Another ECDIS induced accident:
After all these years, why can't we get it right?

T. Porathe, E. S. Petersen, M. Lützhöft

HVL, Western Norway University of Applied Sciences, Norway

The ErgoShip conference, Esbjerg, Denmark, 2-3 November 2023

Slite

Drogheda
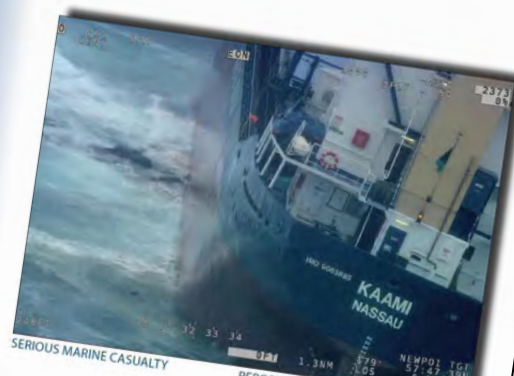
ocean

The Little Minch

Slite

Drogheda
Ireland

ACCIDENT REPORT

Report on the investigation of
the grounding of the general cargo vessel

Kaami

on Sgeir Graidach, the Little Minch, on

23 March 2020

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SERIOUS MARINE CASUALTY

KAAMI
NASSAU

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Reproduced from Admiralty Chart 1794 by permission of HMSO and the UK Hydrographic Office

Shiant Islands

Grounded position

Southbound IMO recommended route

Kaami AIS track

Northbound IMO recommended route
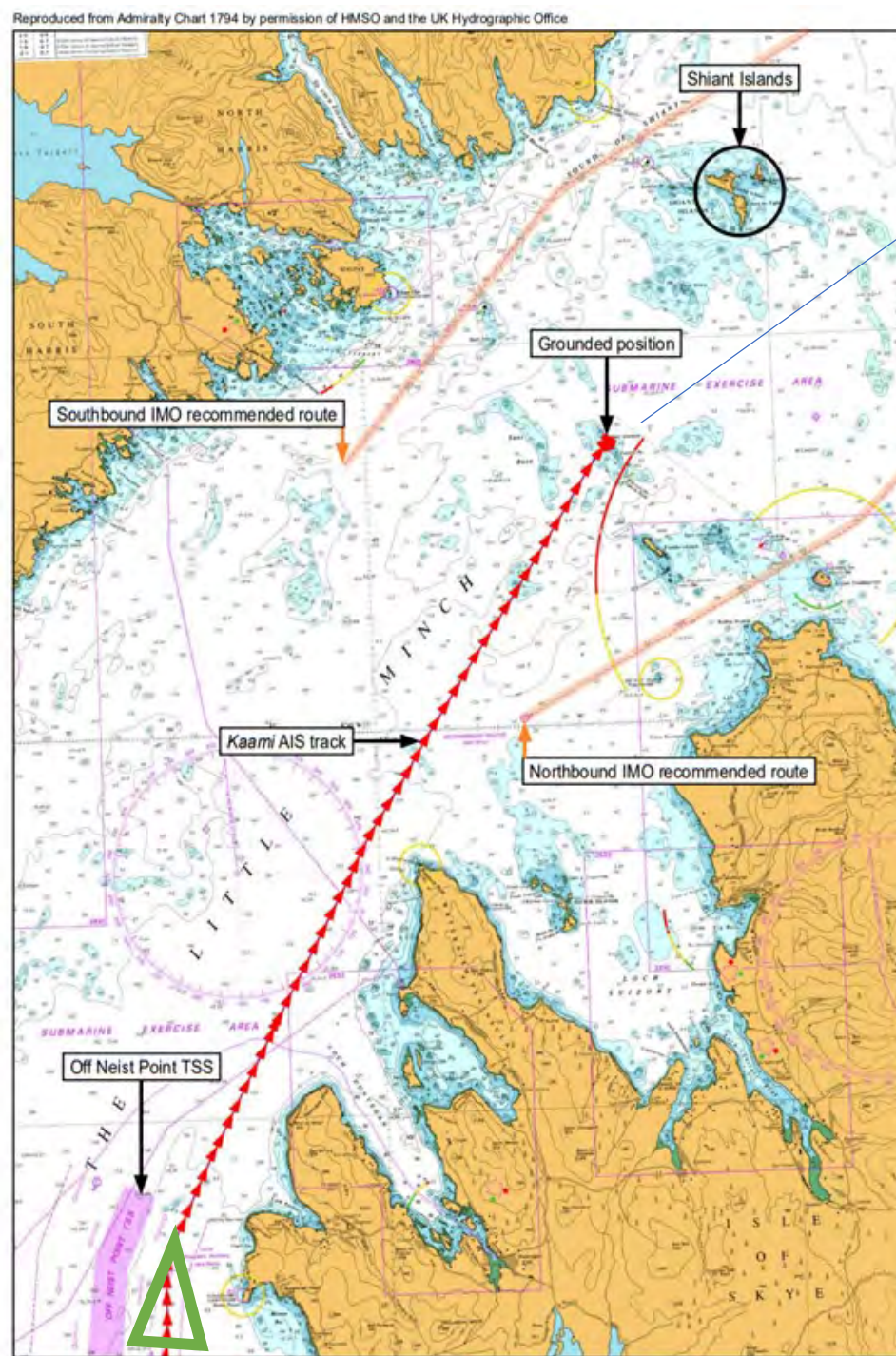
Off Neist Point TSS

Figure 15: Different routes due to weather routeing. Photo of onboard ECDIS. Courtesy of MAIB

Reproduced from Admiralty Chart 1794 by permission of HMSO and the UK Hydrographic Office

Shiant Islands

Grounded position

Southbound IMO recommended route

Southern cardinal mark on Eugenie Rock

Kaami AIS track

Northbound IMO recommended route

Reporting point "F"
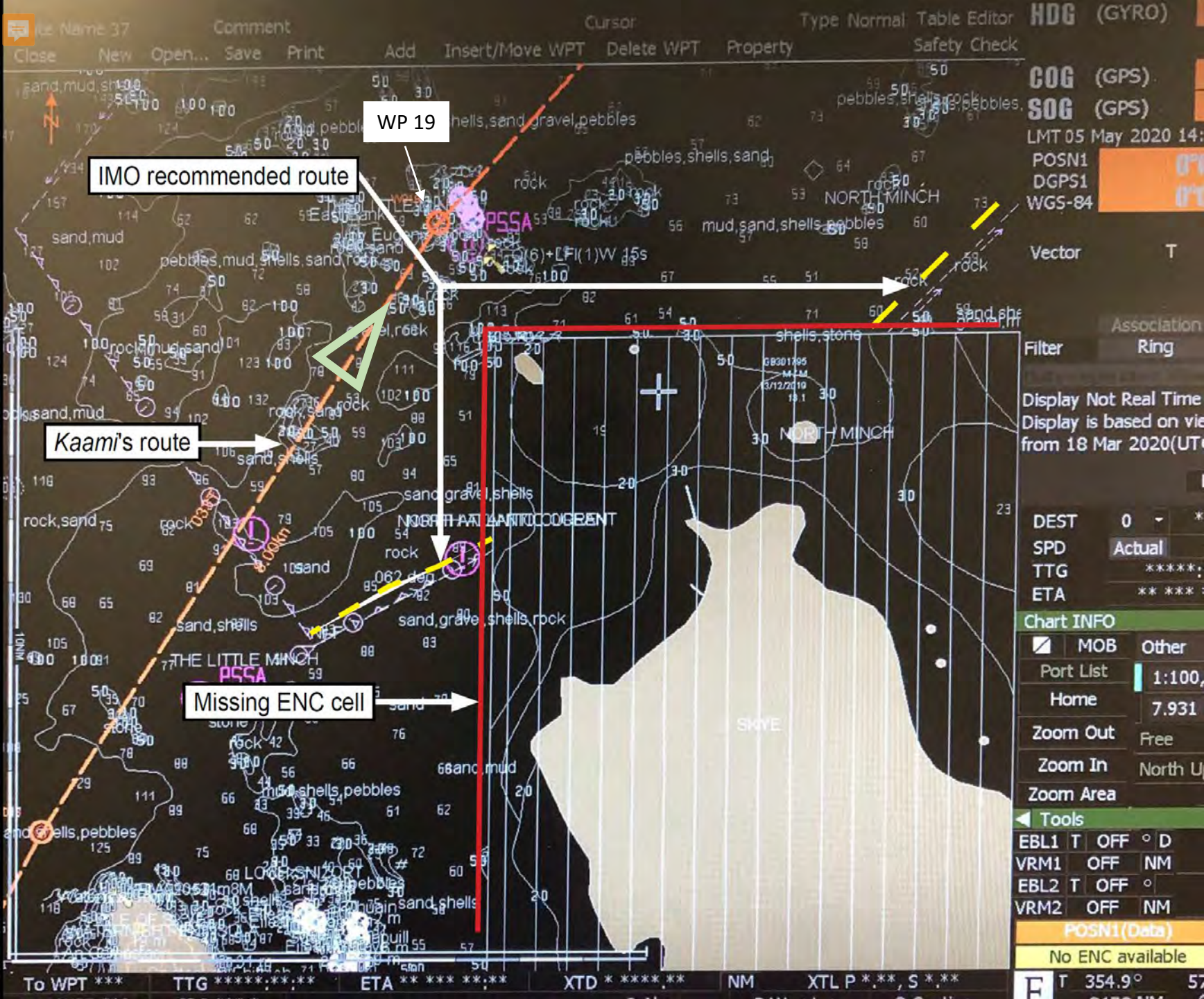
Off Neist Point TSS

Figure 12: Photo of *Kaami's* ECDIS display showing route in comparison to the missing cell (indicated by vertical bars) which covered the IMO recommended route to the north of the Isle of Skye. Courtesy of MAIB.
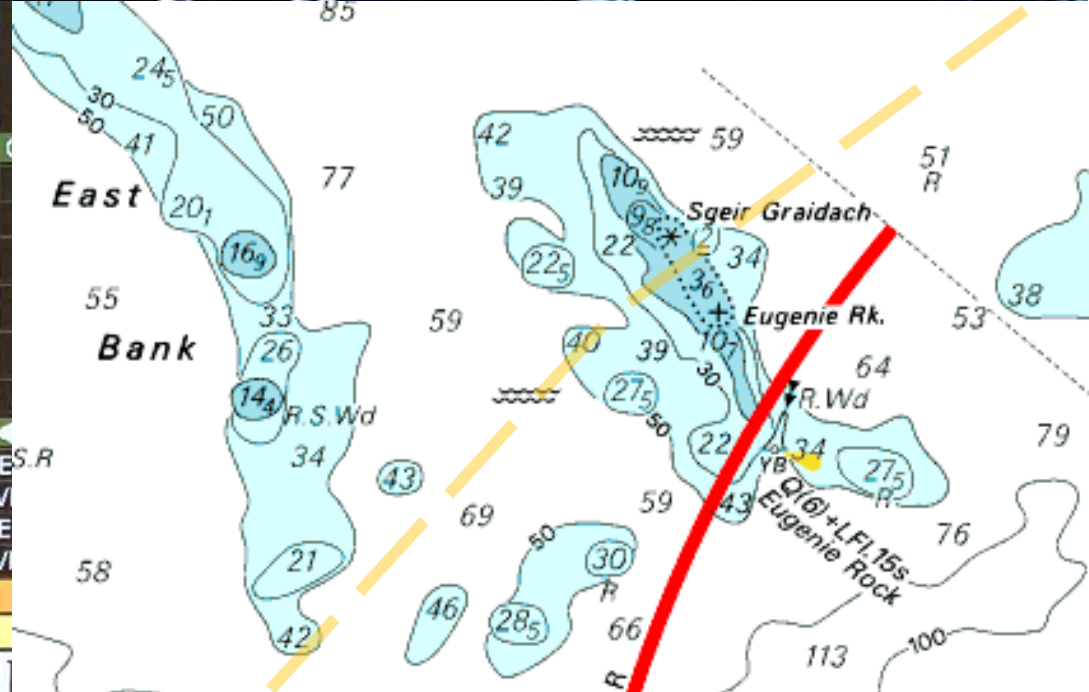
Top-left panel labels:
- WP 19
- IMO recommended route
- Kaami's route
- Missing ENC cell
- NORTH MINCH
- PSSA
- NORTH ATLANTIC CURRENT
- THE LITTLE MINCH
- PSSA
- SKYE
- Q(6)+LFl(1)W 15s
- 062 deg
- GB301795
- M-M
- 13/12/2019
- 1.00kn
- 038
- To WPT ***   TTG *****:**   ETA ** ***:**   XTD * ****.**   NM   XTL P *.**, S *.**

Bottom-right panel labels:
- East Bank
- Sgeir Graidach
- Eugenie Rk.
- Eugenie Rock
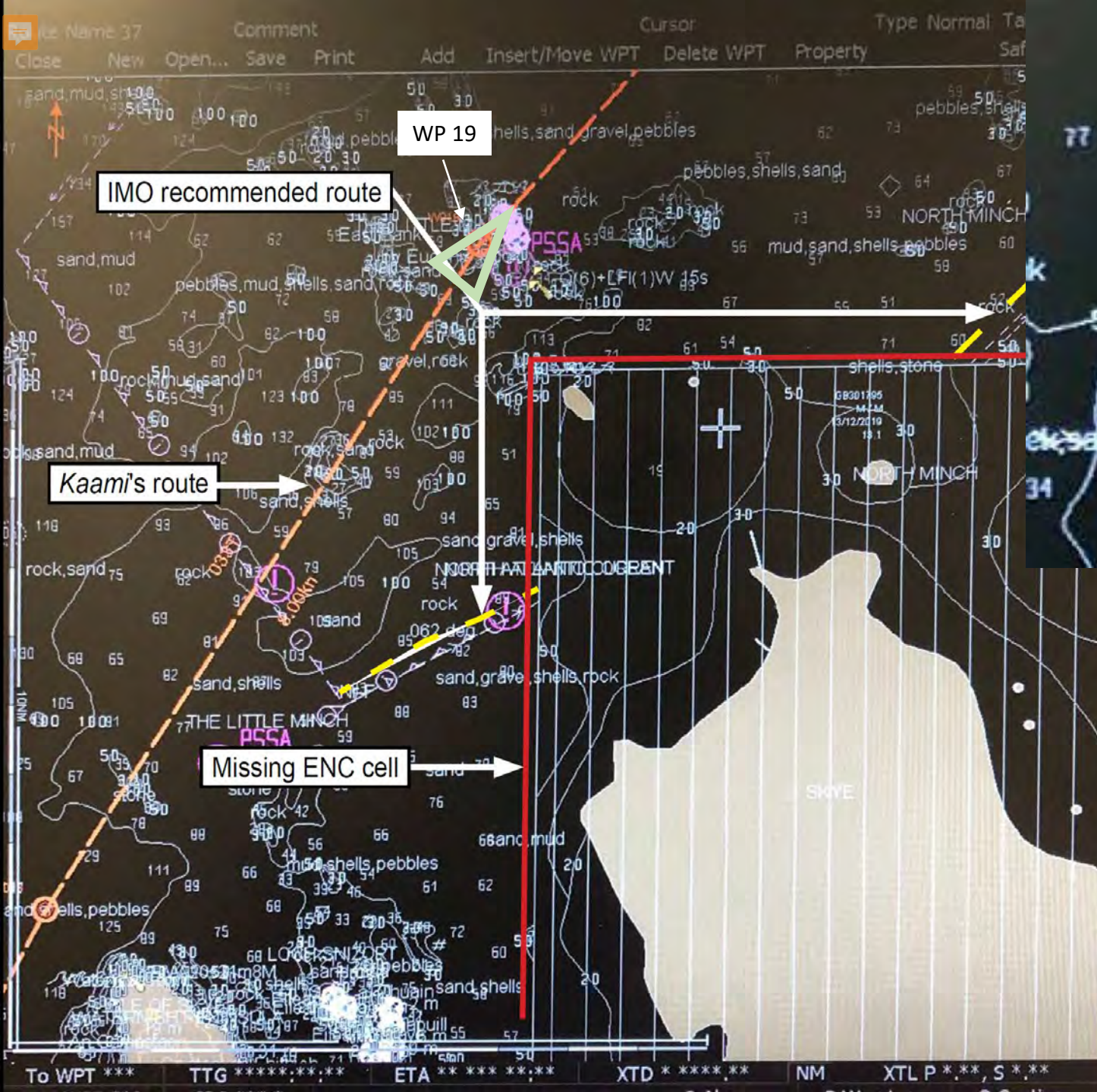- Q(6)+LFl 15s
- R.S.Wd
- R.Wd

Figure 4: *Aerial view from coastguard helicopter's video showing the general cargo vessel Kaami aground on Sgeir Graidach.* Courtesy of MAIB.

The question we may ask is: How could a fully equipped, modern ship, with a properly manned bridge, plan a track away from the IMO recommended route and run aground in good visibility on a charted rock?

Is this yet another ECDIS induced accident?
So, how come we after all these years, still can't get it right?

And is there something the ECDIS designers can do about it?

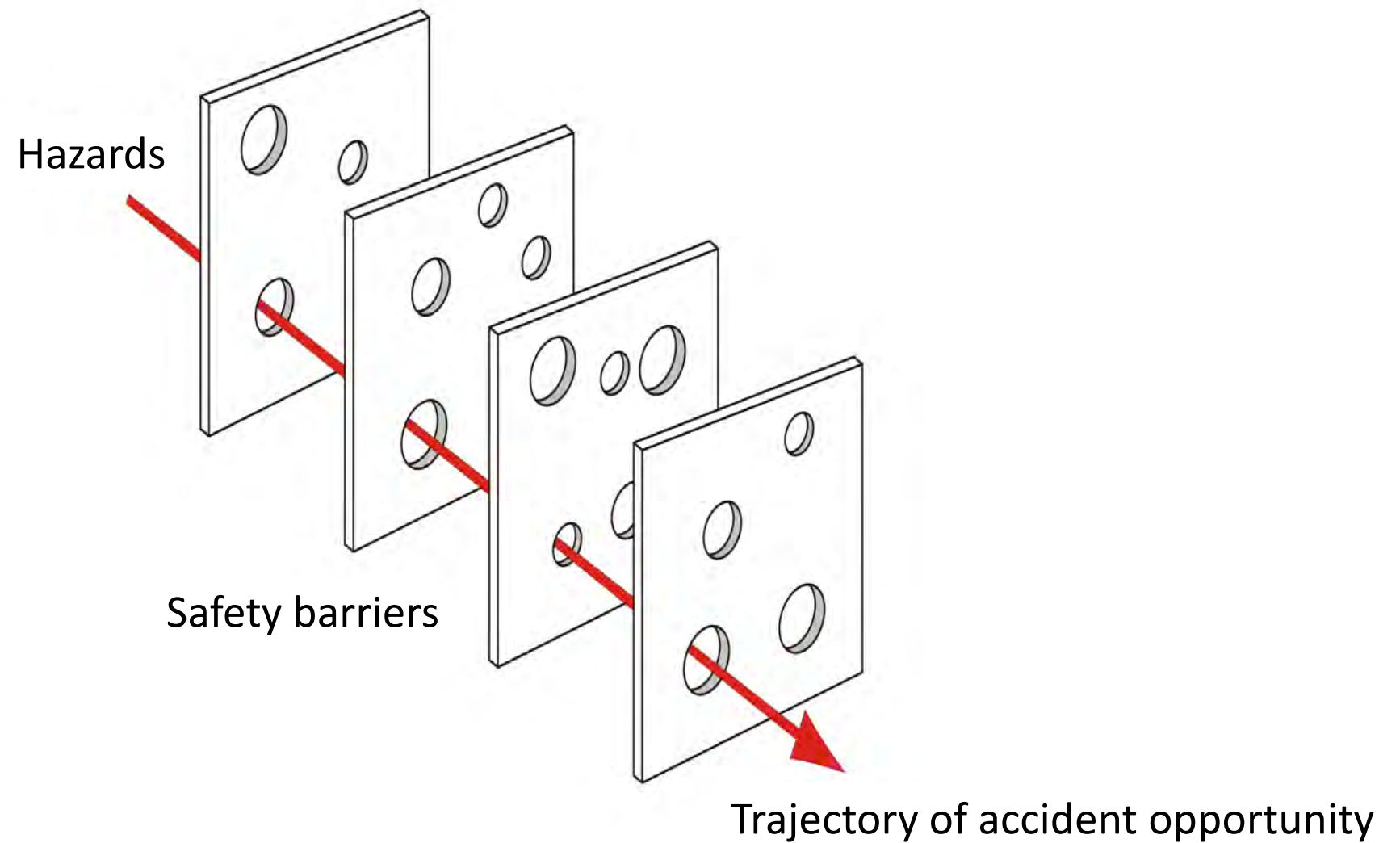# The Electronic Chart and Display Information System, ECDIS

JRC JAN 2000 ECDIS

Main ECDIS.

Backup ECDIS.

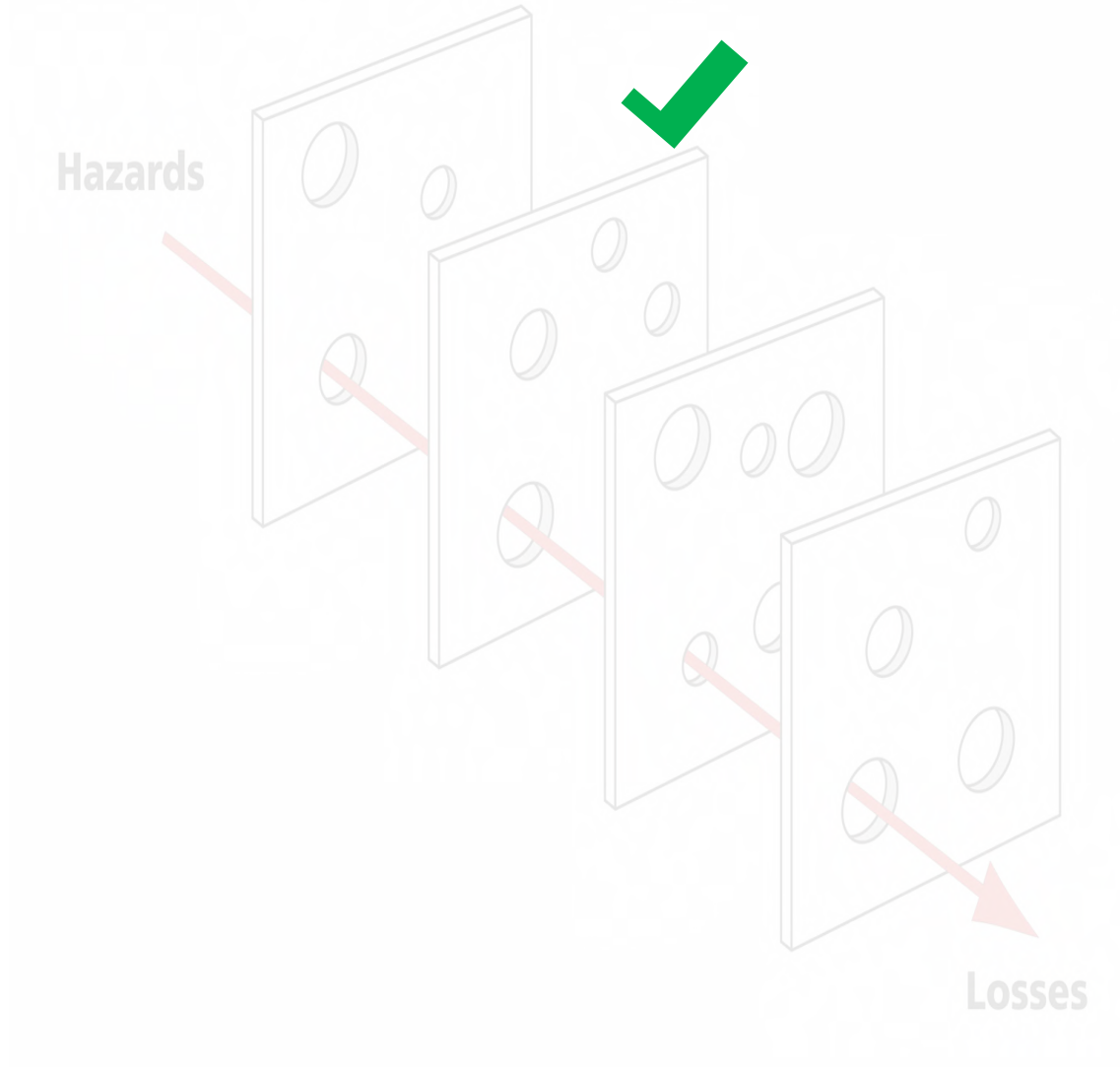Port radar

Starboard radar

Kaami's bridge. Photo curtesy of MAIB.

04/09/2019 10:55

ocean

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James Reason's Swiss Cheese Model

Hazards

Safety barriers

Trajectory of accident opportunity

SAFETY BARRIERS
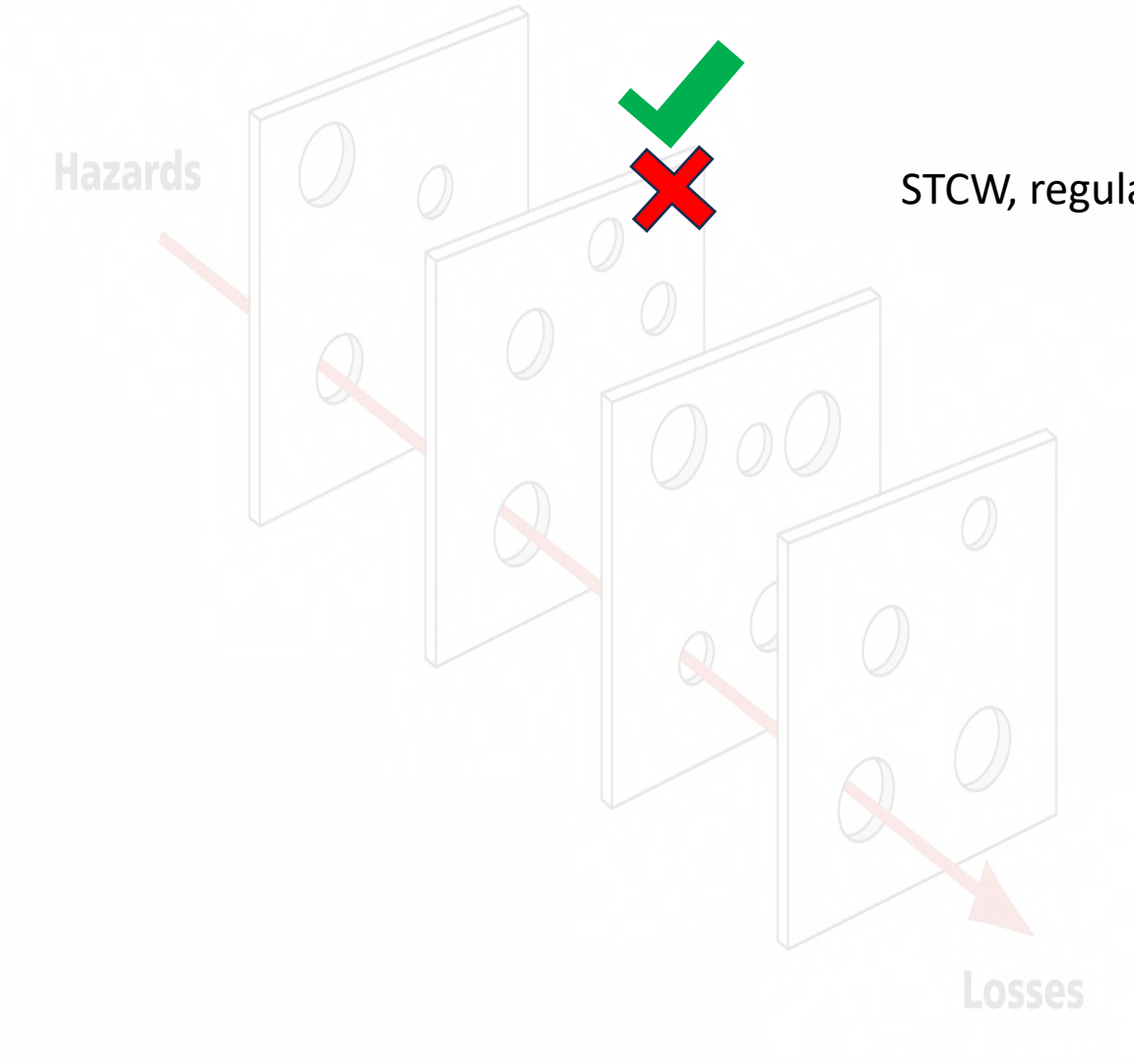
ECDIS

SAFETY BARRIERS

ECDIS

Familiarisation   STCW, regulation I/14, ISM Code section 6.3
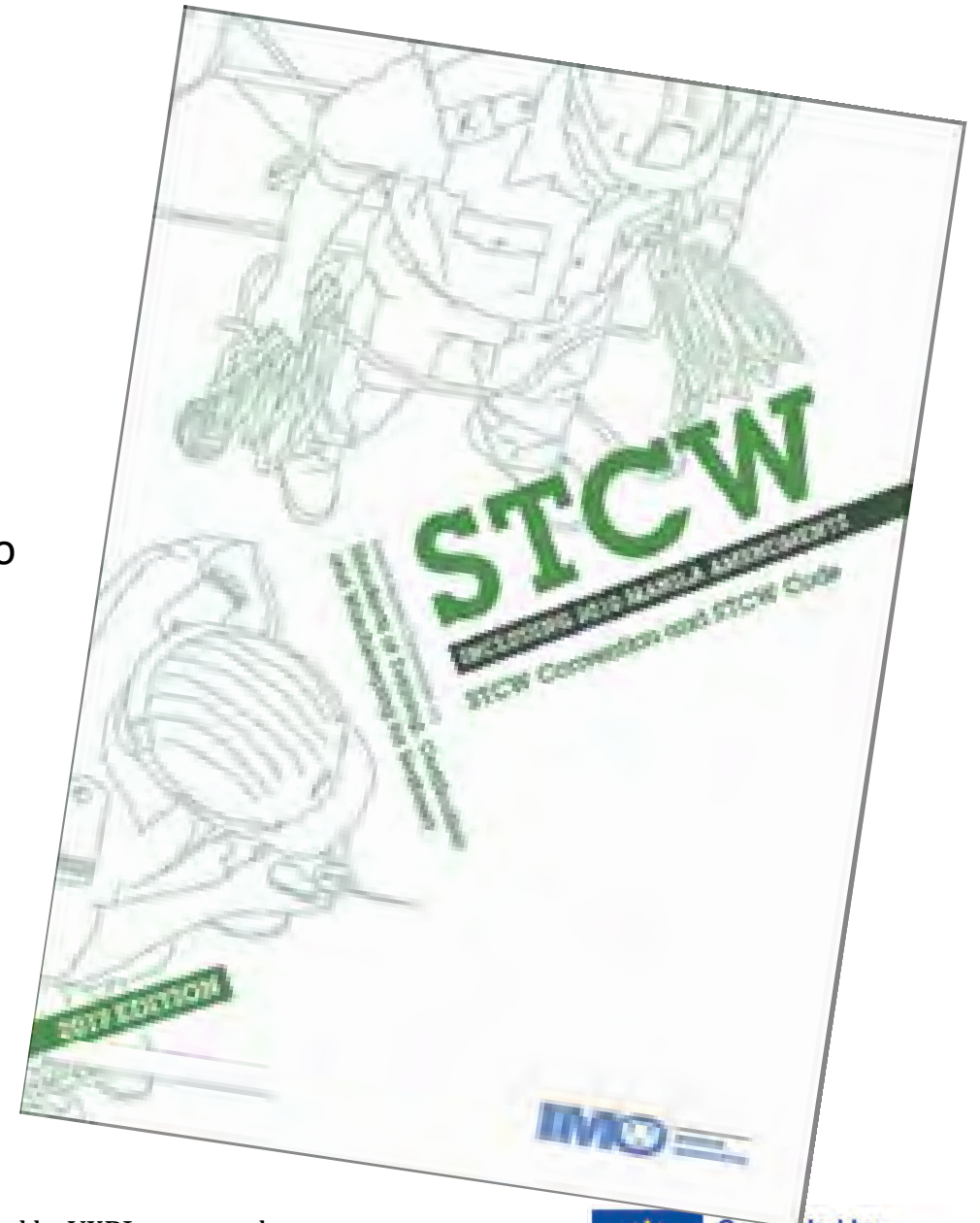
STCW
The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978

STCW, 2010, Part 2: Voyage Planning

"The intended voyage shall be **planned in advance** taking into consideration all pertinent information and any course laid down **shall be checked** before the voyage commences."

Kaami's route passing over shoal waters after WP 19. Photo from the ship's ECDIS. Courtesy MAIB.

Figure 16: Route 37 crossing the safety contour before the Kattegat waypoint. ECDIS route showing an area to the north of the Danish coast, as the route passed from the Skagerrak into the Kattegat, where the safety contour was crossed Courtesy of MAIB.
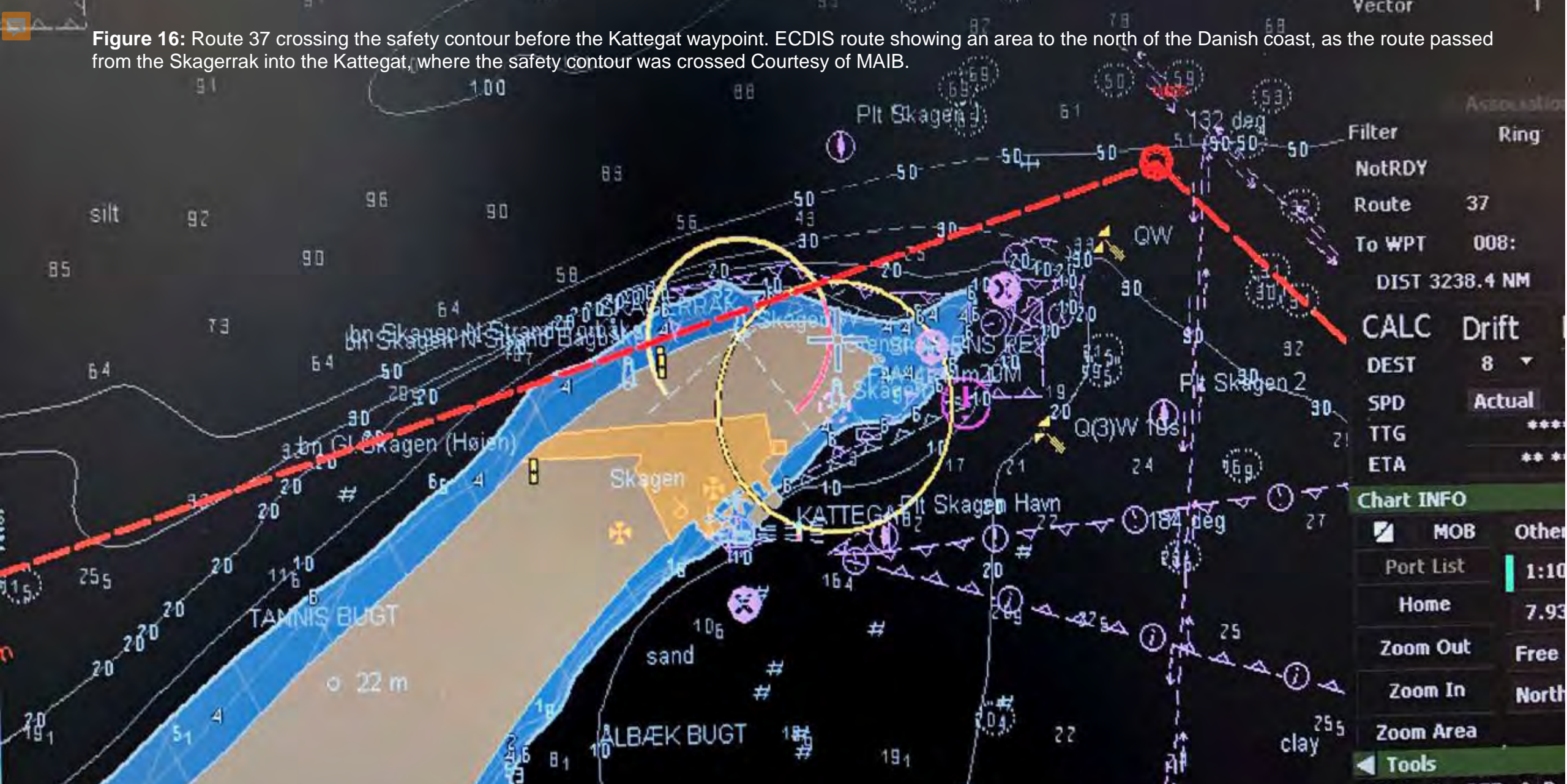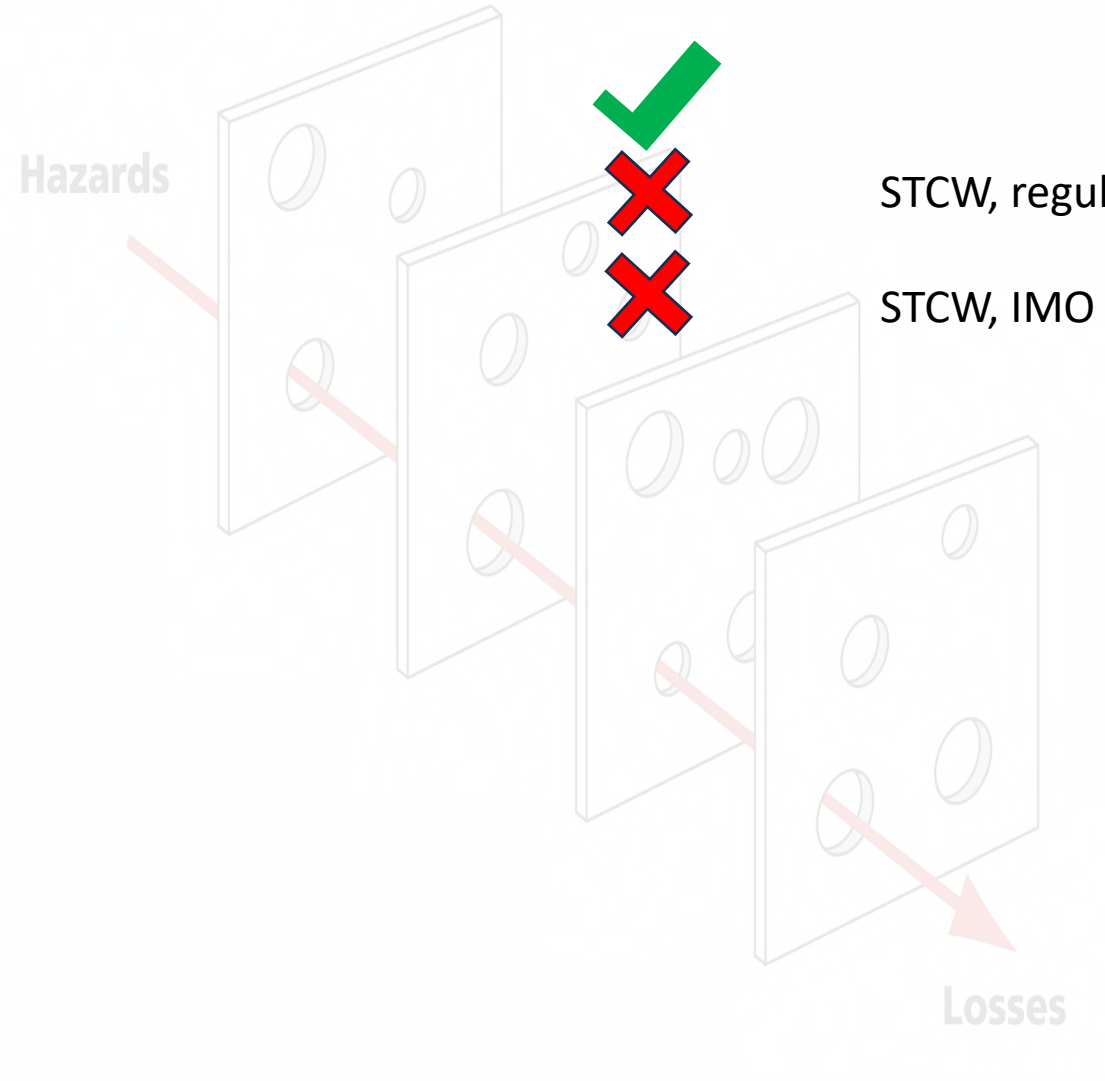
SAFETY BARRIERS

ECDIS

Familiarisation   STCW, regulation I/14, ISM Code section 6.3

Voyage Plan   STCW, IMO A.893(21)

SAFETY BARRIERS

ECDIS

Familiarisation   STCW, regulation I/14, ISM Code section 6.3

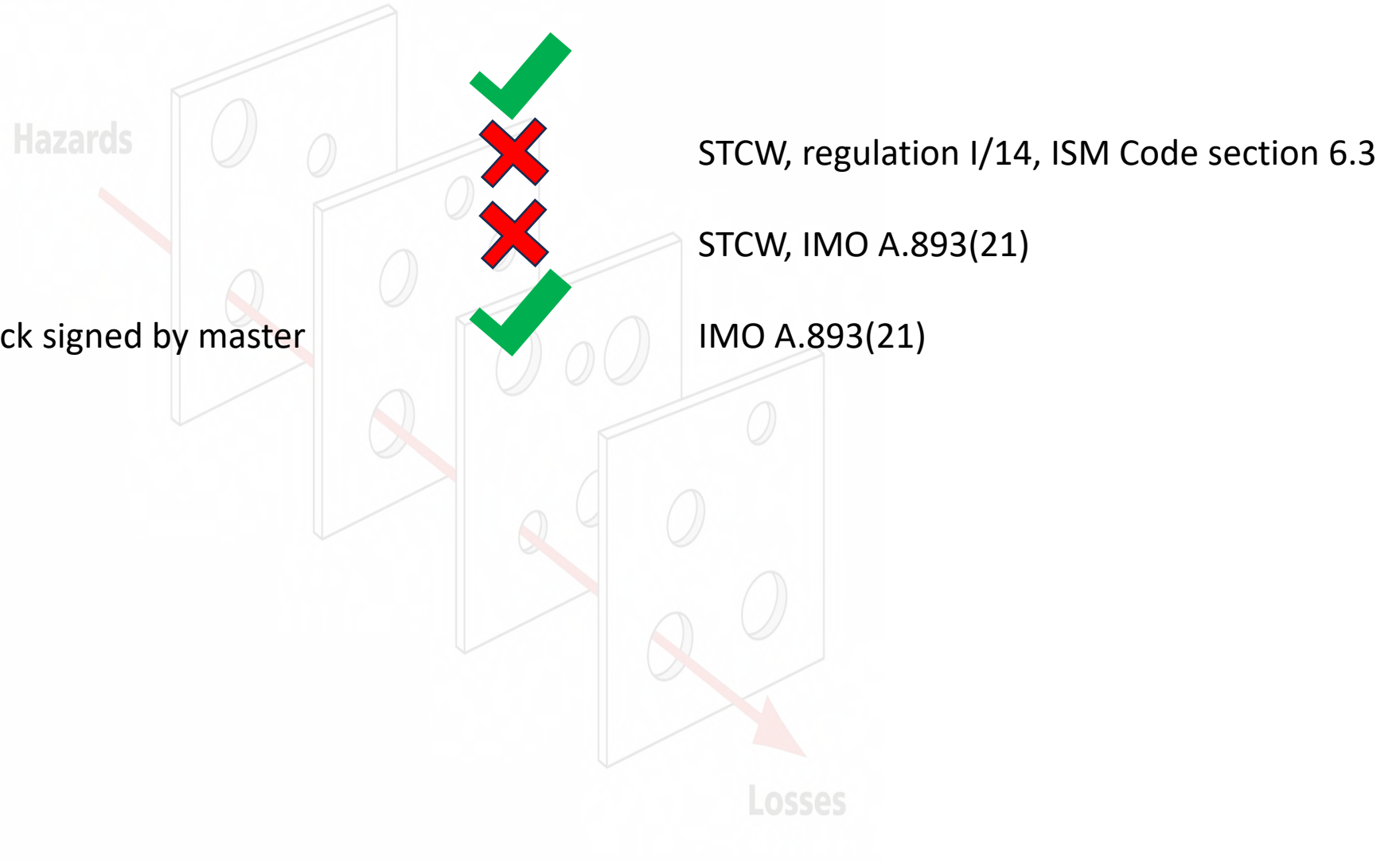Voyage Plan   STCW, IMO A.893(21)

Voyage plan second check signed by master   IMO A.893(21)

Hazards

Losses

Second check

SOLAS Annex 23 (voyage planning) states the following inter alia:

'Masters, skippers and watchkeepers should therefore adhere to the IMO Guidelines taking the following measures to ensure that they appreciate and reduce the risks to which they are exposed: …

b) ensure that there is a systematic bridge organisation that provides for:

- - -

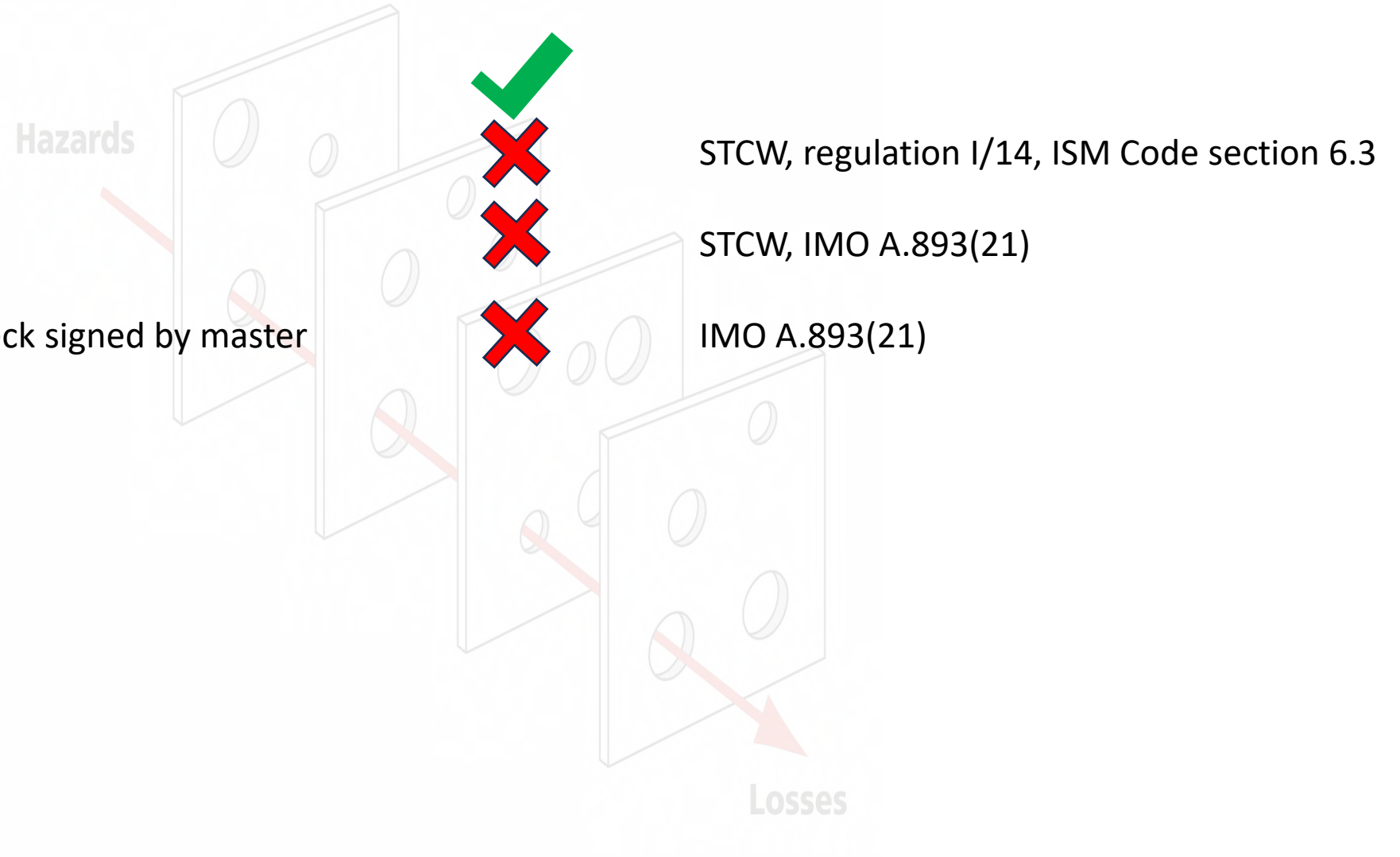*iii) **cross checking of individual human decisions so that errors can be detected and corrected as early as possible'.***

SAFETY BARRIERS

ECDIS

Familiarisation   STCW, regulation I/14, ISM Code section 6.3

Voyage Plan   STCW, IMO A.893(21)

Voyage plan second check signed by master   IMO A.893(21)

Kaami's draught 5.4 m (aft) + Under-Keel Clearance (UKC)
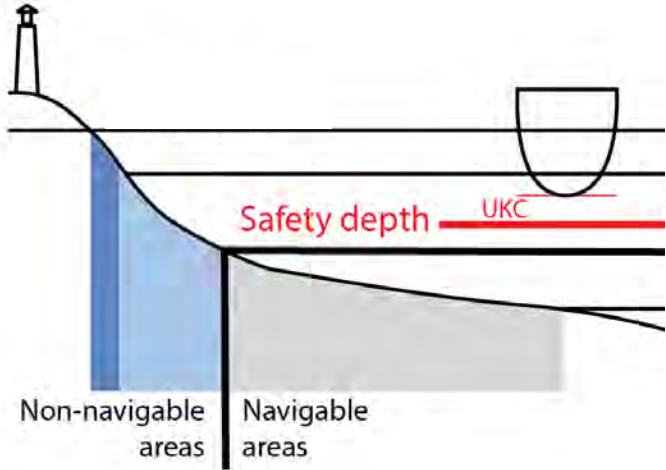
SAFETY BARRIERS

ECDIS ✅

Familiarisation ❌ STCW, regulation I/14, ISM Code section 6.3

Voyage Plan ❌ STCW, IMO A.893(21)

Voyage plan second check signed by master ❌ IMO A.893(21)

Safety Contour correctly set ❌ IMO A.893(21),
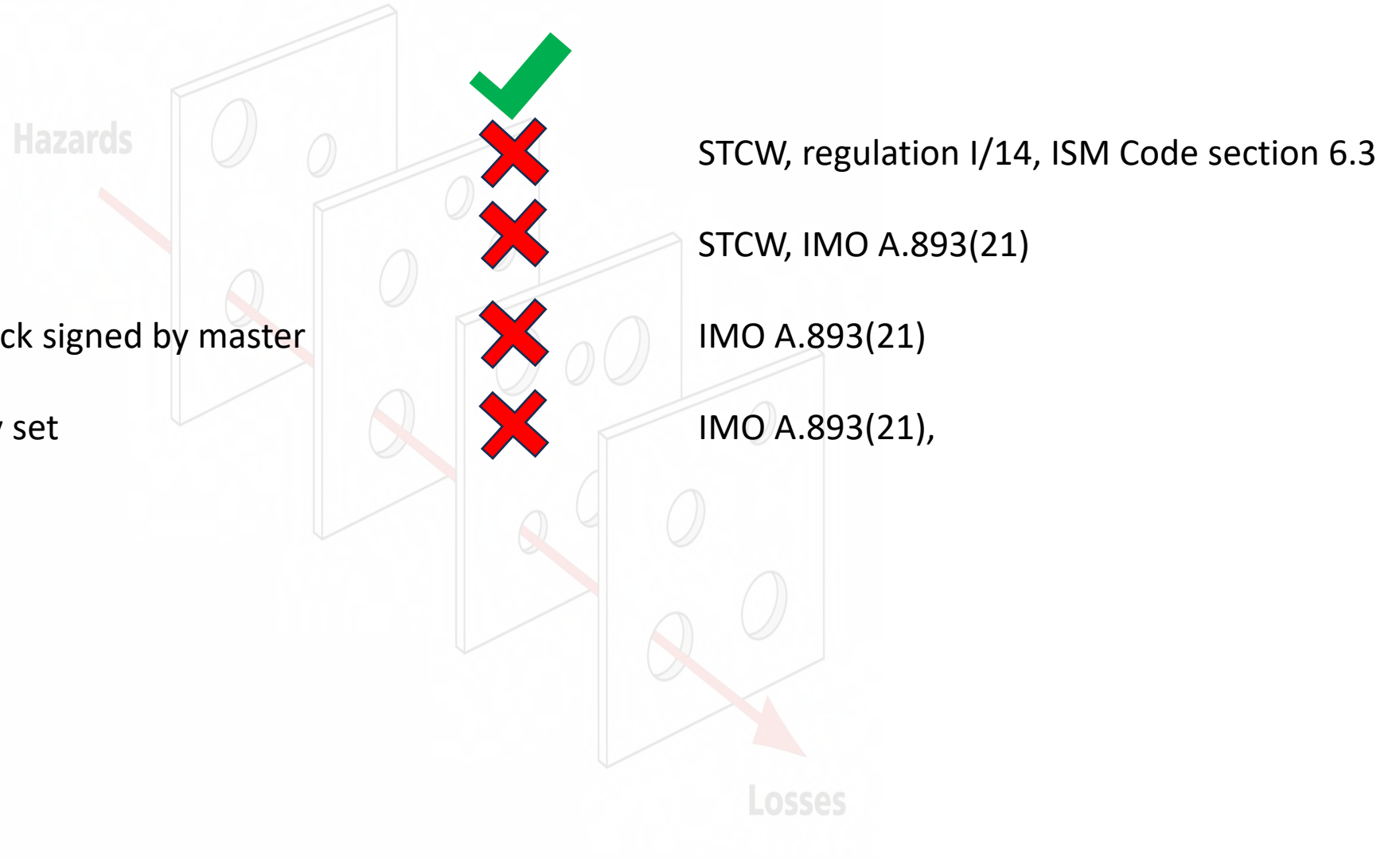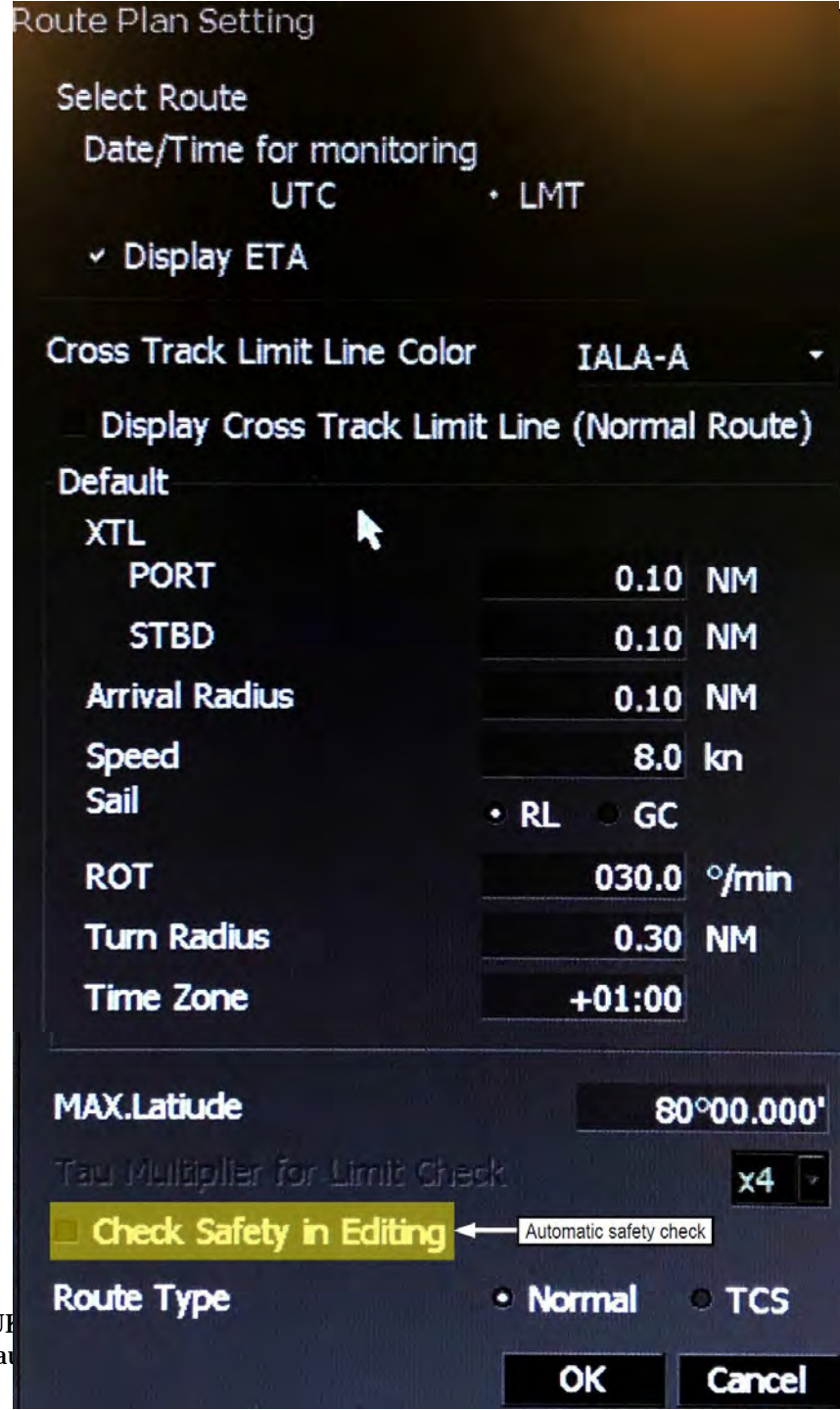
Hazards

Losses

Figure 14: Automatically generated alarm for crossing a safety contour. Courtesy of MAIB

Figure 8: Voyage planning screen showing XTD and safety check. Voyage planning display screen with cross track limit and automatic safety check data highlighted. Courtesy of MAIB

SAFETY BARRIERS

ECDIS ✅

Familiarisation ❌ STCW, regulation I/14, ISM Code section 6.3

Voyage Plan ❌ STCW, IMO A.893(21)

Voyage plan second check signed by master ❌ IMO A.893(21)

Safety Contour correctly set ❌ IMO A.893(21),

ECDIS Route Safety Check ❌ IMO, MSC.232(82)

Hazards

Losses

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Figure 12: Photo of *Kaami's* ECDIS display showing route in comparison to the missing cell (indicated by vertical bars) which covered the IMO recommended route to the north of the Isle of Skye. Courtesy of MAIB.

SAFETY BARRIERS

ECDIS ✓

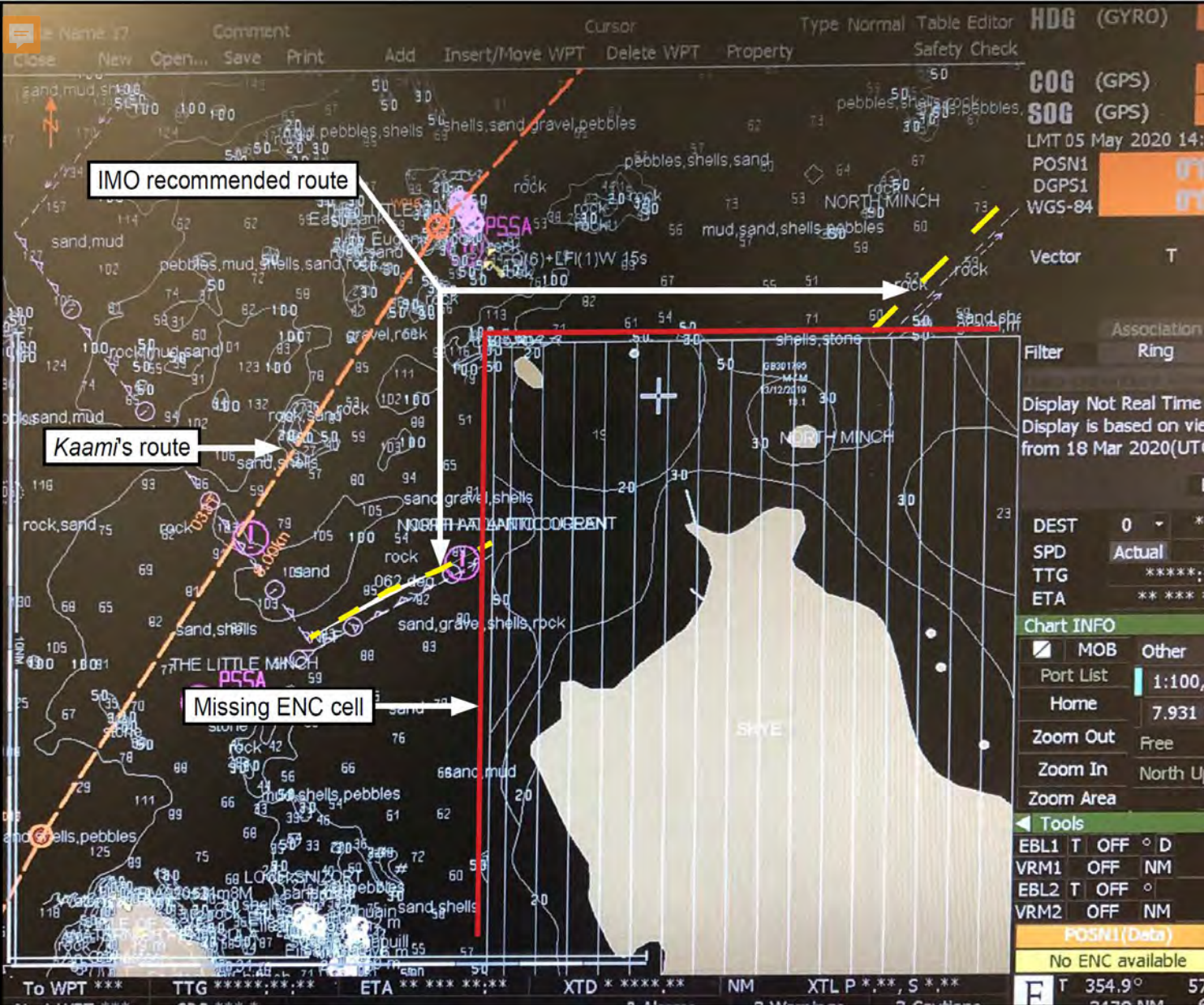Familiarisation ✗ STCW, regulation I/14, ISM Code section 6.3

Voyage Plan ✗ STCW, IMO A.893(21)

Voyage plan second check signed by master ✗ IMO A.893(21)

Safety Contour correctly set ✗ IMO A.893(21),

ECDIS Route Safety Check ✗ IMO, MSC.232(82)

Inappropriate Scales used ✗ IMO, MSC.232(82)

Missing ENC cell ✗ IMO, MSC.232(82)

Hazards

Losses

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Warning
Safety contour

Danger Detection Sector radius
(1.0min to 30.0min
or 0.1NM to 5.0NM)

Danger Detection Vector length
(1.0min to 30.0min
or 0.1NM to 5.0NM)

Danger Detection Sector angle
(0.0deg to 359.9deg)

Danger Detection Vector width
(30m to 250m)

Look-ahead functions: the Danger Detection Sector and Vector.
Illustration from the JRC JAN-2000 Instruction Manual.
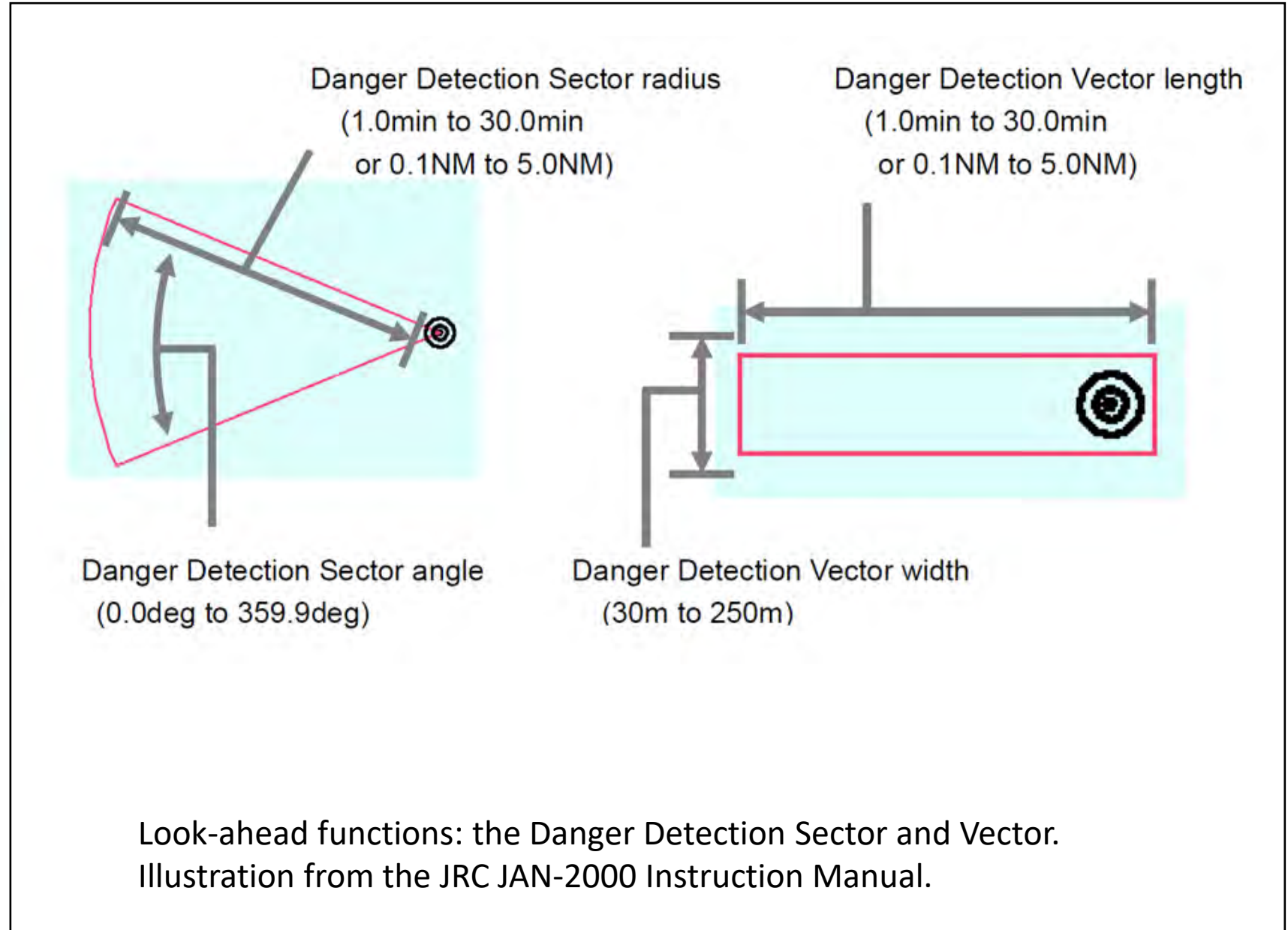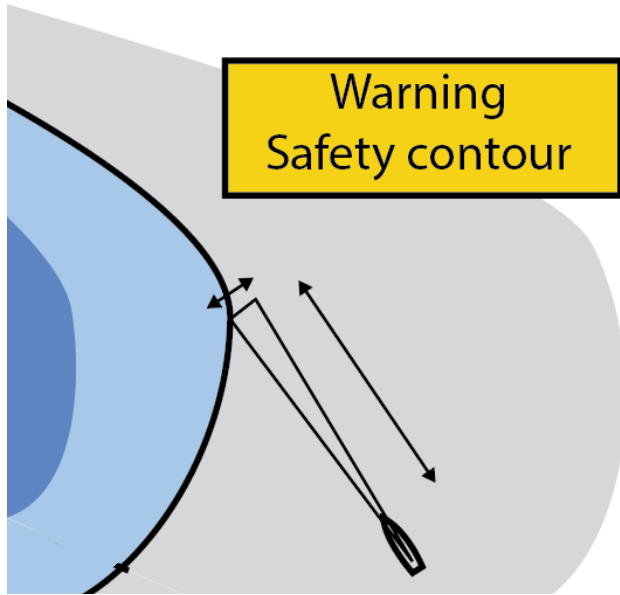
Co-funded by
the European Union
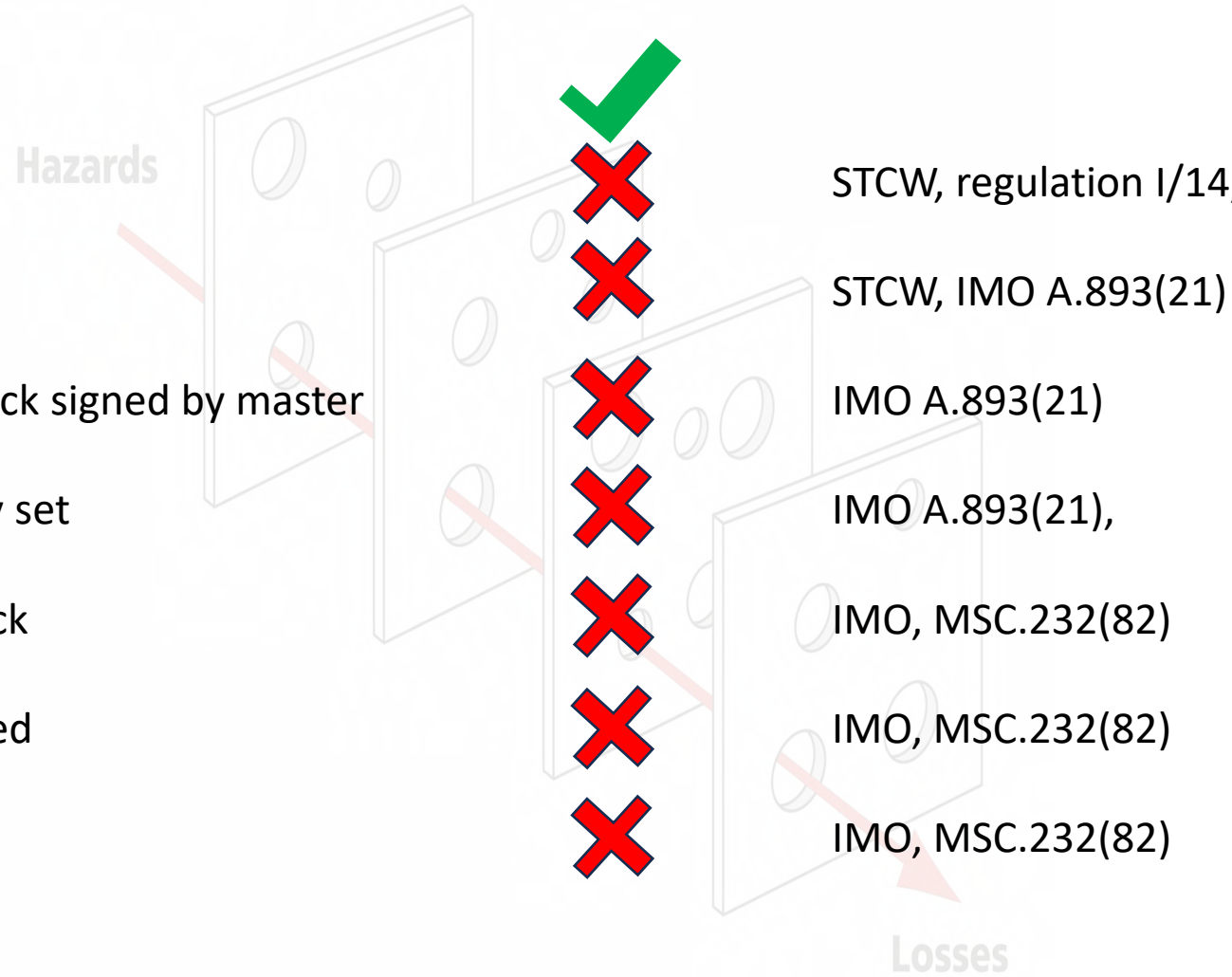
Figure 9: Look ahead options on Kaami's JRC JAN 2000 ECDIS. Kaami's ECDIS screen showing boxes for activating look ahead were unchecked. Courtesy of MAIB.

Figure 10: Alert buzzer settings all set to zero

SAFETY BARRIERS

ECDIS ✅

Familiarisation ❌ STCW, regulation I/14, ISM Code section 6.3

Voyage Plan ❌ STCW, IMO A.893(21)

Voyage plan second check signed by master ❌ IMO A.893(21)

Safety Contour correctly set ❌ IMO A.893(21),

ECDIS Route Safety Check ❌ IMO, MSC.232(82)

Inappropriate Scales used ❌ IMO, MSC.232(82)

Missing ENC cell ❌ IMO, MSC.232(82)

Look Ahead function inactivated ❌ IMO, MSC.232(82)

The alarm audio buzzers inactivated ❌ IMO, MSC.232(82)

Hazards

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Why did the navigators onboard disable all the helpful features design into the system to help them?

Where they even aware of that the features were inactivated or that they had missed doing some action?

Fatigue?

Complicated technology. Unintuitive design?
(Low learnability, low usability)

And what can we do about it?

Potential solutions (ranked No to High policing)

1. **Nudging for better design.** Improved usability through Human-Centred Design. S-mode.

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Potential solutions (ranked No to High policing)

1. **Nudging for better design.** Improved usability through Human-Centred Design. S-mode.

2. **Regulations.** Recommendations and guidelines should be firmer, e.g., Ships MUST sail with safety checked routes, activated alarms and look ahead functions.

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Potential solutions (ranked No to High policing)

1. **Keep nudging for better design.** Improved usability through Human-Centred Design. S-mode.

2. **Regulations.** Recommendations and guidelines should be firmer, e.g., Ships MUST sail with safety checked routes, activated alarms and look ahead functions.

3. **Prevent "dangerous" settings**, e.g., the ability to turn off alarms, buzzers and warnings, inactivate look-ahead functions and automatic route checks. Remove the possibility to set faulty Safety Depth and Safety Contour. (How? Automatic draught gauges? Set by harbour authorities?)

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4. **Clears visual indicators when ECDIS' settings are not complete.**

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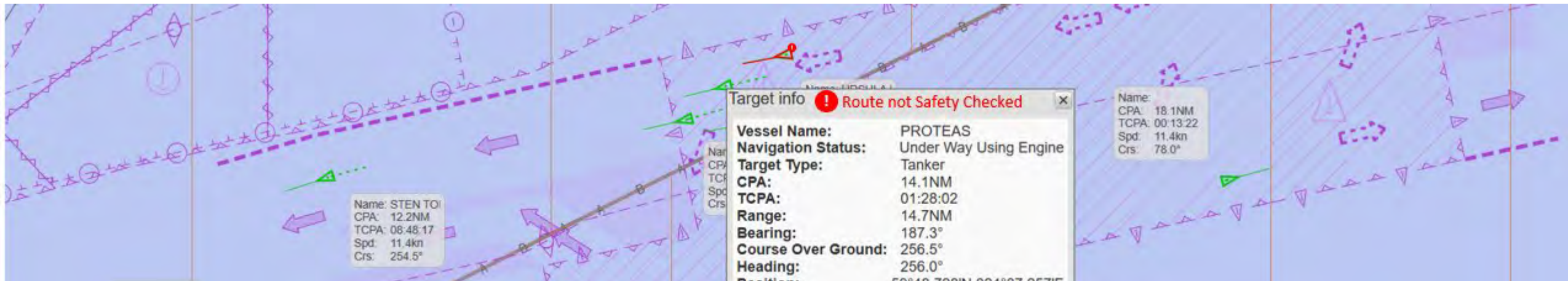5. **Lock down ECDIS if all mandatory settings is not OK**. Is this too much?

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6. **Social control.** Flag ships AIS target as "unreliable" through an AIS message, e.g., "Voyage plan not Safety Checked."

Potential solutions (ranked No to High policing)

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7. **Automatic message to VTS** and Coast Guard Centres if mandatory ECDIS settings are not followed.

Thank you for listening

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