Human error? No, bad design!

How bad design can cause accidents

Design commissions and
design omissions

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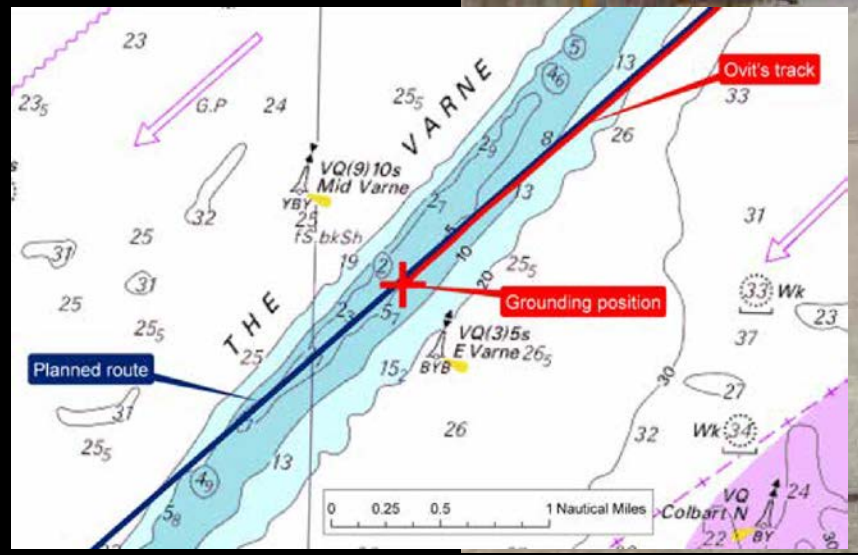
Design commissions

ECDIS usability



The Ovit accident September 2013

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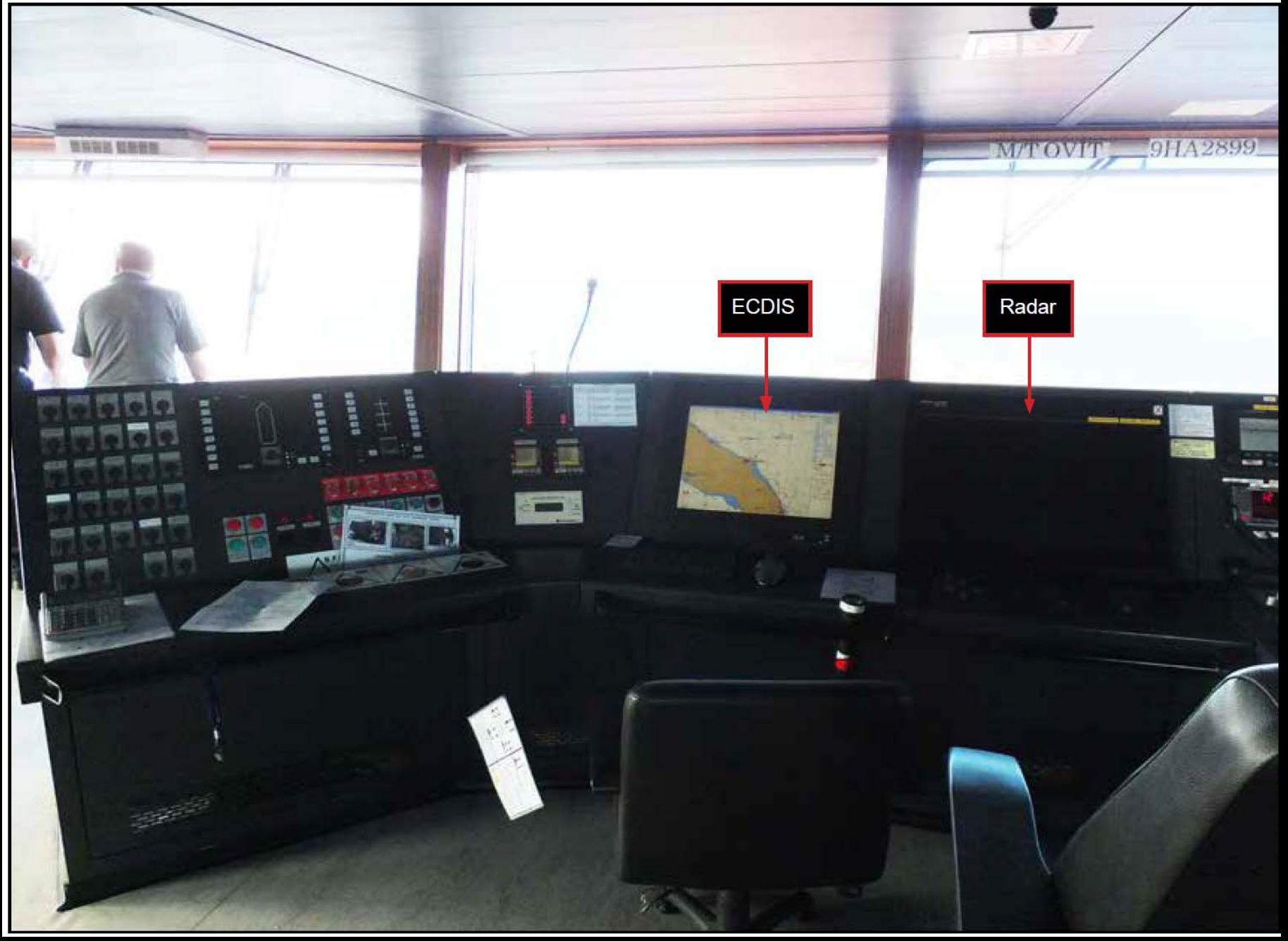
NTNU



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“On the basis of the fullest possible appraisal, a detailed voyage or **passage plan** should be prepared which should cover the entire voyage or passage from berth to berth.”

(IMO, 1999)

IMO, International Maritime Organization, ‘Guidelines for Voyage Planning’, Resolution A.893(21), adopted on 25 November 1999.

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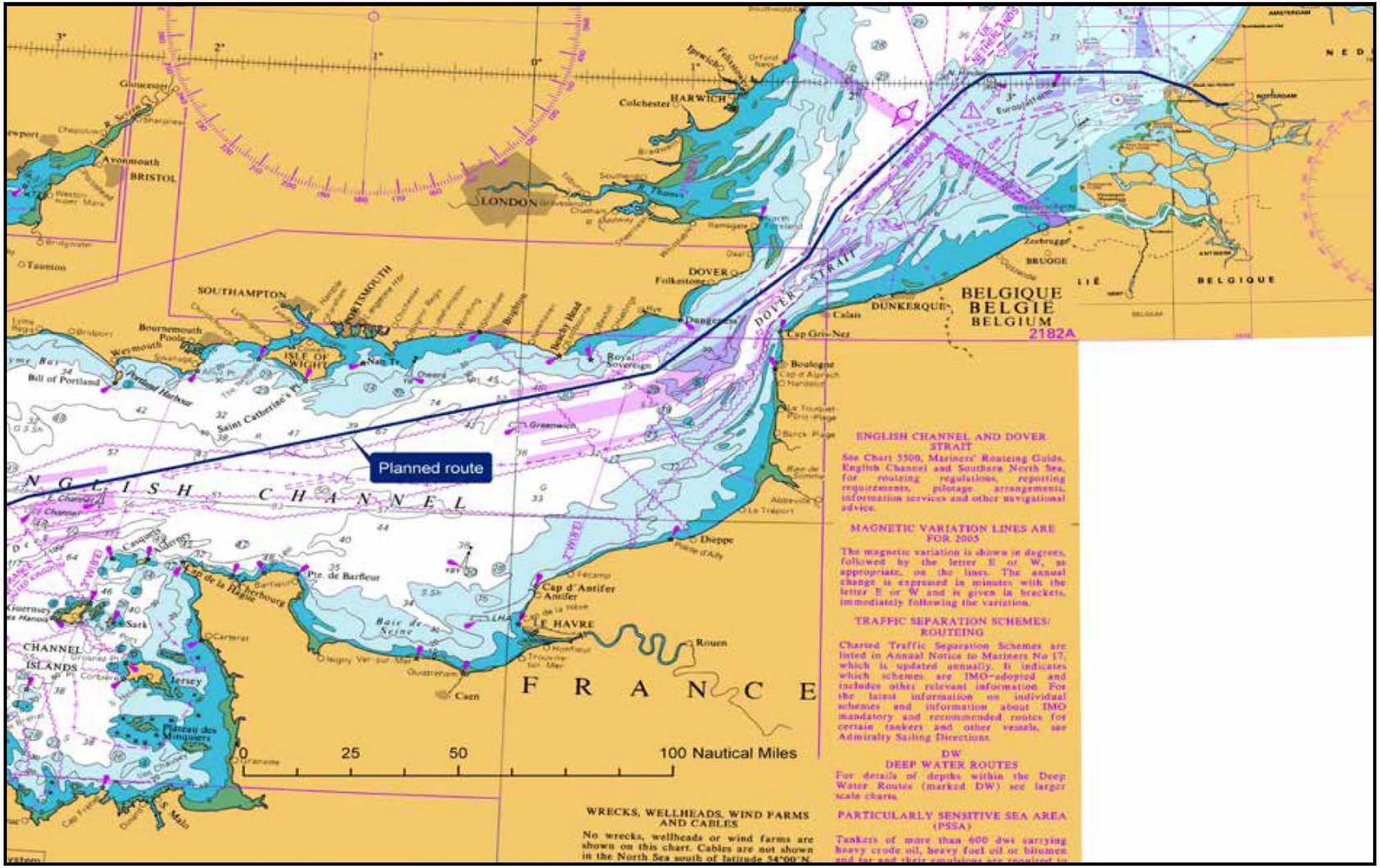

Figure 1: *Ovit*'s passage plan through the Dover Strait

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Reproduced from Admiralty Chart BA 2675-0 by permission of the Controller of HMSO

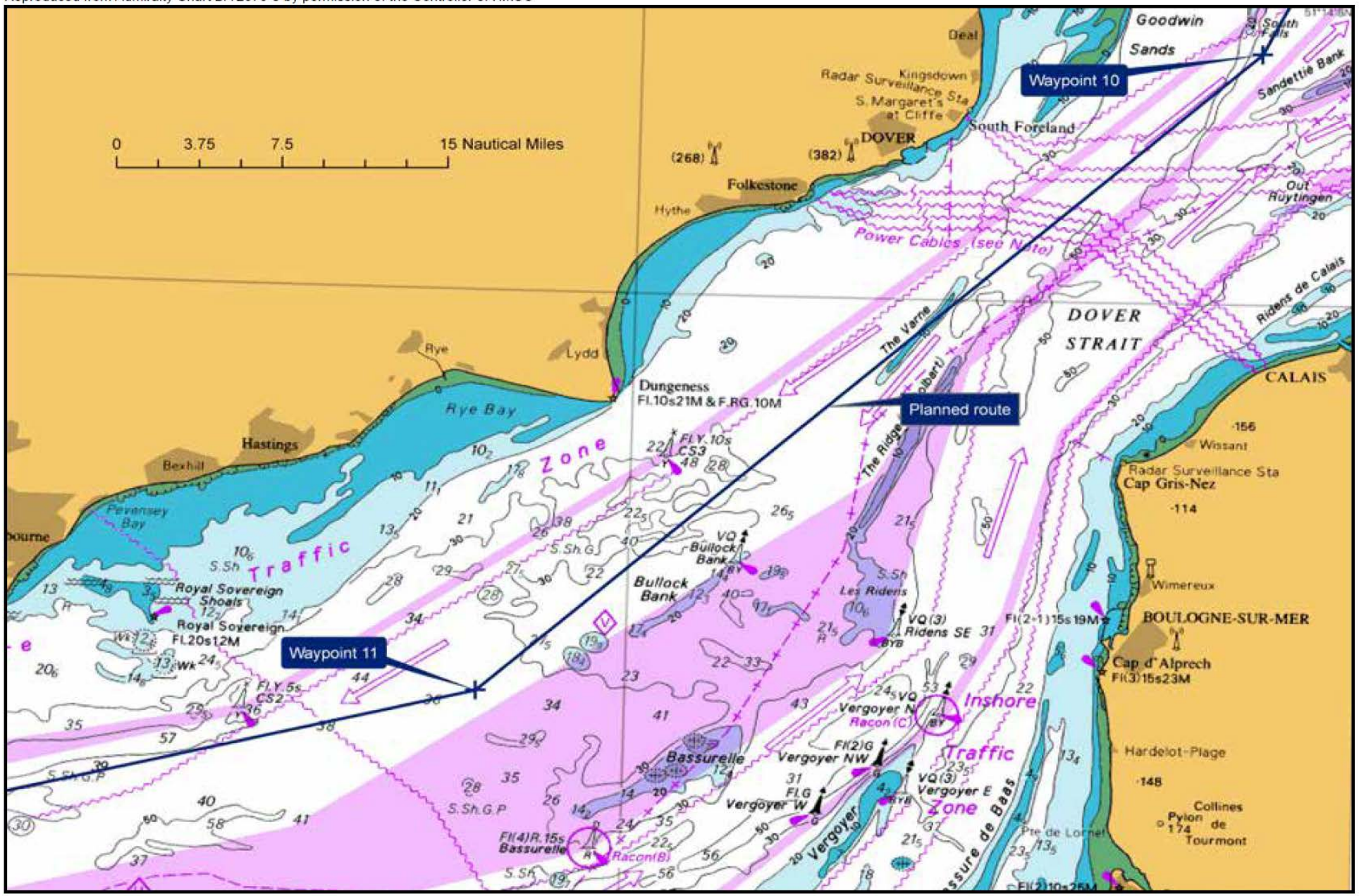

Figure 2: Detail of Dover Strait passage plan

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Reproduced from Admiralty Chart BA 1892-0 by permission of the Controller of HMSO

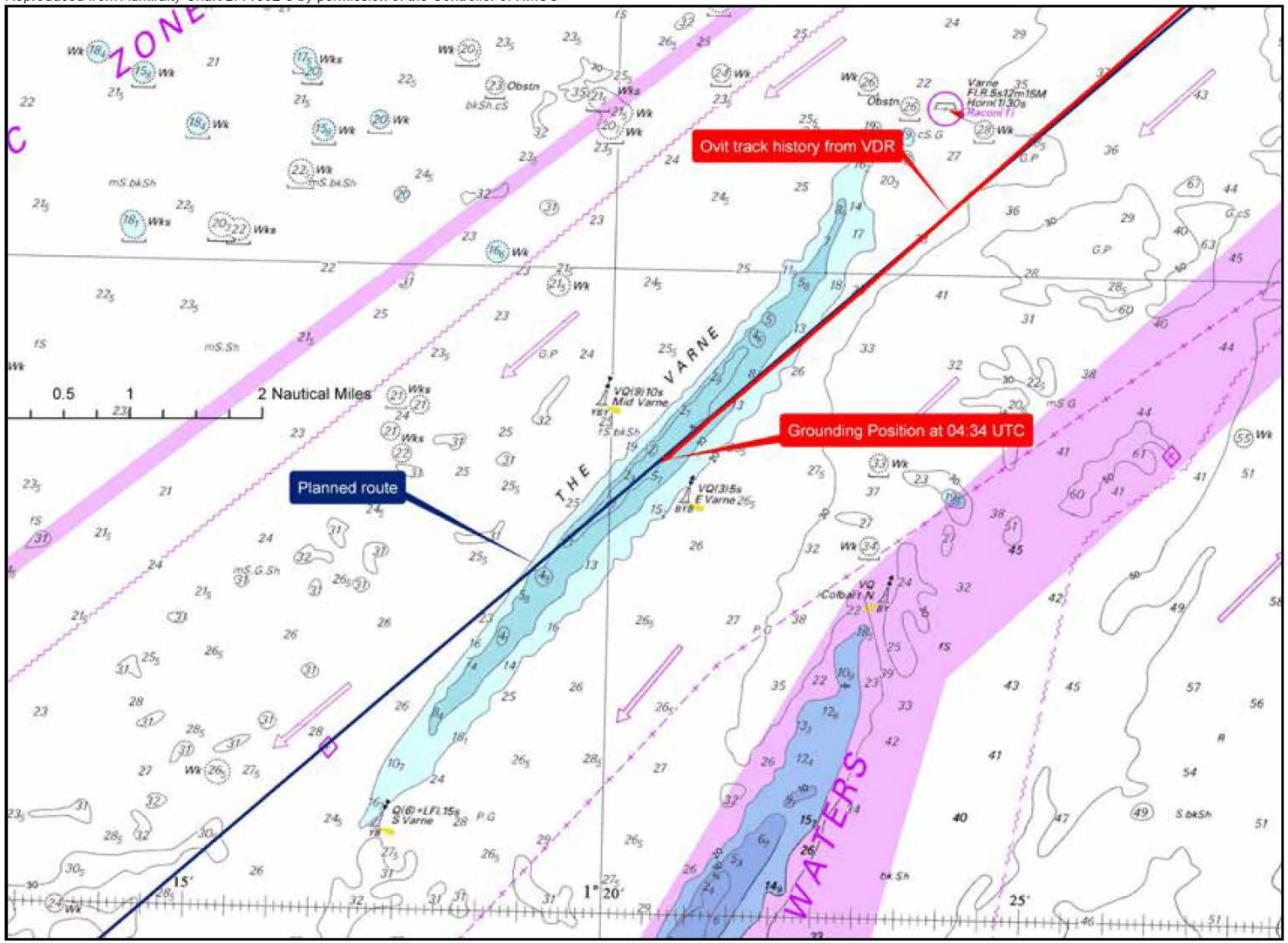

Figure 4: *Ovit*'s grounding position

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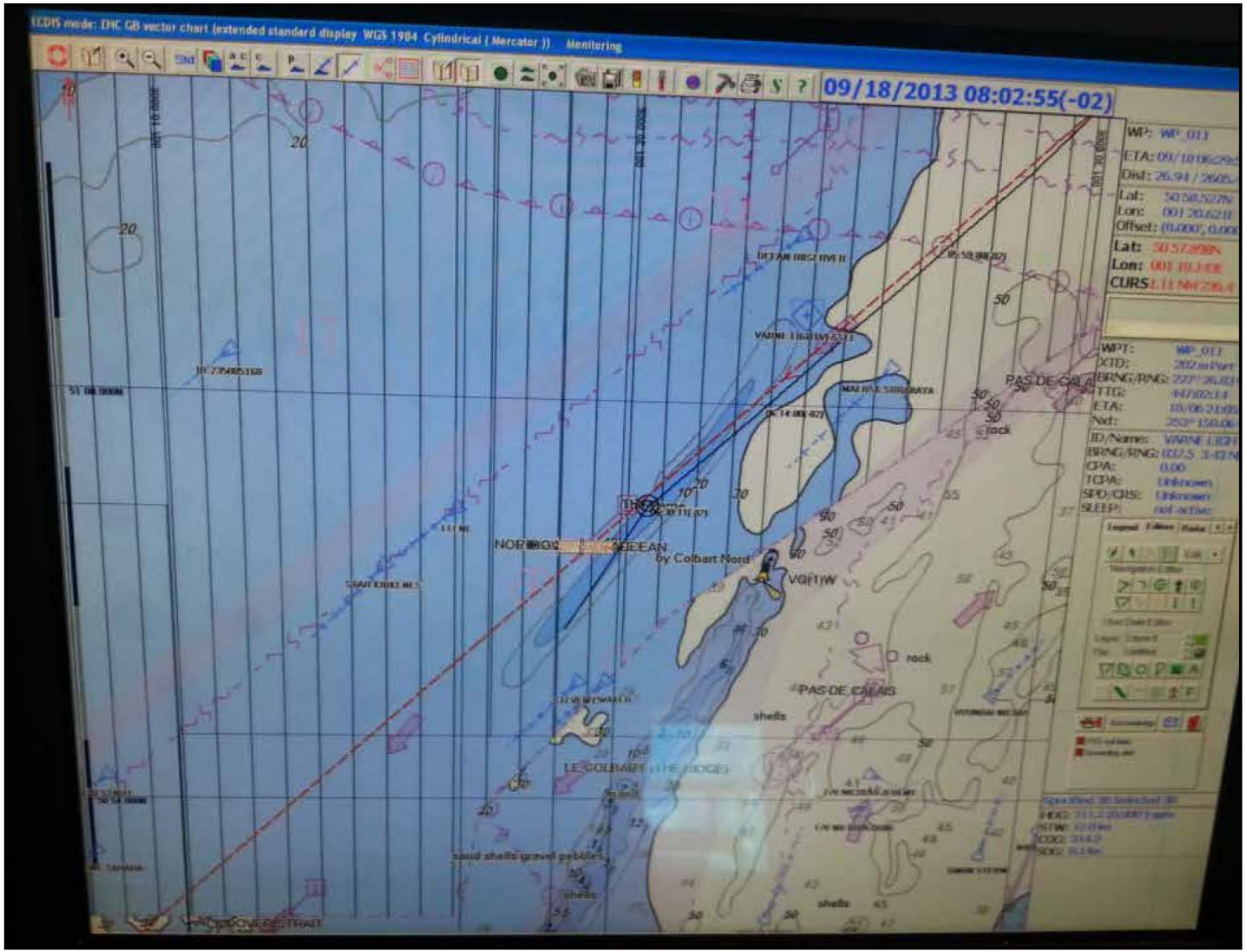

Figure 6: *Ovit*'s ECDIS display when the ship was aground

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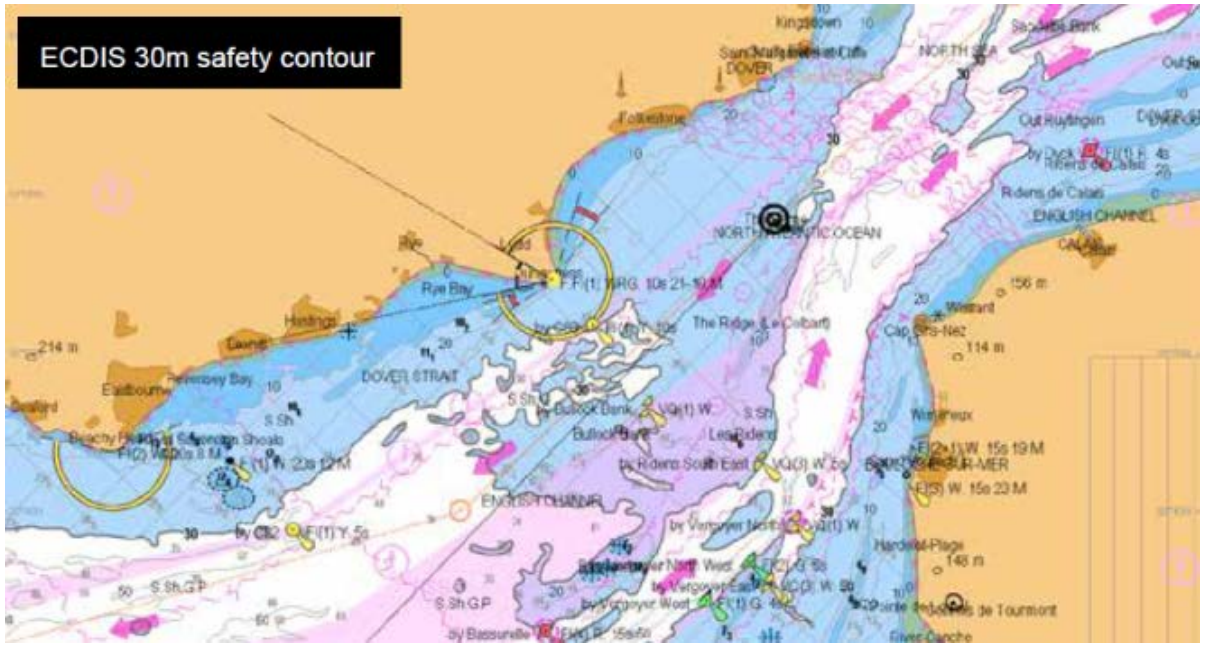

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The Maris 900 incorporates two depth alarms:

• The safety contour alarm activates if the guard zone crosses the selected safety contour. This is a mandatory alarm required by the IMO performance standards. The Maris 900 factory default setting value for the safety contour was 30m.

• The grounding alarm activates when the depth at the ship's position is less than the selected safety depth.

Both features were turned off.

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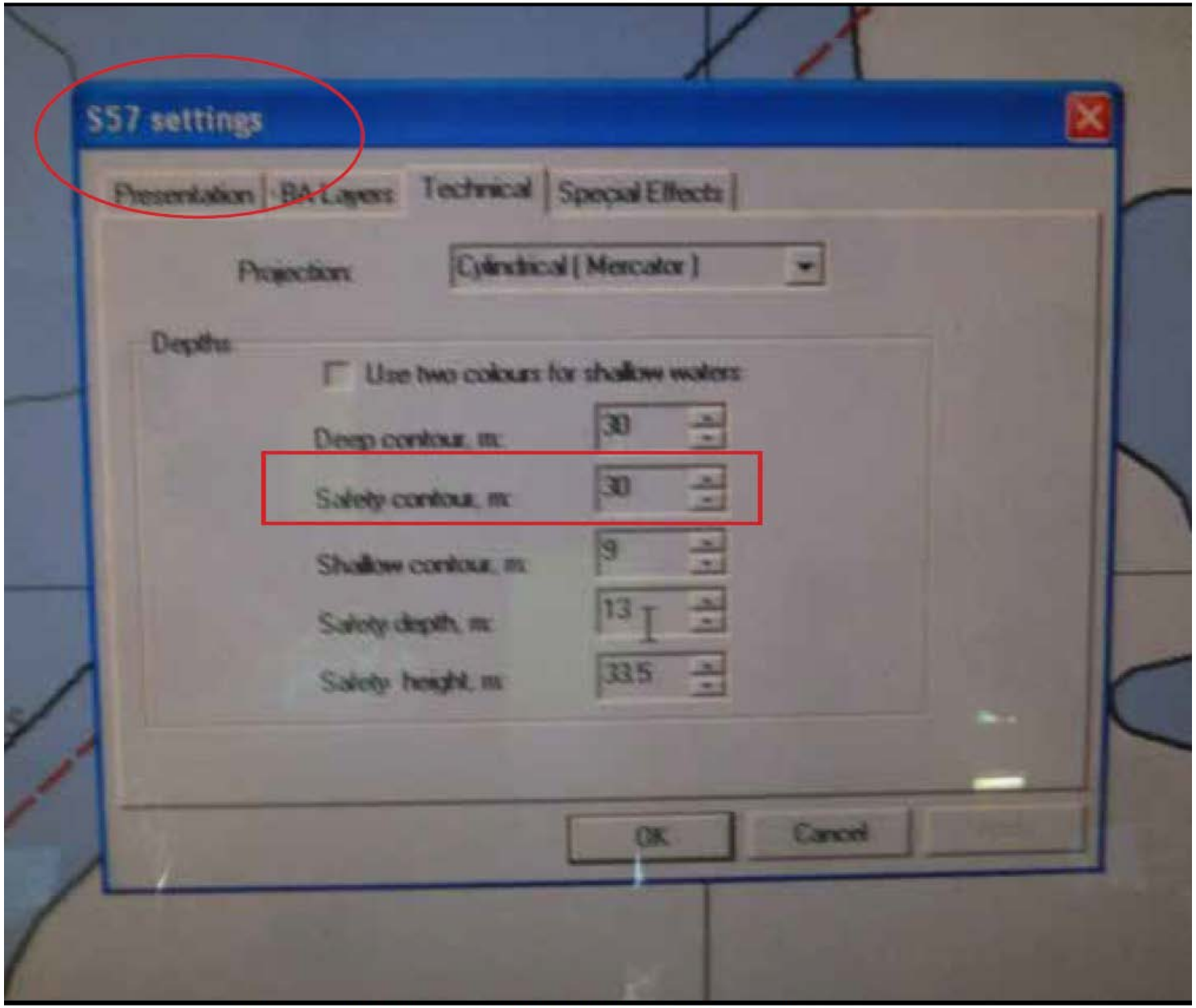

Figure 9: Maris 900 ECDIS 'S57' input page

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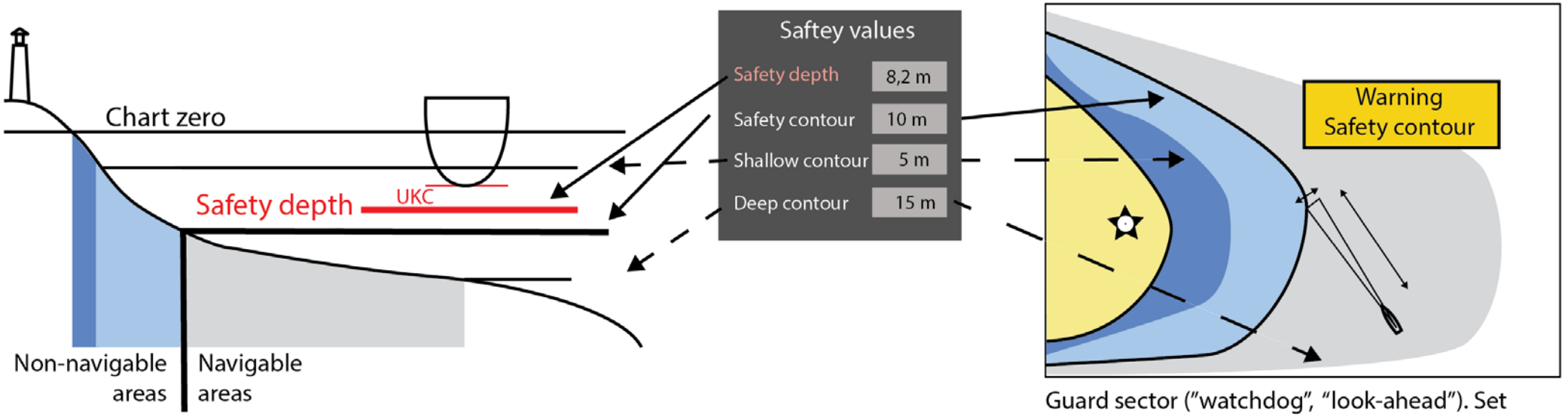

Guard sector ("watchdog", "look-ahead"). Set distance/time ahed and sector width.

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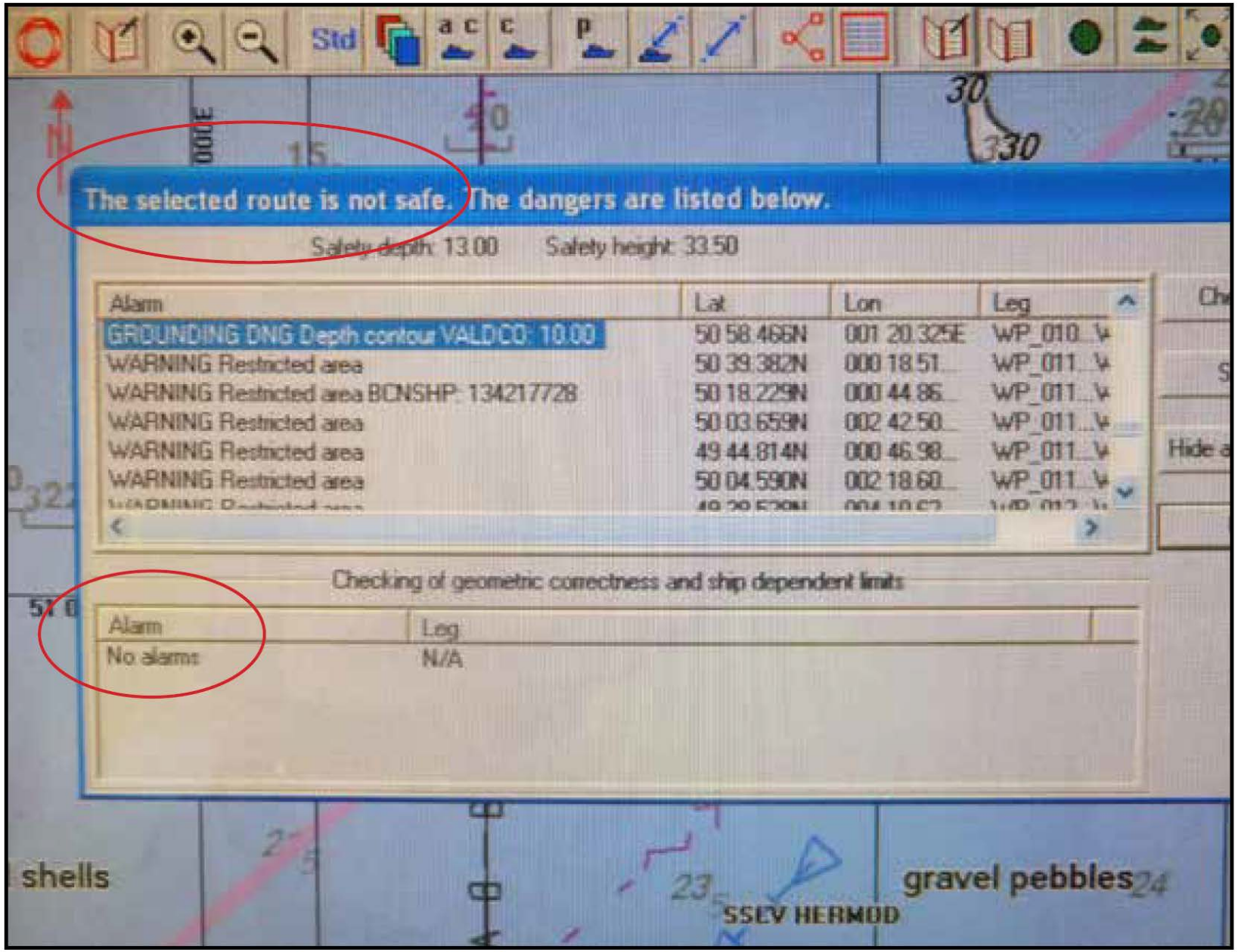

Figure 11: Maris 900 ECDIS check-route page

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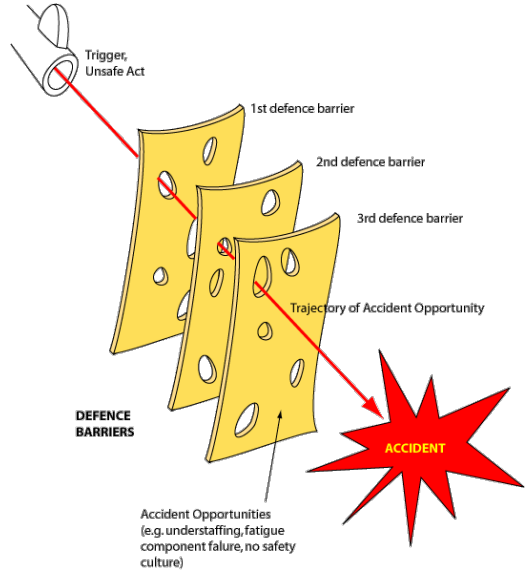
Holes in the Swiss cheese

Breaches of safety barriers



Voyage plan	Incorrect
Safety contour setting	Incorrect
Route check	Done but not understood
Grounding alarm	Off
Look-ahead sector	Off
Off-track alarm	Off
VTS; CoastGuard, Navy	Not intervening

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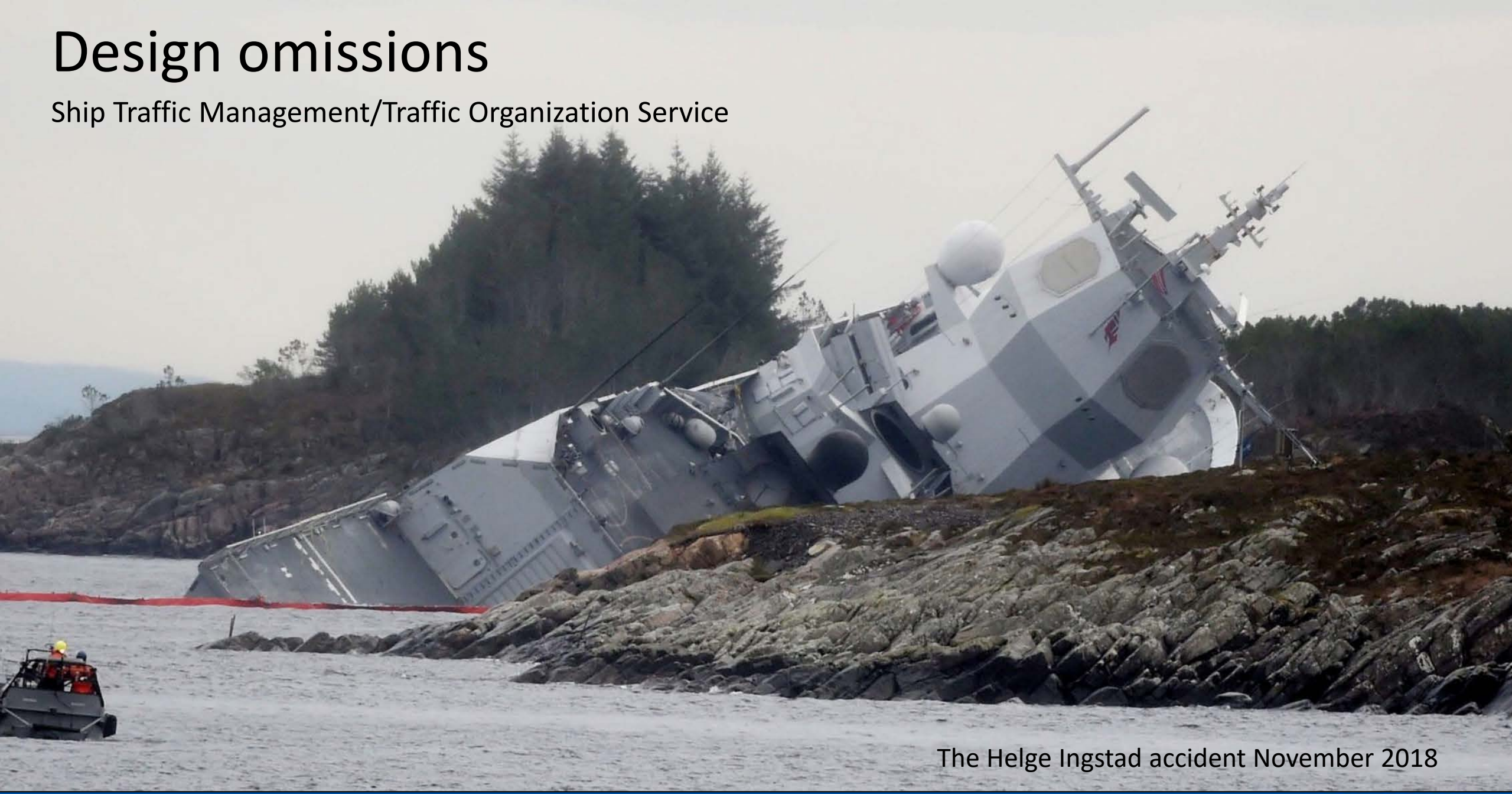
Design omissions

Ship Traffic Management/Traffic Organization Service



The Helge Ingstad accident November 2018

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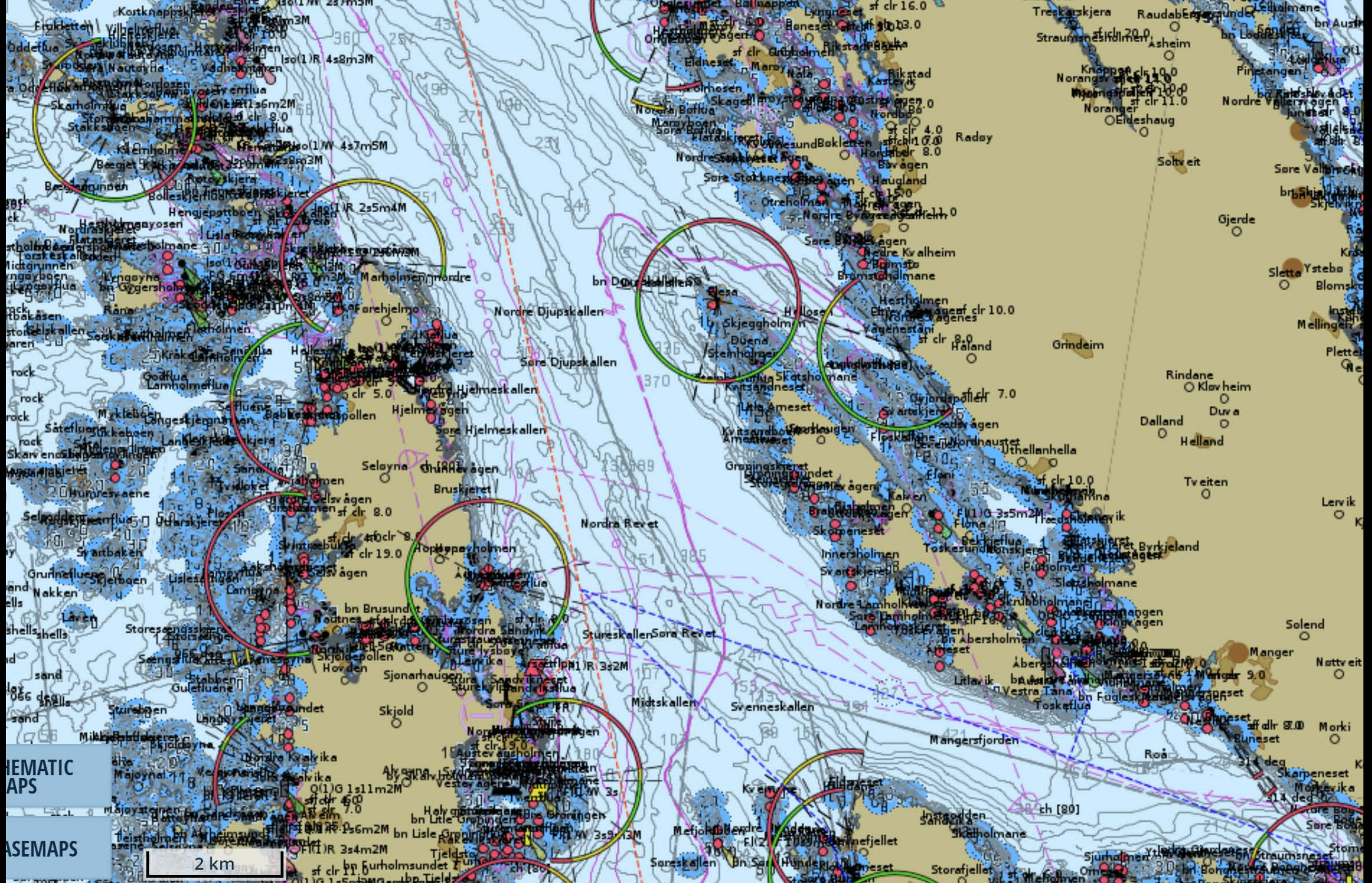
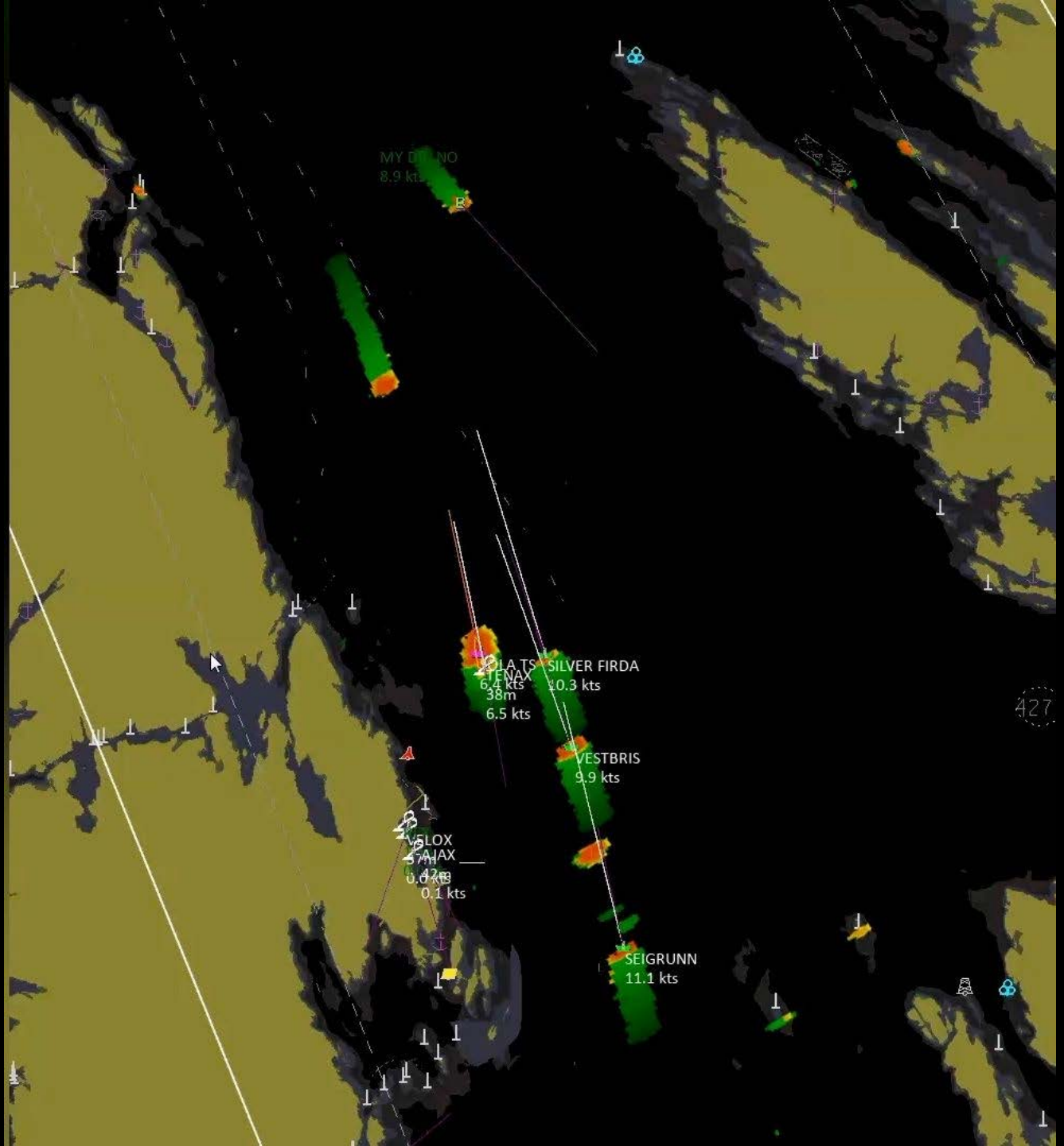
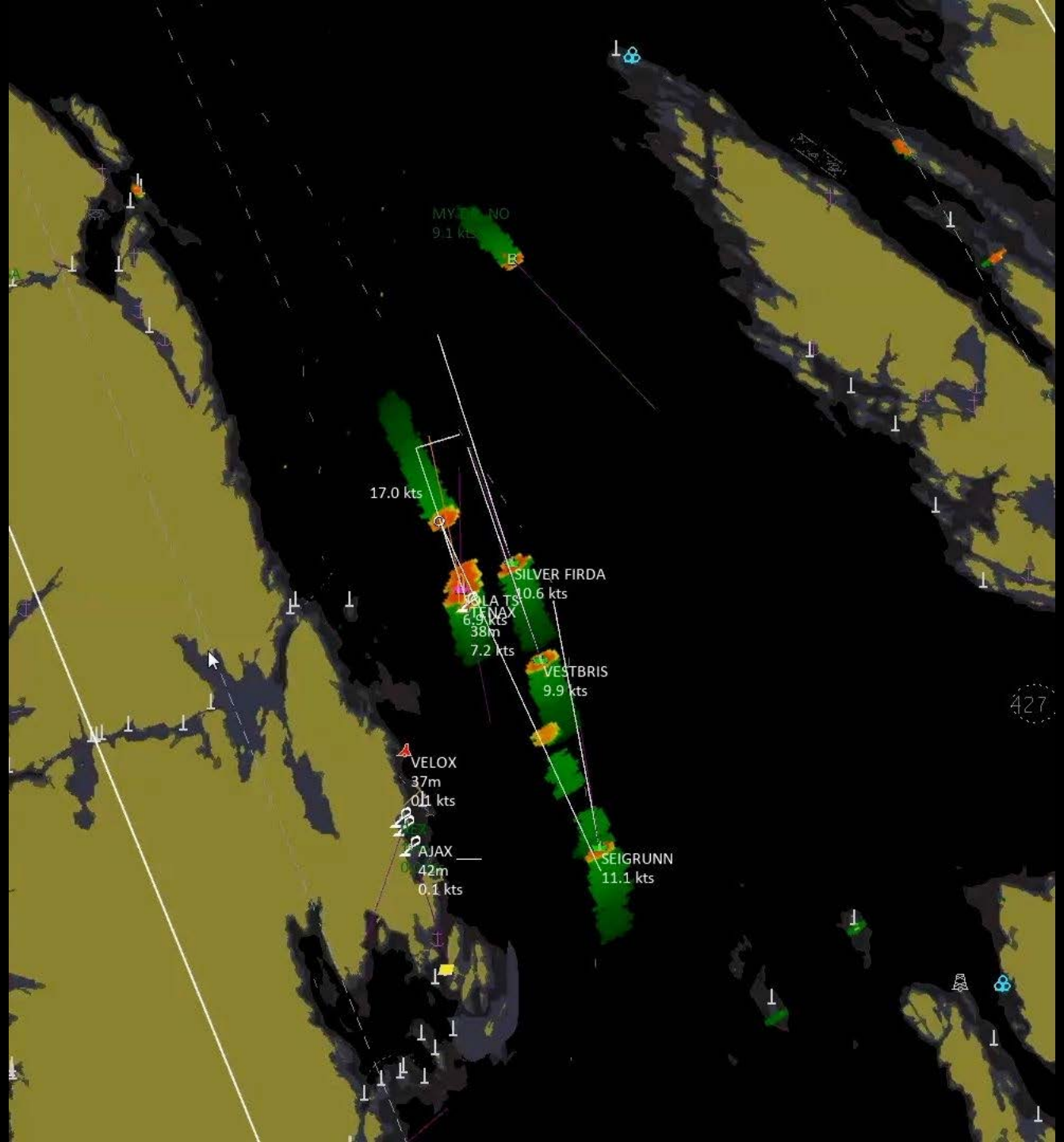
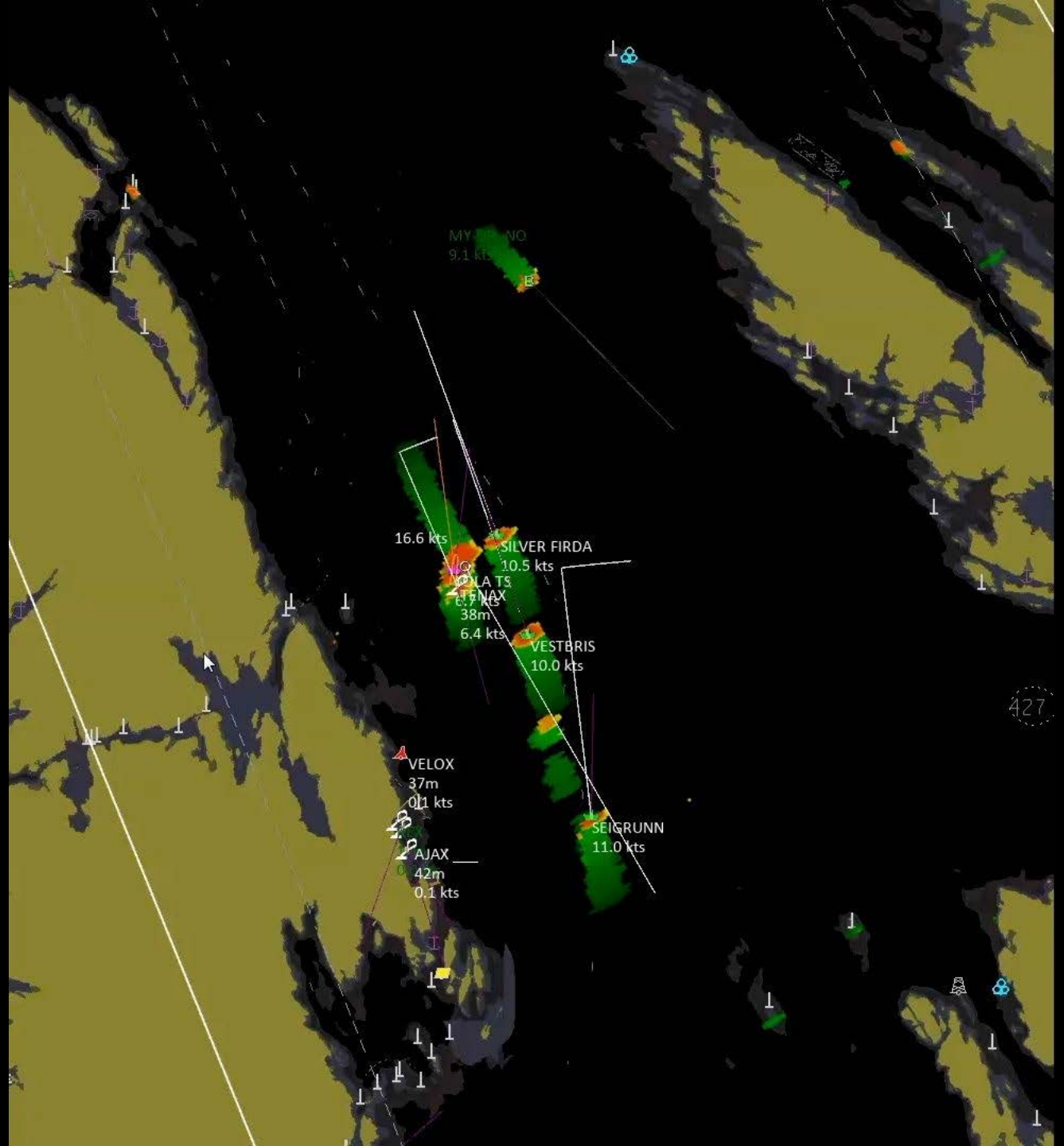

HEMATIC
APS
ASEMAPS
2 km


8.9 kts
SILVER FIRDA
10.3 kts
6.4 kts
38m
6.5 kts
VESTBRIS
9.9 kts
0.1 kts
SEIGRUNN
11.1 kts
427


17.0 kts
SILVER FIRDA
10.6 kts
7.2 kts
VESTBRIS
9.9 kts
VELOX
37m
0.1 kts
AJAX
42m
0.1 kts
SEIGRUNN
11.1 kts
427


9.1 kts
16.6 kts
SILVER FIRDA
10.5 kts
38m
6.4 kts
VESTERIS
10.0 kts
427
VELOX
37m
0.1 kts
SEIGRUNN
11.0 kts
AJAX
42m
0.1 kts

e-Navigation

Human Factors
Human-Machine Interface
Information Design

Route Exchange
STM
“Intended and suggested routes”
“Moving Havens” (submarine operation)

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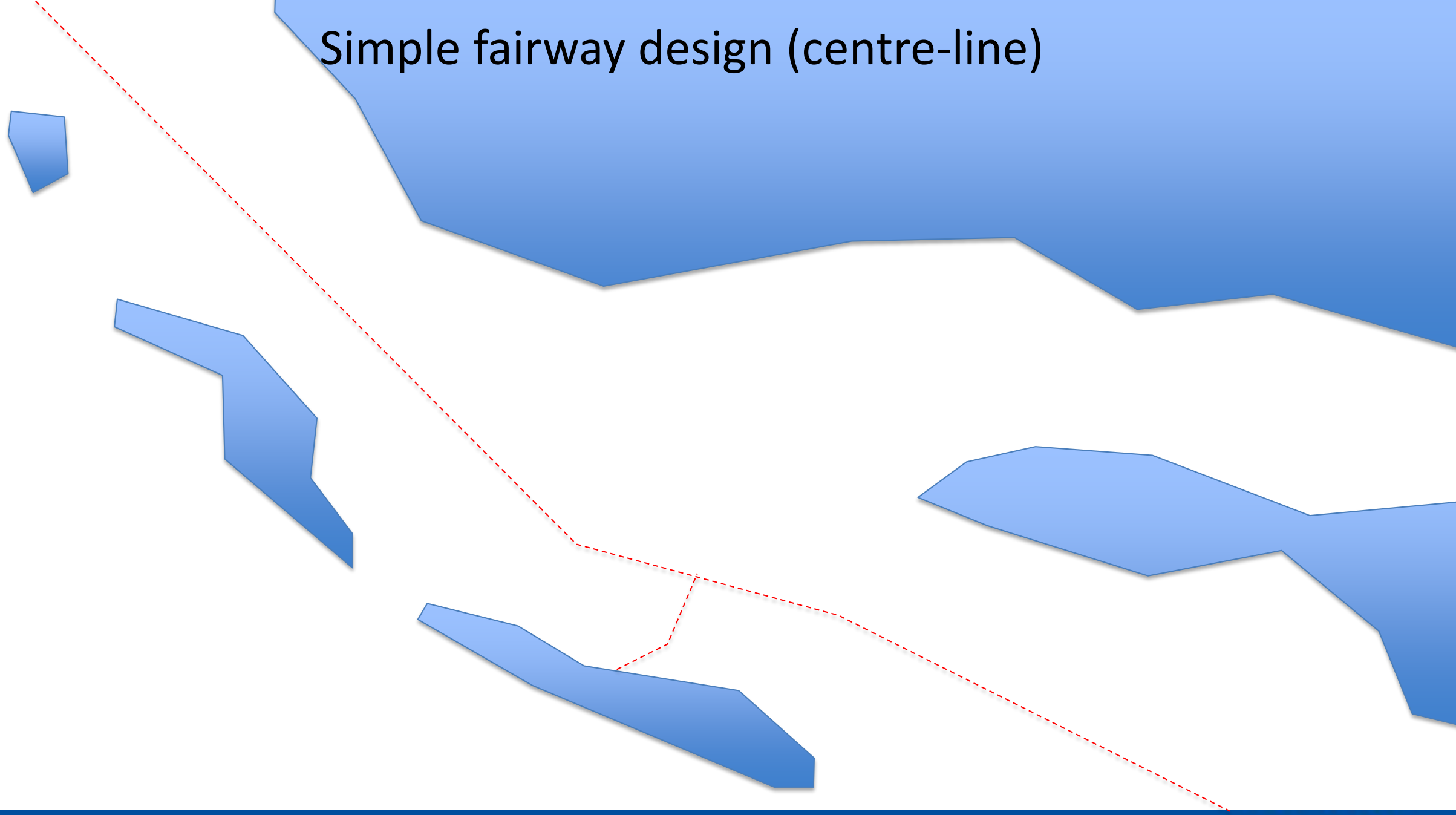
Simple fairway design (centre-line)



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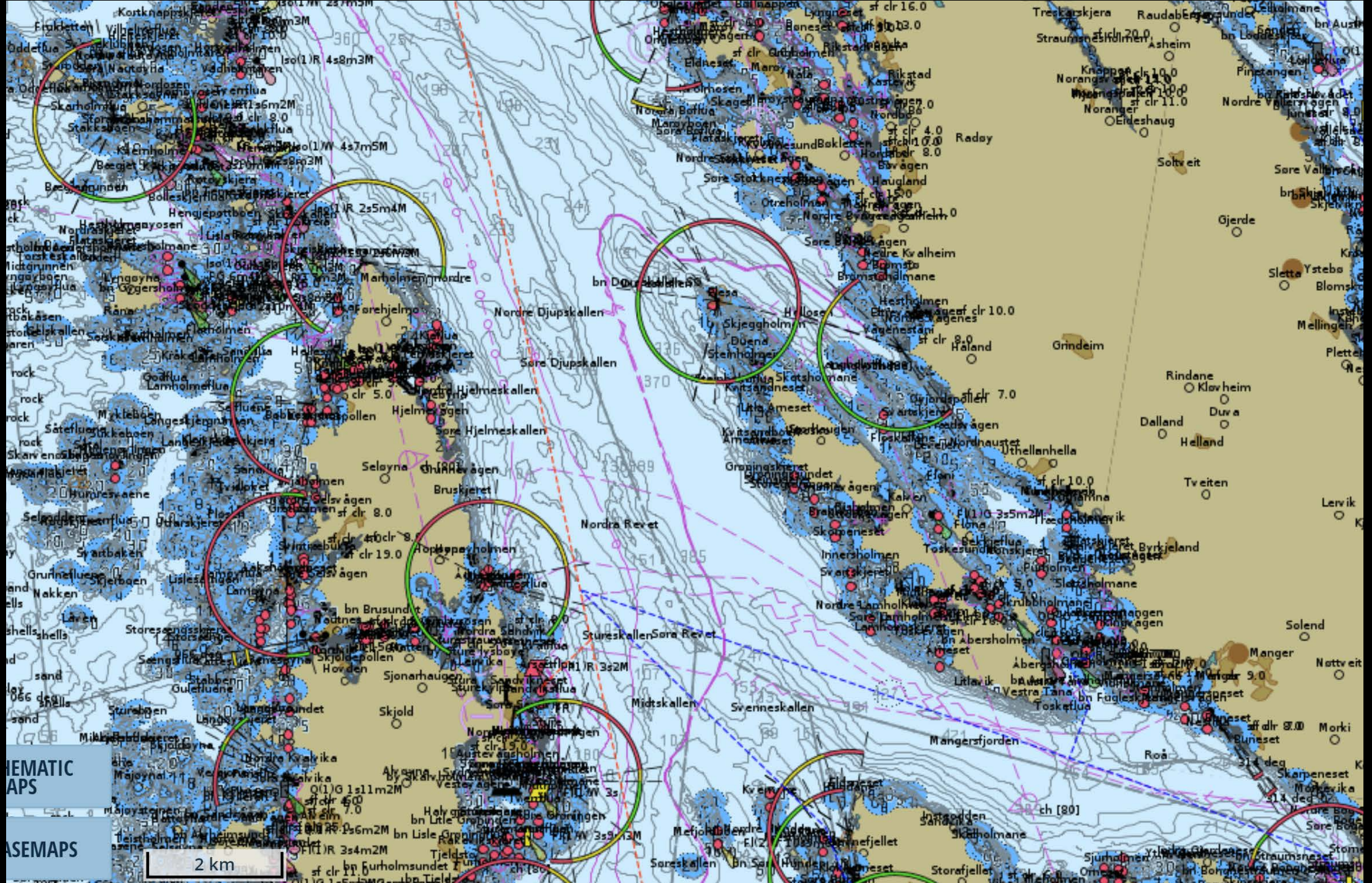
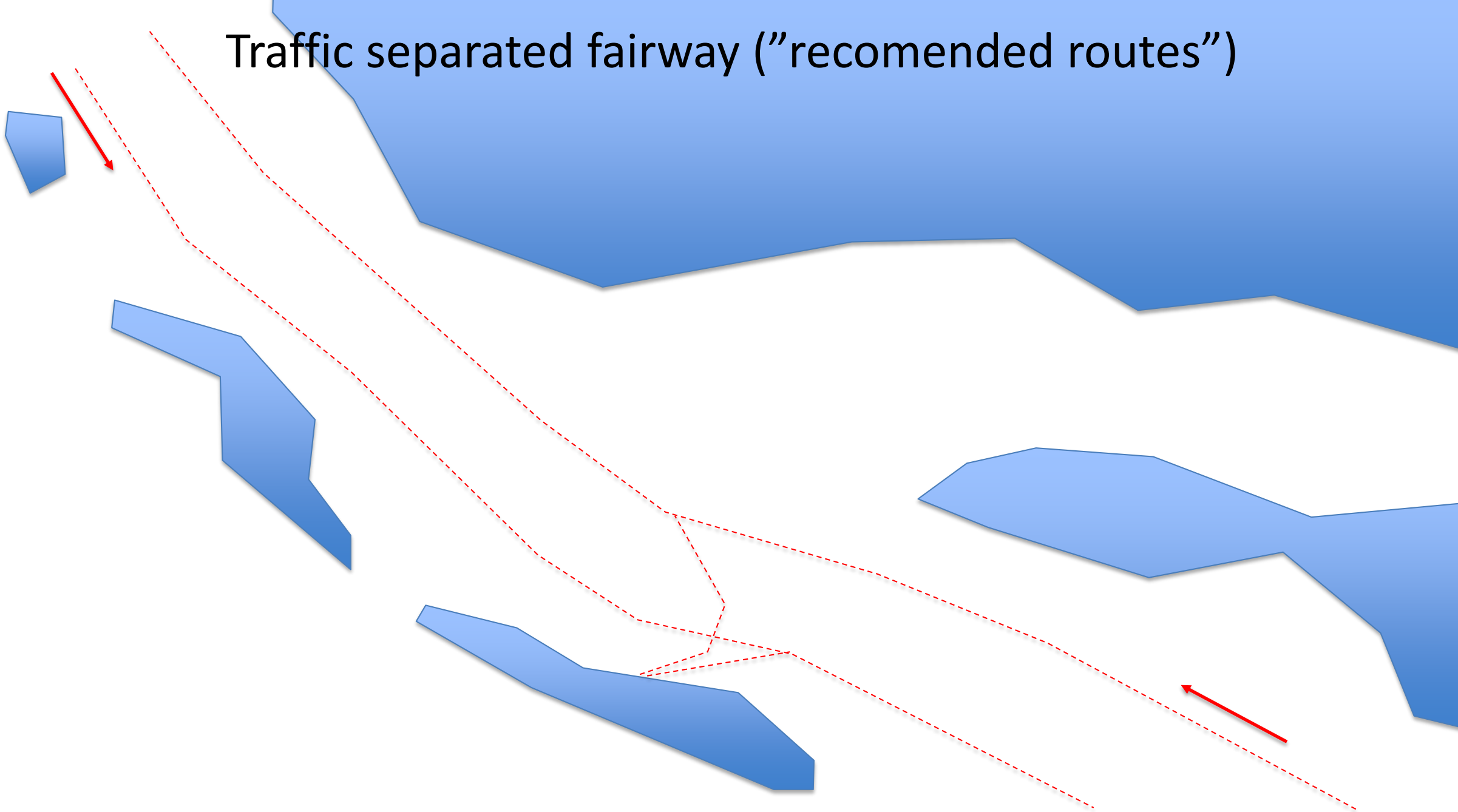

HEMATIC
APS
ASEMAPS
2 km

Traffic separated fairway (”recomended routes”)



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Digital rutetjeneste - routeinfo.no

KYSTVERKET

Den digitale rutetjenesten er tilgjengelig for fartøy som anløper havner i farvannet mellom svenskegrensen i øst og Haugesund i sørvest. Tjenesten blir trinnvis gjort tilgjengelig fra sør til nord og vil dekke hele kysten i løpet av 2020.

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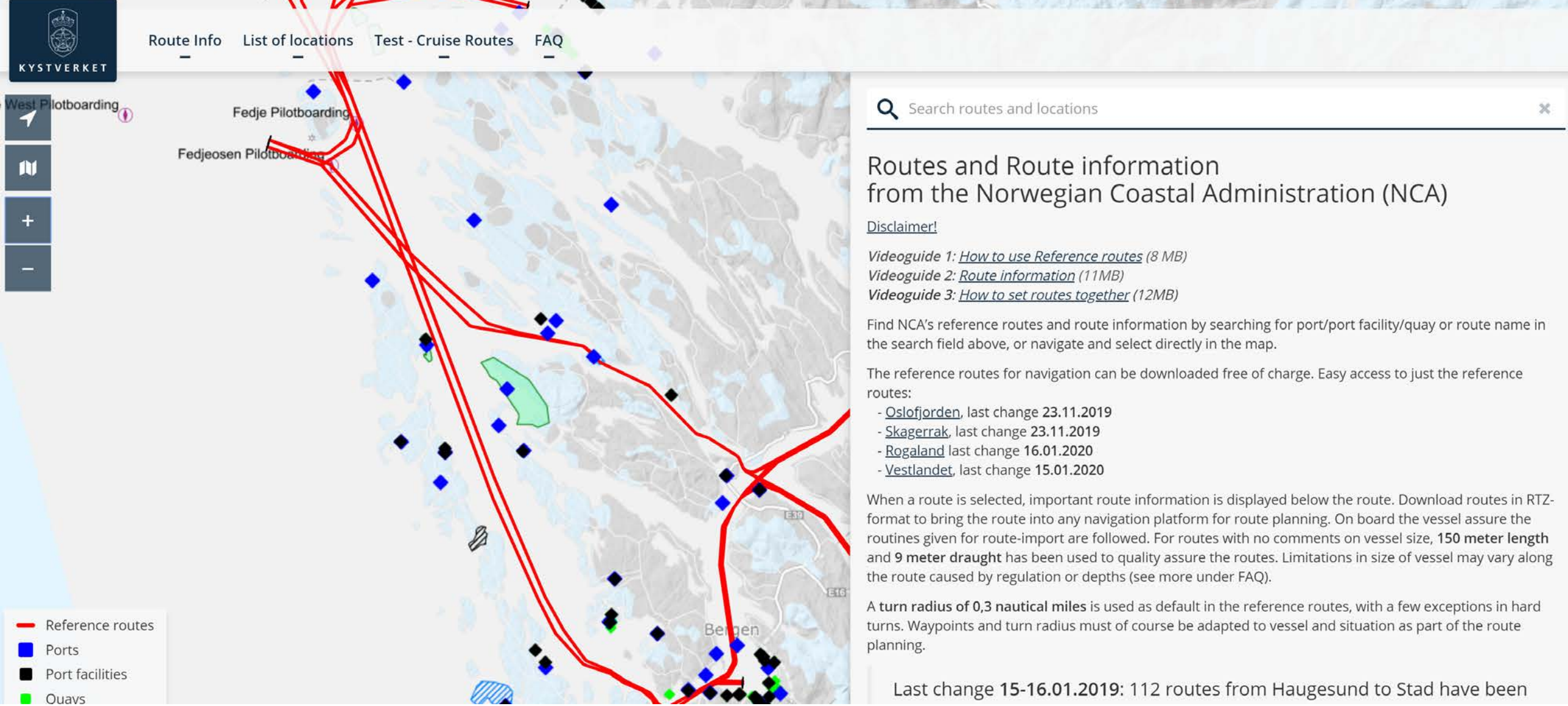

https://www.routeinfo.no/

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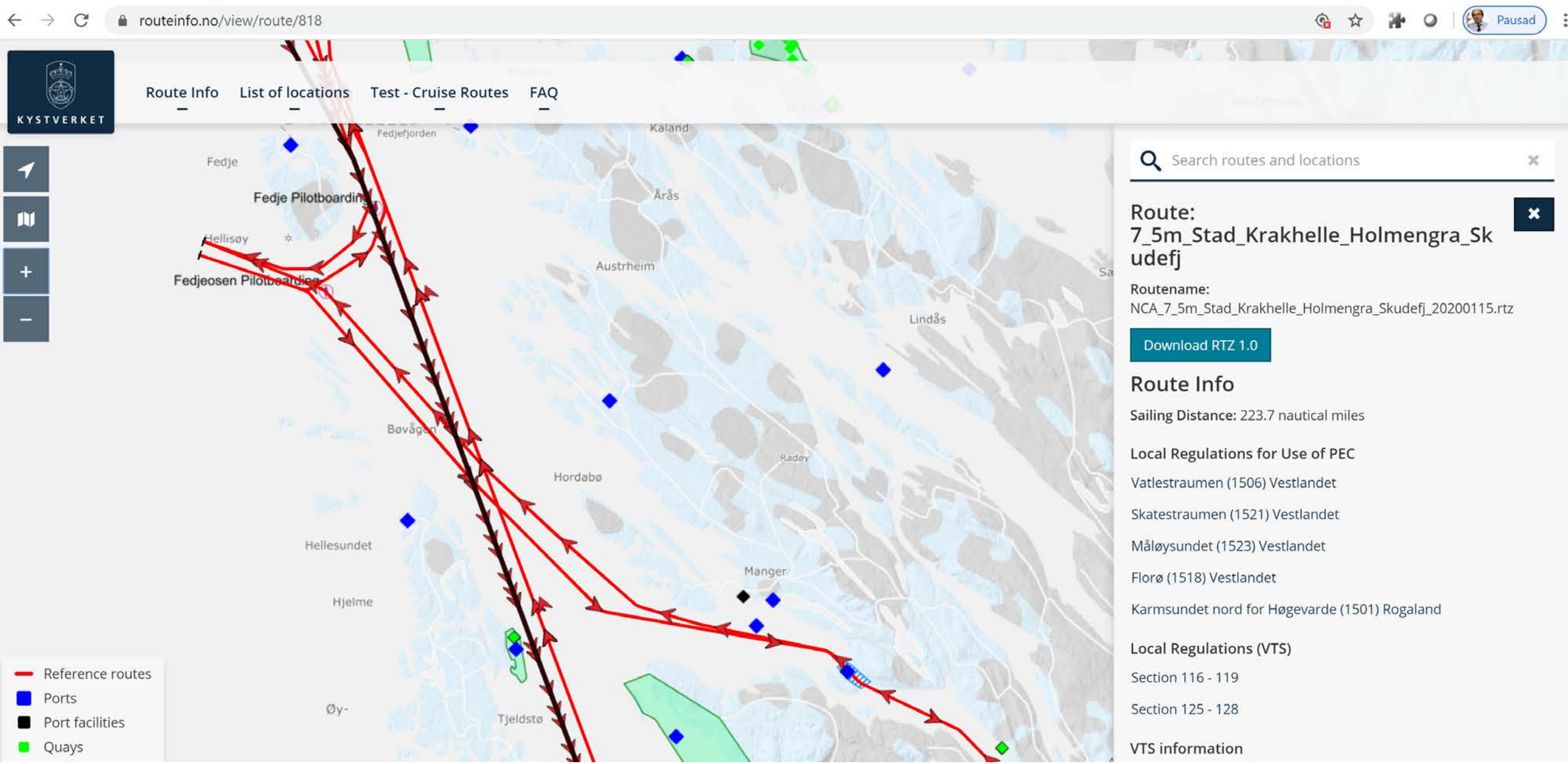

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```
<?xml version="1.0"?>
<route xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" version="1.0" xmlns="http://www.cirm.org/RTZ/1/0">
  <routeInfo routeName="NCA_Ardal_Skudefjorden_Out_20190704" validityPeriodStart="2019-07-04T02:00:00+02:00"
validityPeriodStop="2020-08-14T02:00:00+02:00" vesselName="Norwegian Coastal Administration"
vesselVoyage="NO-320010" />
  <waypoints>
    <defaultWaypoint radius="0.10">
      <leg starboardXTD="0.04" portsideXTD="0.04" safetyContour="30.00" safetyDepth="30.00"
geometryType="Loxodrome" staticUKC="0.00" dynamicUKC="0.00" />
    </defaultWaypoint>
    <waypoint id="1" name="Ardal">
      <position lat="59.14432287" lon="6.1542135" />
    </waypoint>
    <waypoint id="2" name="Kvannholmen">
      <position lat="59.14189573" lon="6.08508445" />
    </waypoint>
    <waypoint id="3" name="Smaskjaerene">
      <position lat="59.13572616" lon="6.08322484" />
      <leg starboardXTD="0.07" portsideXTD="0.07" />
    </waypoint>
```

Rout: Ardal_Skudefjorden_Out

Rout name

NCA_Ardal_Skudefjorden_Out_20190704.rtz

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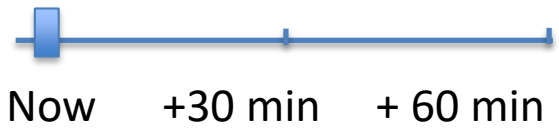
Traffic organization(“Moving Havens”)

Level 1: Own ship intende route
Level 2: Transmitted intended routes
Level 3: Route exchange / VTS TOS



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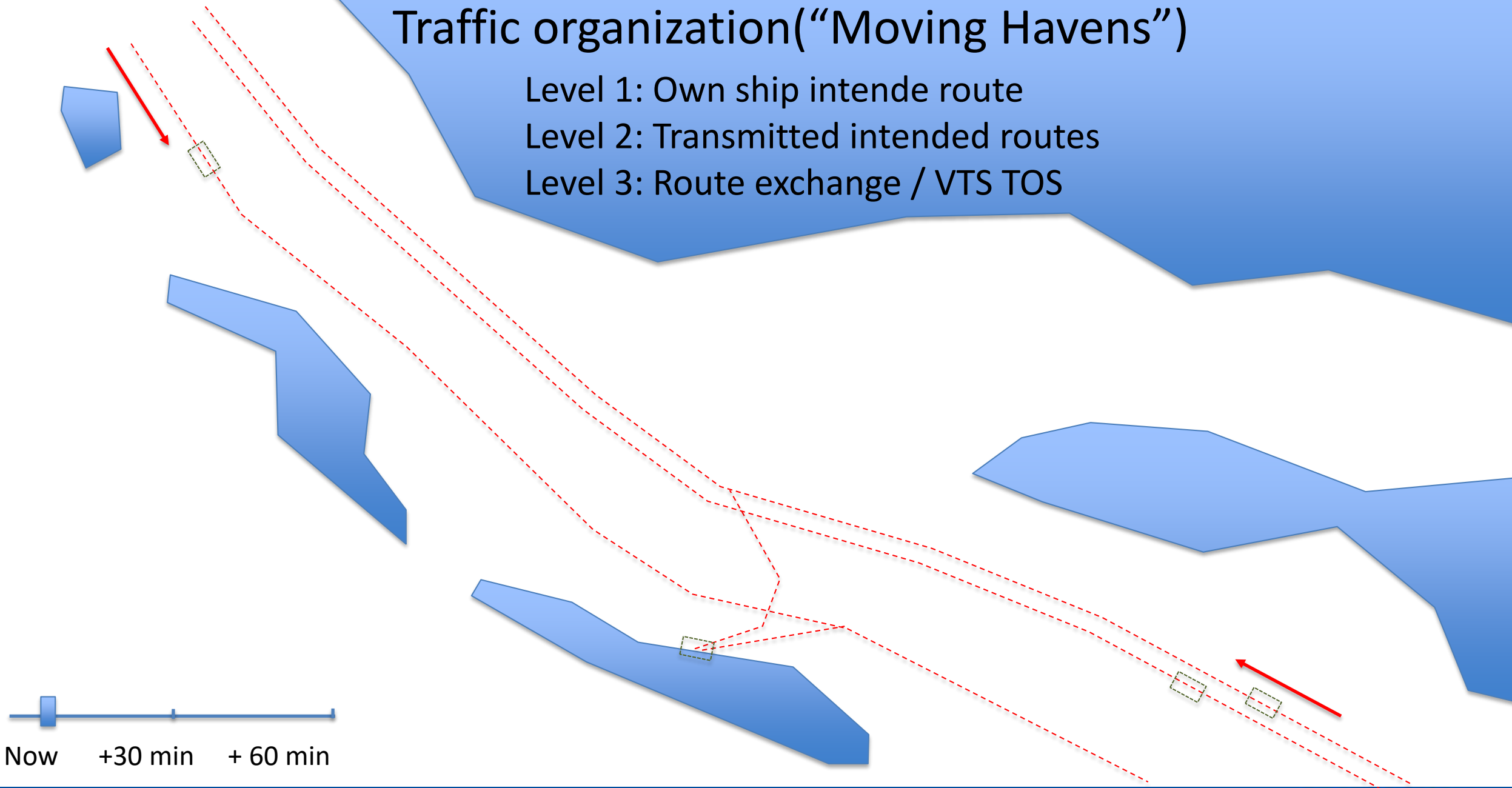

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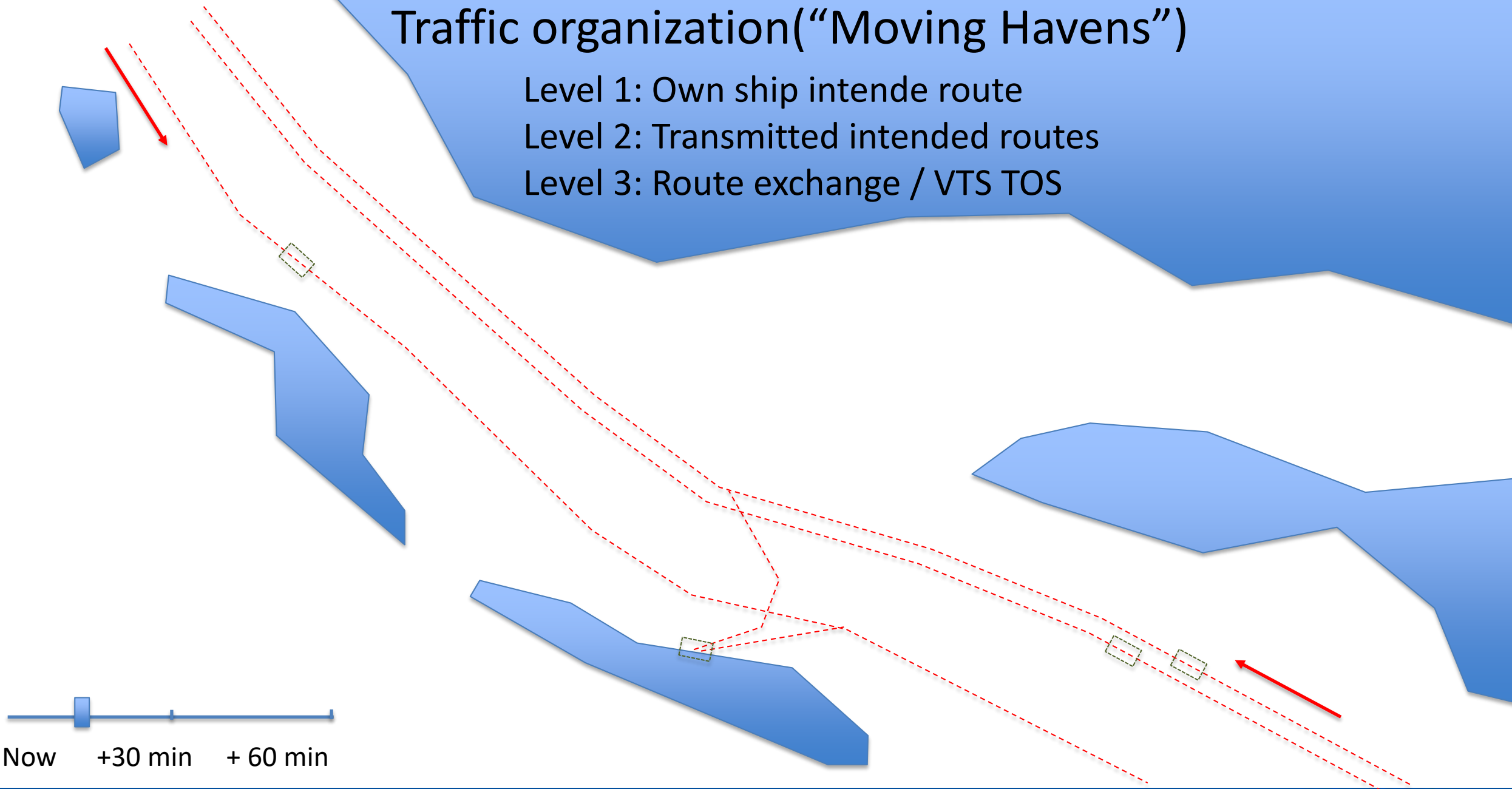

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Traffic organization(“Moving Havens”)

Level 1: Own ship intende route
Level 2: Transmitted intended routes
Level 3: Route exchange / VTS TOS

Now +30 min + 60 min

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Traffic organization(“Moving Havens”)

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Level 2: Transmitted intended routes
Level 3: Route exchange / VTS TOS

Now +30 min + 60 min

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Level 2: Transmitted intended routes
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Now +30 min + 60 min

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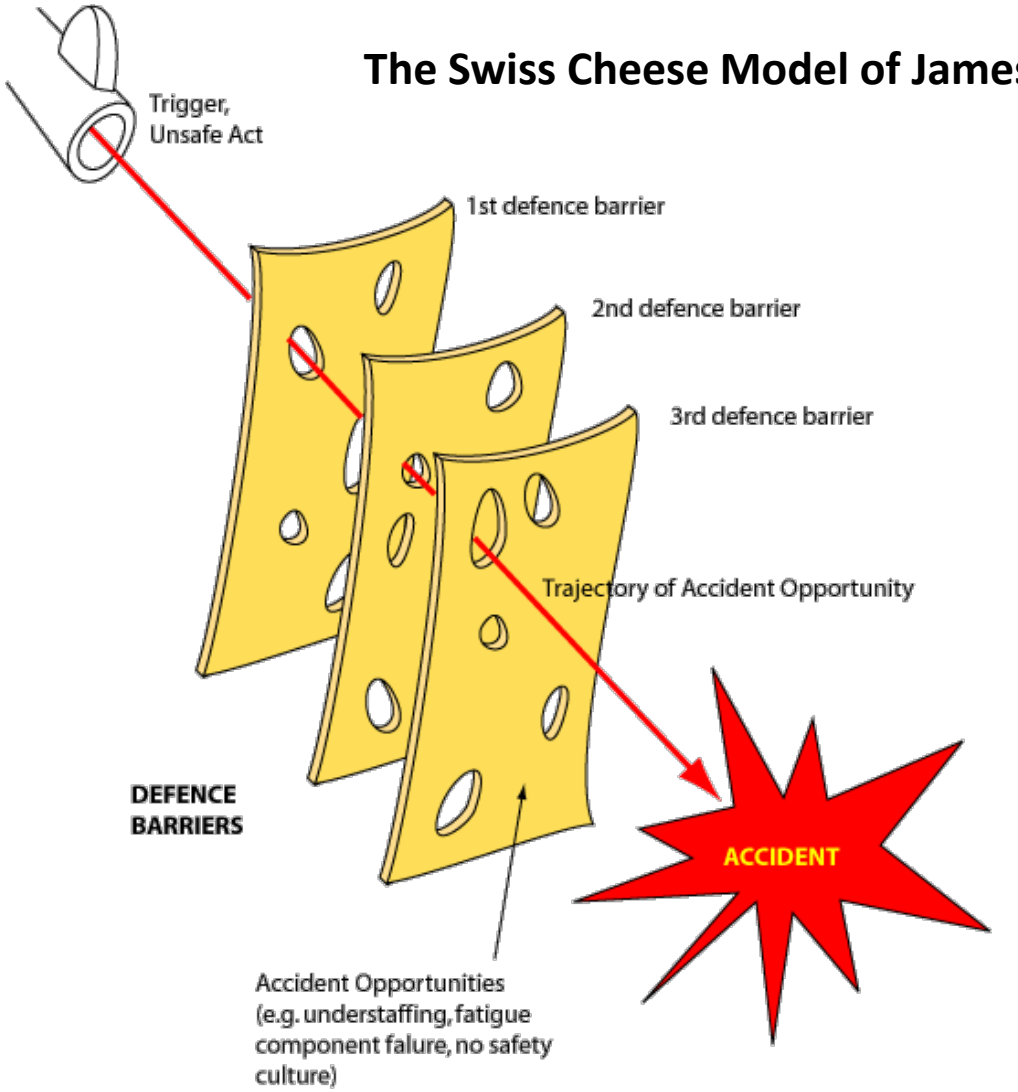
The Swiss Cheese Model of James Reason (1990).



Reason, J. (1990). *Human error*. Cambridge: Cambridge University Press. ISBN 0-521-31419-4.

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