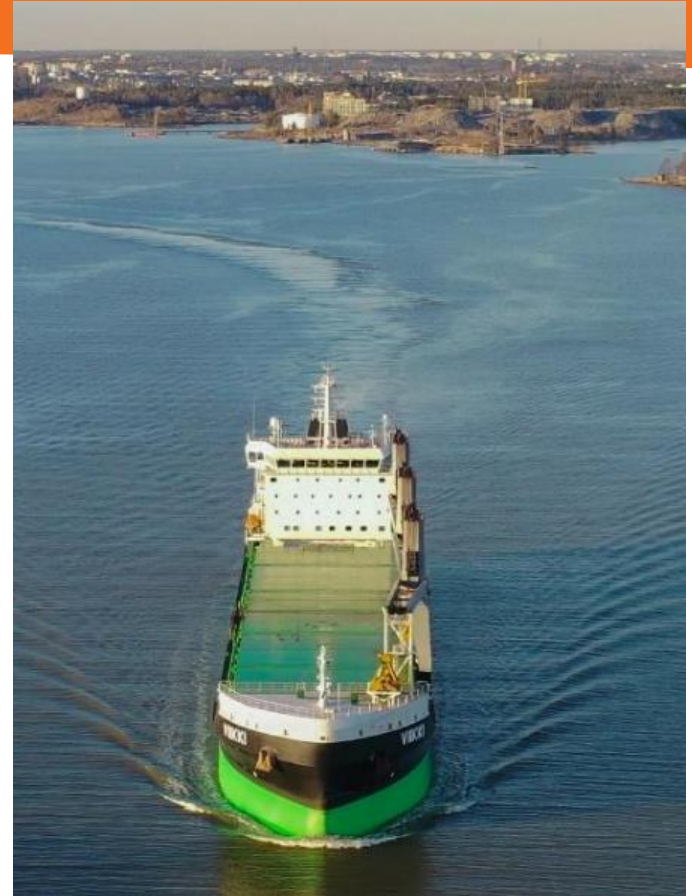
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Low profit – low costs – low competence?



- The customer: High technology ships with highly competent crews.
- New technology is not only required to be installed to the ships and to the remote pilotage centre but also to fairways.
- Training and qualification requirements must be developed.



ISO 9001 · ISO 14001



DATA SET 01
ROT 0°/MIN.

DATA SET 02
PITCH 85 / RPM 613

DATA SET 03
COG 025° / HDG 026°

ETA 09:05
RTB 08:25



FINNPILOT



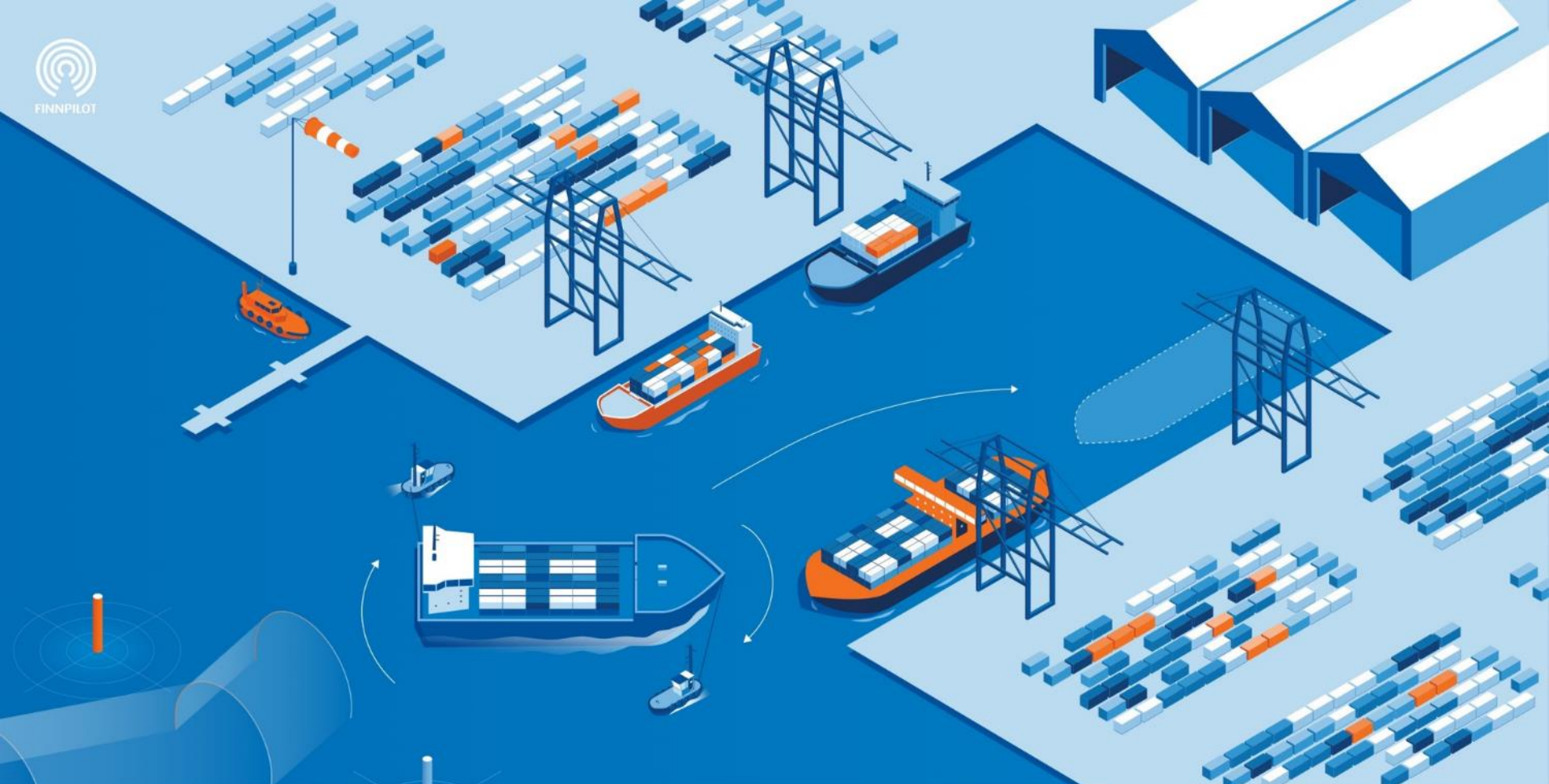
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DATA SET 02
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DATA SET 03
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DATA SET 01
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DATA SET 02
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DATA SET 03
COG 097° / HDG 100°

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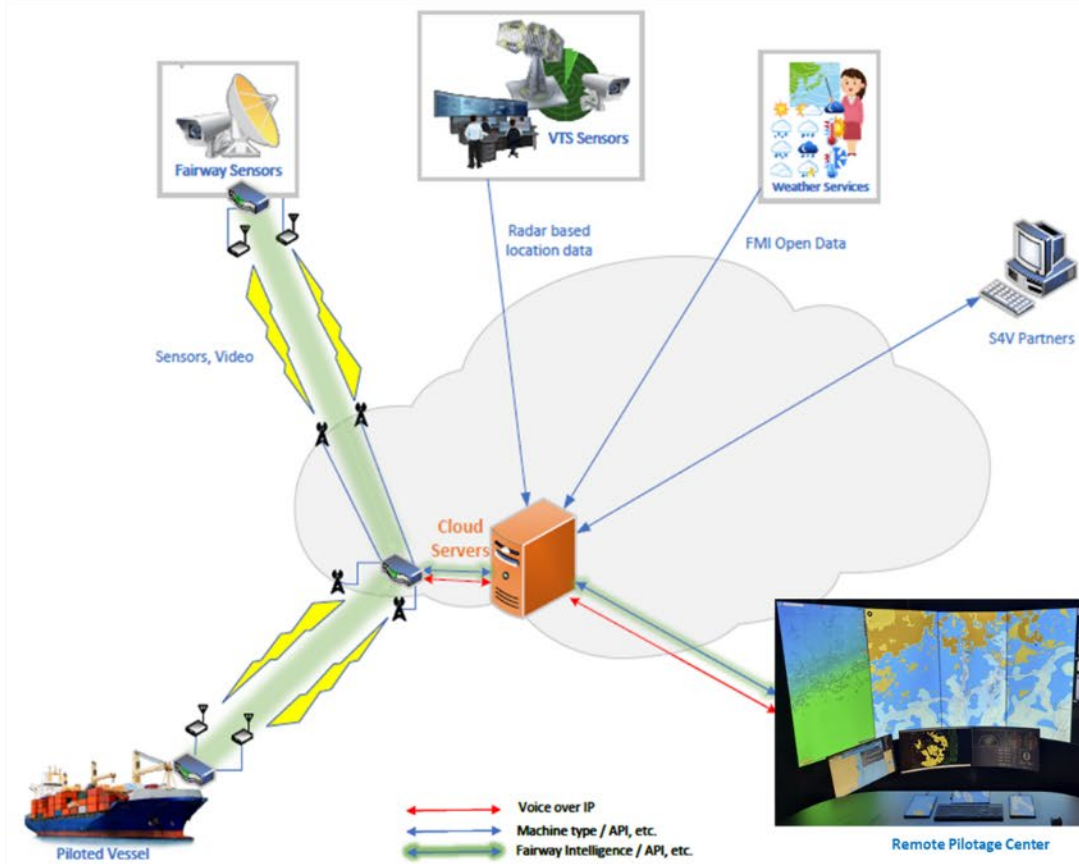


Sea4Value - Future Fairway Navigation



- Sea for Value (S4V) is a One Sea Ecosystem project.
- Funding from Business Finland, duration 2020-2022.
- Remote pilotage is a use case for the "future fairway" as in general, S4V is project for visioning of the future fairway usage.
- The aim is to define the concept of Future Fairway (safe navigation) and e.g. VTS-operation and services needed or provided by the intelligent fairway.
- S4V/F is necessary research for the realisation of remote pilotage.

S4V Intelligent Fairway & Remote Pilotage test setup



Remote Pilotage Center

- Situational awareness (AIS + VTS location data) view
- Video streams from fairway cameras
- Precise weather information from fairway weather stations
- FMI data
- ETA's & Safety contours
- Conning display from vessel
- ECDIS from vessel
- Radar from vessel
- IP based communication channel (data, voice and chat)

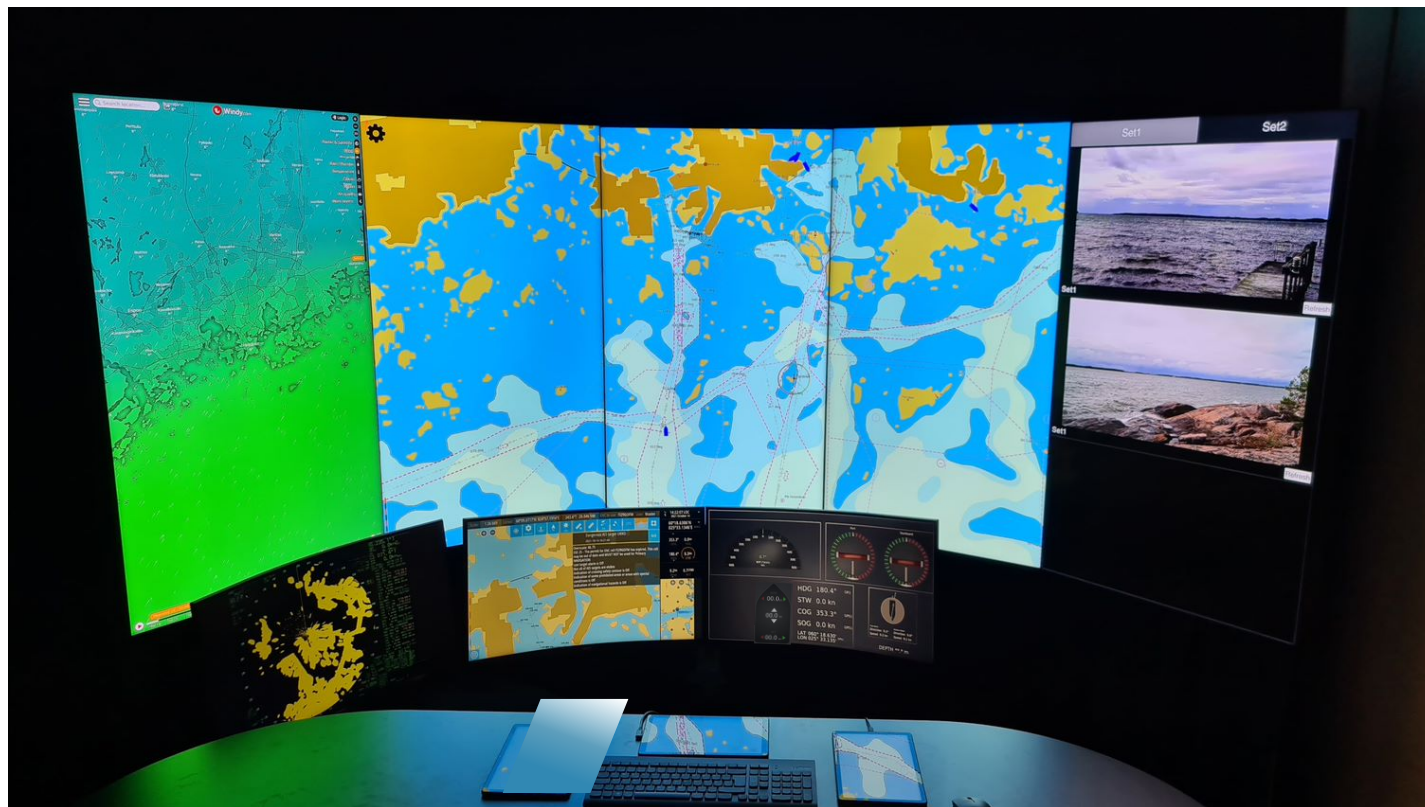
Vessel

- Interface to bridge system
- IP based communication channel (data, voice and chat)
- SmartBox data gathering and transmitting unit

Sensor Station (2 pcs)

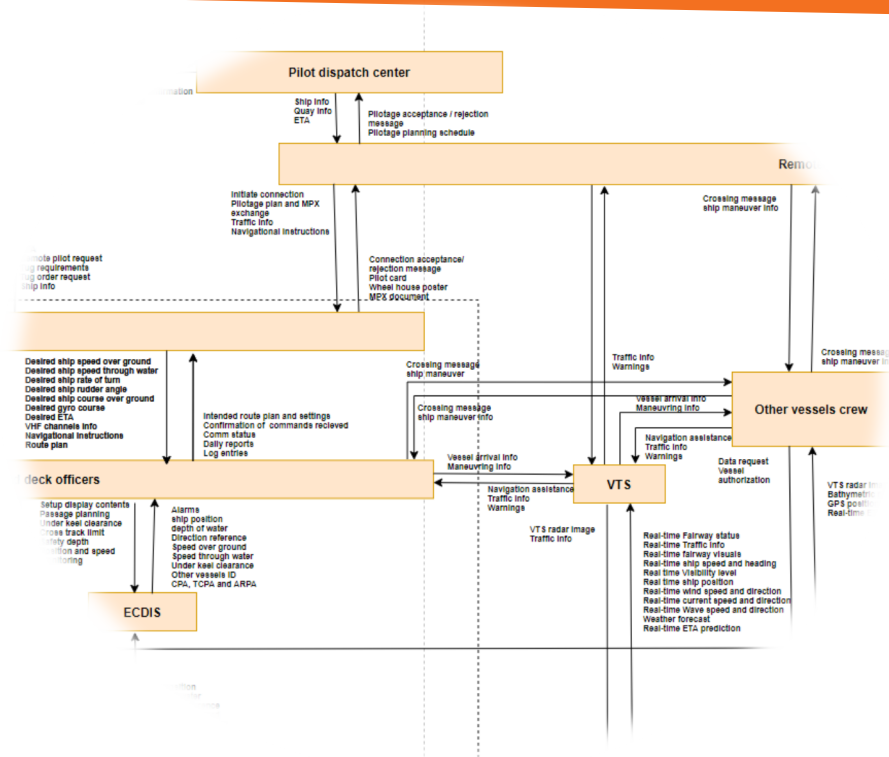
- Cameras
- Weather station
- SmartBox data gathering and transmitting unit

More info: markku.sahlstrom@brighthouse.fi



Safety and Security of remote pilotage demo

- Safety related to human errors
- Safety/Security related to information exchange
- Safety related to equipment
- Governance of Maritime security threats
- Additional factors related to demonstration
- Conclusion and future directions



Safety related to human factors

Lack of skills /competence	Fatigue	Stress	Distraction
High level of task complexity	Lack of trust	Lack of checklists/ guidelines	Lack of standard phrases
Lack of seamanship	Language barrier	Wrong assumption	Poor situational awareness

Also relevant to conventional pilotage

Skills related to remote pilot : Navigational suggestions, pilotage planning, establishing connection and sending info, suggesting emergency procedures, communication skills, situational awareness, handling new equipment e.t.c.

Skills related to Master and navigation crew: Vessel navigation, communication skills, executing emergency procedures e.t.c

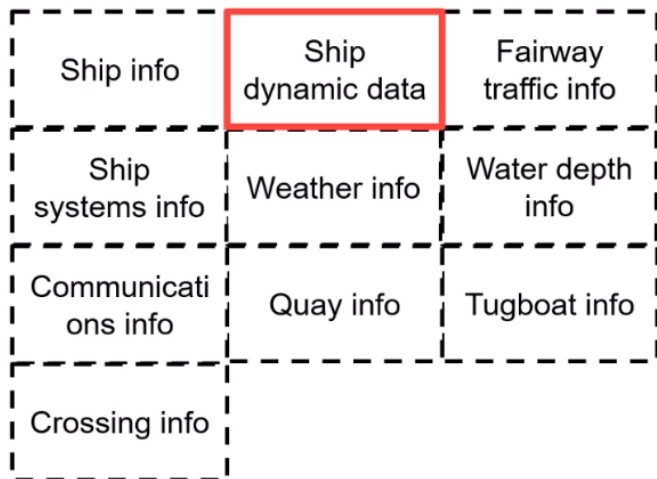
Risk control measures:

- Selection of ship and fairway
- Simulation practices for remote pilotage
- Experienced and skilled pilots / crew
- Half-Duplex or Duplex communication

Risk control measures to be considered in future:

- Certification of Remote pilots and its validity
- Trainings for remote pilots and ship crew.
- Emergency procedures for remote pilotage (changing to conventional pilotage in case of major issues)
- Increased situational awareness (Installation of more camera stations in fairway, other types of technologies)

Safety/Security related to information exchange



Also relevant to conventional pilotage

Ship dynamics data (Speed, heading, ship motions etc)

- Lack of data transmission
- Wrong data transmission
- Delayed data transmission

Can result due to equipment malfunction or unsecured interfaces

Risk control measures:

- Redundant network options
- Configurable multi-displays
- Low latency for data transmission

Risk control measures to be considered in future:

- Multiple sources (also originating from fairway infrastructures)
- Increased reliability of component related to generation and transmission of ship dynamics data
- Increased security (data access authorization, encryption, data masking, anti-malware etc)
- Further reduction of latency
- Checklists/ procedures to verify the data before pilotage

Safety related to equipment

GYRO	RADAR	AIS	GPS
Engines	Fairway infrastructures	Lights onboard	Cloud services
Displays	Sound signaling device	Integrated alarm system	Communication device
Autopilot device	ECHO sounder	ECDIS	Rudder and helm
Data transmission unit	Networking equipment	Thruster and propulsion unit	

Also relevant to conventional pilotage

GYRO issues such as:

- Lack of adjustments
- Error in heading info
- Jamming
- Time to recover from turns
- Bad visibility

Potential risk control measures:

- Good device reliability
 - Standard and certified
 - Rigorous testing
- Regular maintenance
- Pre-operational checklists and procedures to verify the functionality
- Redundant GYRO
- The crew should be trained for visual navigation in the absence of GYRO
- Improved situational awareness and duplex communication to identify and handle the unsafe situations in case of failure
- Service only available to the crew with at least 3 persons onboard including watchmen to address the unsafe situation in case of failure

Risk matrix

Risk matrix		Severity 			
		Minor	Significant	Severe	Catastrophic
Frequency 	Extremely remote	0	1	0	2
	Remote	6	10	7	2
	Reasonably probable	1	0	13	2
	Frequent	0	1	3	1

Estimated risk levels

Low risk level – 18 categories
Medium risk level – 9 categories
High risk level – 22 categories

- The estimated risk levels are prior to the implementation of risk control measures
- The successful implementation of risk control measures is expected to lower the risk levels
- At this development stage, the worst-case scenarios for safety are considered and the safety margins are set high (over estimation).

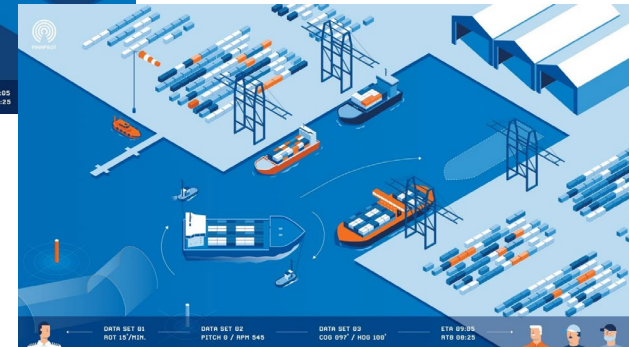
Barriers and obstacles of remote pilotage



- Connectivity and its redundancy is critical, but there is no commercial interests to ensure connectivity for fairway areas.
- Pilotage is under national regulation, no basis for common regulation for technical standards or operational procedures.



- Need for at least European or North European standardisation.
- Remote pilotage is seen to require smart fairways and increased information exchange.
- Uncertainty in financing the development.
- **It is no longer a question about whether we can do remote pilotage, it's a question about whether we want to do it.**



When will we pilot remotely?

- The pure research phase is coming to end in 2022 and during 2023 the service development will start.
- The obstacles of remote pilotage are significant and they must be solved before the service can be provided. Majority of these problems can be solved with existing technology and good co-operation with relevant stakeholders, but e.g. connectivity or required smart fairway elements cannot.
- In order the remote pilotage to gain international or even European usage, standardisation must be achieved.
- Customer group will be very limited in the first phase due to the high demands. This will change gradually.



Thank you!



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