

KL Odd Sveinung Hareide  
Fagleder Elektronisk Navigasjon  
Sjøforsvarets Navigasjonskompetansesenter  
Sjøkrigsskolen

An aerial photograph of a naval fleet in a large fjord. The fleet consists of several large white frigates and smaller support vessels, all moving in a coordinated pattern across the dark blue water. In the foreground, two white submarines are visible, moving towards the fleet. The background features snow-capped mountains under a cloudy sky.

# Navigatorens øyebevegelser

Innovasjonskonferansen e-nav.no 2018

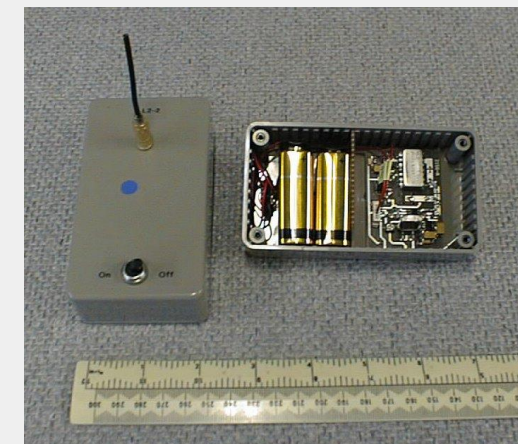
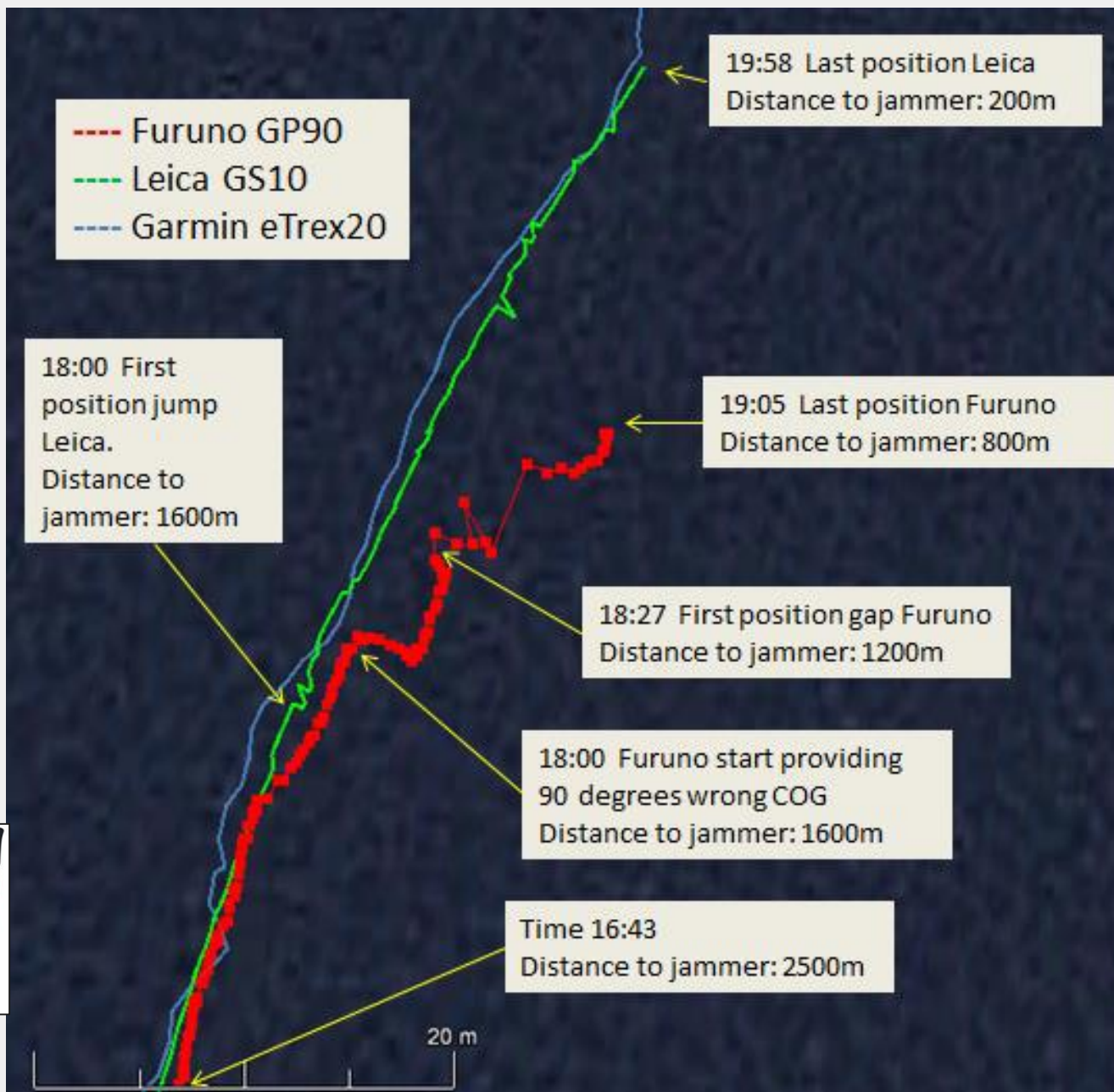


# Paradigmeskifte – Elektronisk navigasjon



Human-in-the-loop?

# Sårbarhet - eksempel



Glomsvoll O, Bonenberg LK. GNSS jamming resilience for close to shore navigation in the Northern Sea. The Journal of Navigation. 2017;70(1):33-48.



«Kontrollert» grunnstøting

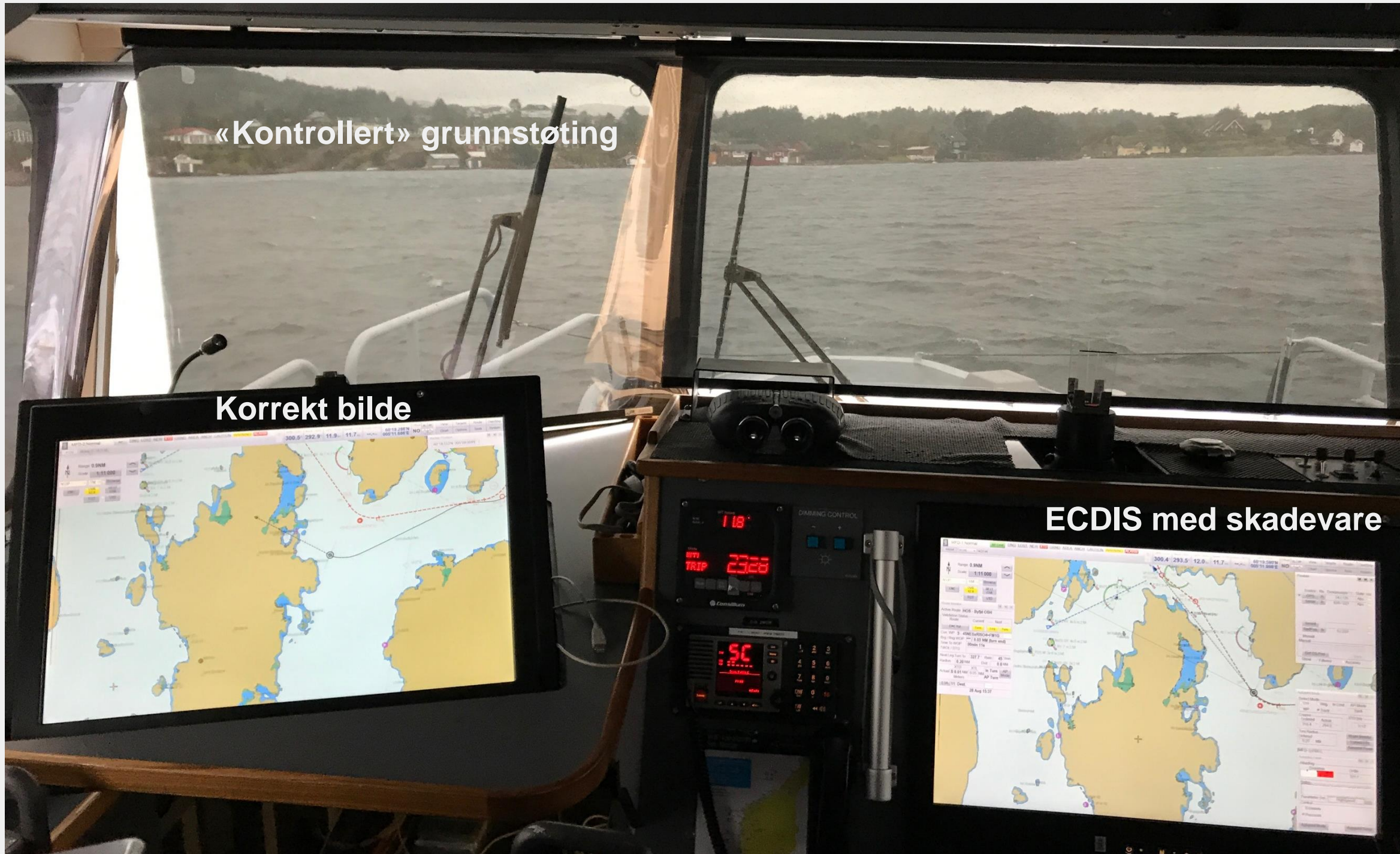
Auto  
Pilot

Track  
Mode

Korrekt bilde

ECDIS med skadevare

Lund MS,  
Hareide OS,  
Jøsok Ø,  
Skare KE.  
*An attack on  
an integrated  
navigation  
system.*  
Necesse.  
2018;3(2):138  
-153.



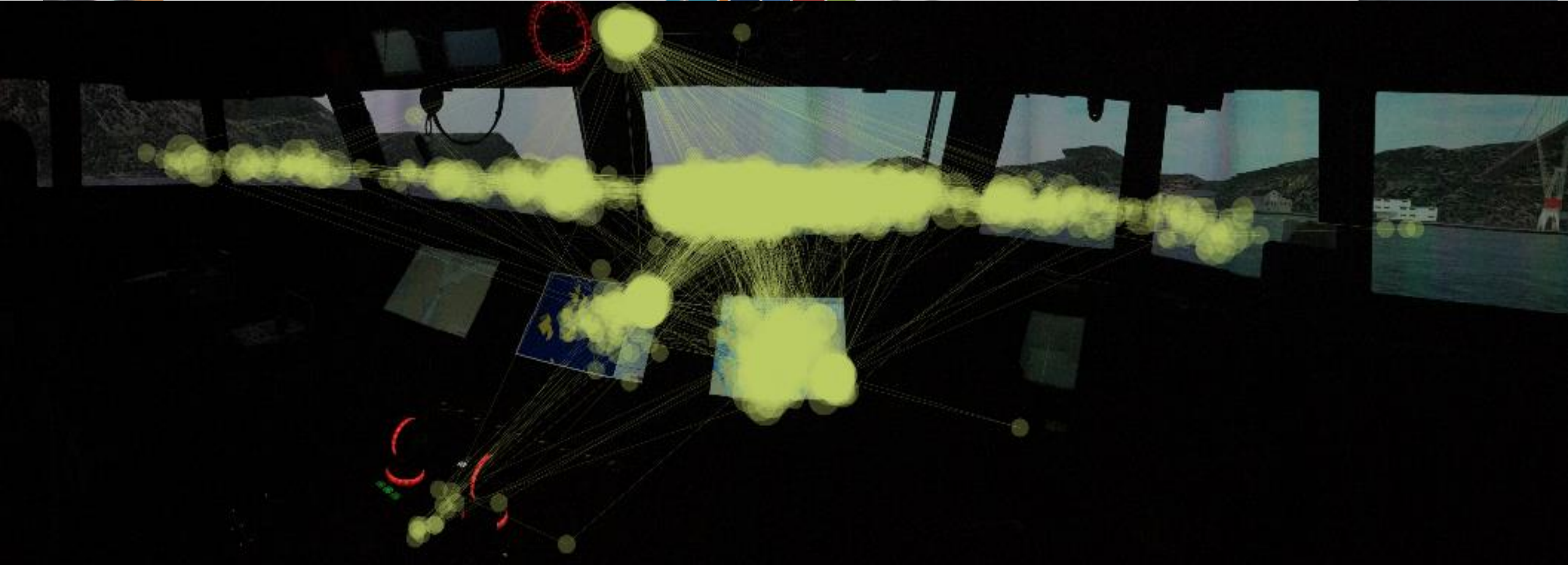




## Dwell time

Route Monitor  
1,8 %

Consoles  
1,7 %







**FORSVARET**  
Sjøforsvaret

# Informasjonshåndtering

Hareide OS.  
Improving Passage Information  
Management for the Modern Navigator.  
19th IALA Conference 2018

KDP40046317: ECDIS MODE: Default ACK XTD limit exceeded ECDIS 17:32:01 MOB

Range: 3.8NM Scale: 1:48 000

Vector: True, Ground Stabilised 6 min

277° 304°  
0.00 nm 1.73 nm  
**<RISO4**  
20m 59s 0.0 ki  
QRxQG  
335° 1.88 nm  
>QW+VRD  
Dette er en beskjed  
S 3457 m 1.00 nm

CCRPR, Conning POSN  

TIME	CCRS	SEL Sensor	SEL Mode
19:34:18 UTC		Computer	Man
HDG	277.0°	Manual	Bet Man
ROT	0.0°/min	Manual	Bet Man
STW	0.0m	Manual	Bet Man
COG	278.0°	Manual	Bet Man
SOG	14.3kn	Manual	Bet Man
DPTH	0.0m	SBE	Man
POSN	60°05.786' N DR		Bet Man
Offset NO	005°29.025' E		

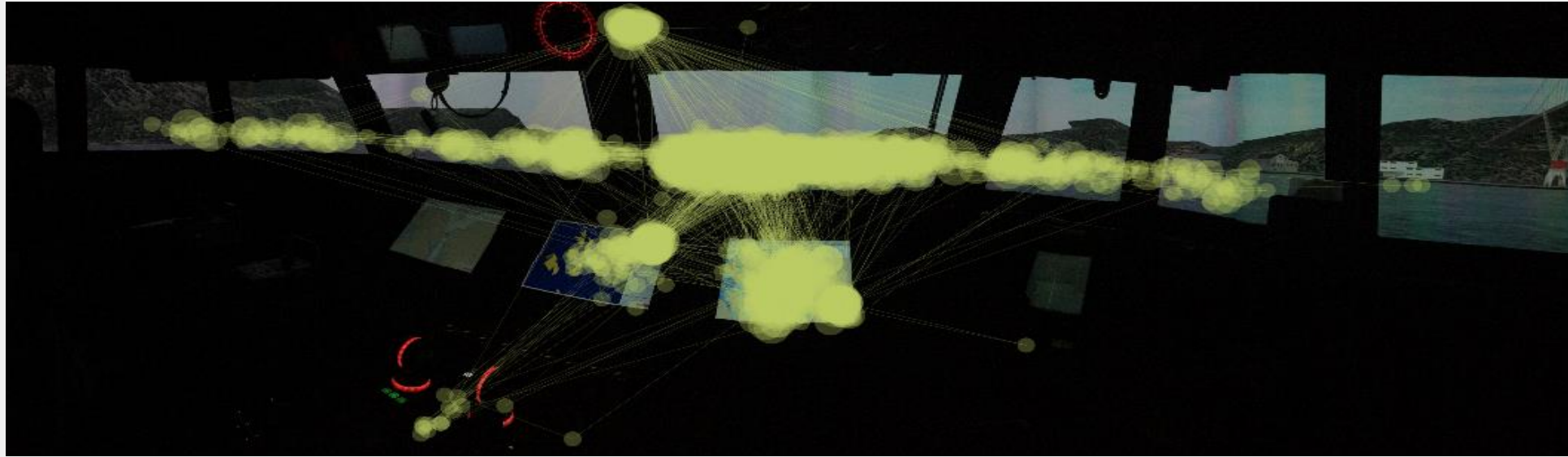
CENTER STD DISP SUPPRESS  
ACT TURN AUTO PLAN AIS FILTER

L R View Targets Route OwnShip  
Chart Options Tools System

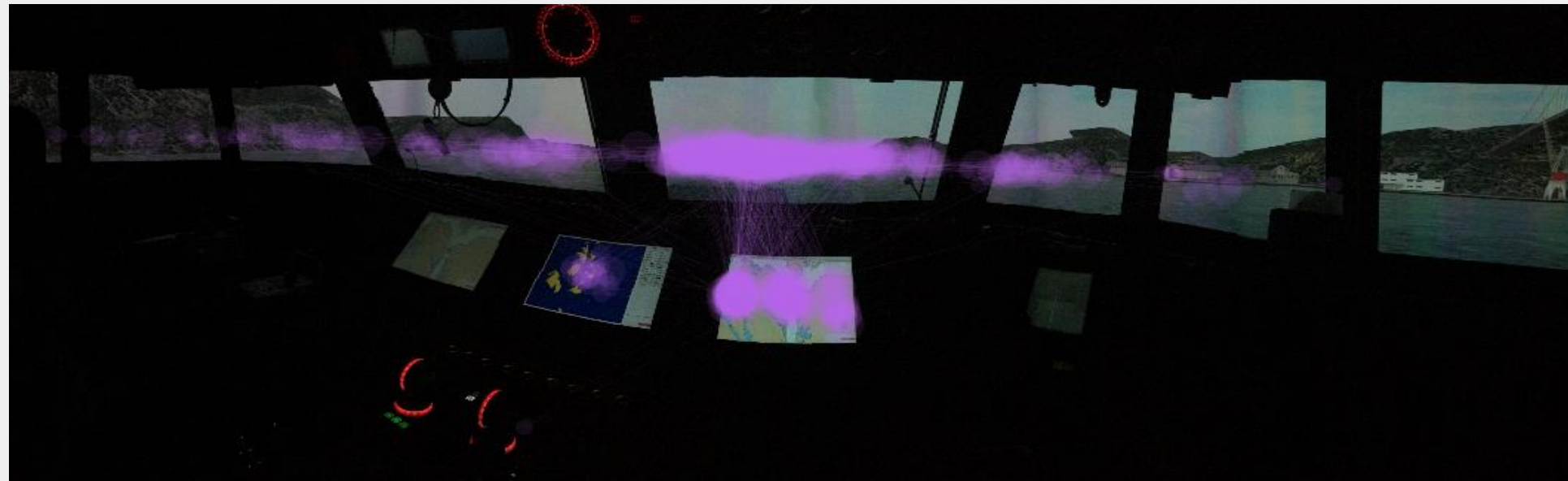
Route Monitor (Surface)  
Active Route **BjørnafjordenMarstein SURF**  
Validation Status  
Route Current --- Next ---  
ENC Val. Leg Turn Leg  
Curr WP 5 - QRxQG >QW+VRD  
BRGRNG WOP 280.9° / 4.68 NM (RL)  
Time To WOP 20min 58s  
Transit Depth\*\*\*  
Next Leg Turn To 334.5° Rate 13°/min  
Radius 1.00 NM Dist 1.4 NM  
Next Depth\*\*\*  
Leg Dep. KC + Planned TD: \*\*\* m  
XTD XTL  
Actual (Y) S 3456 m 300 m Meters  
Depth (Z) \*\*\* m \*\*\* m (BL)  
11: Dest.  
ETA 21 Sep 19:07



# Brukersentrert design – utfordringer med nye systemer

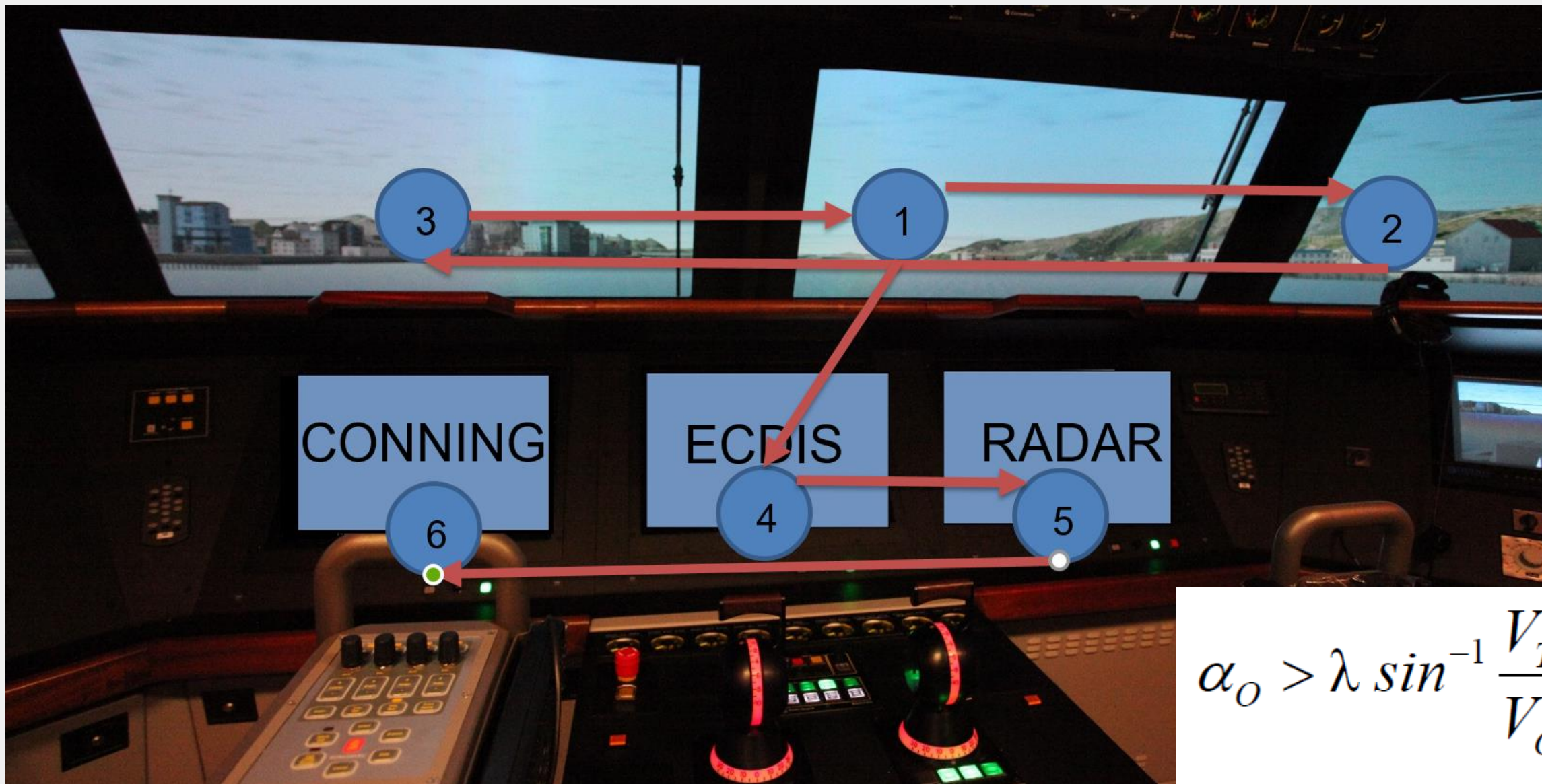


Før  
oppdatering  
av  
programvare



Etter  
oppdatering  
av  
programvare

# Navigatorens søkemønster



$$\alpha_0 > \lambda \sin^{-1} \frac{V_T}{V_0}$$



# Redusere HDT



Virtual Tactician

W P 16:47

## Test A

3.6

H D G 45.3

# 359

5.3

172

STW

PHDG

Current Navigation

17:01

## Test B

45.3

# 11:12

359

LEG

COG

Upcoming Navigation



# Informasjonspresentasjon – Augmented Reality

