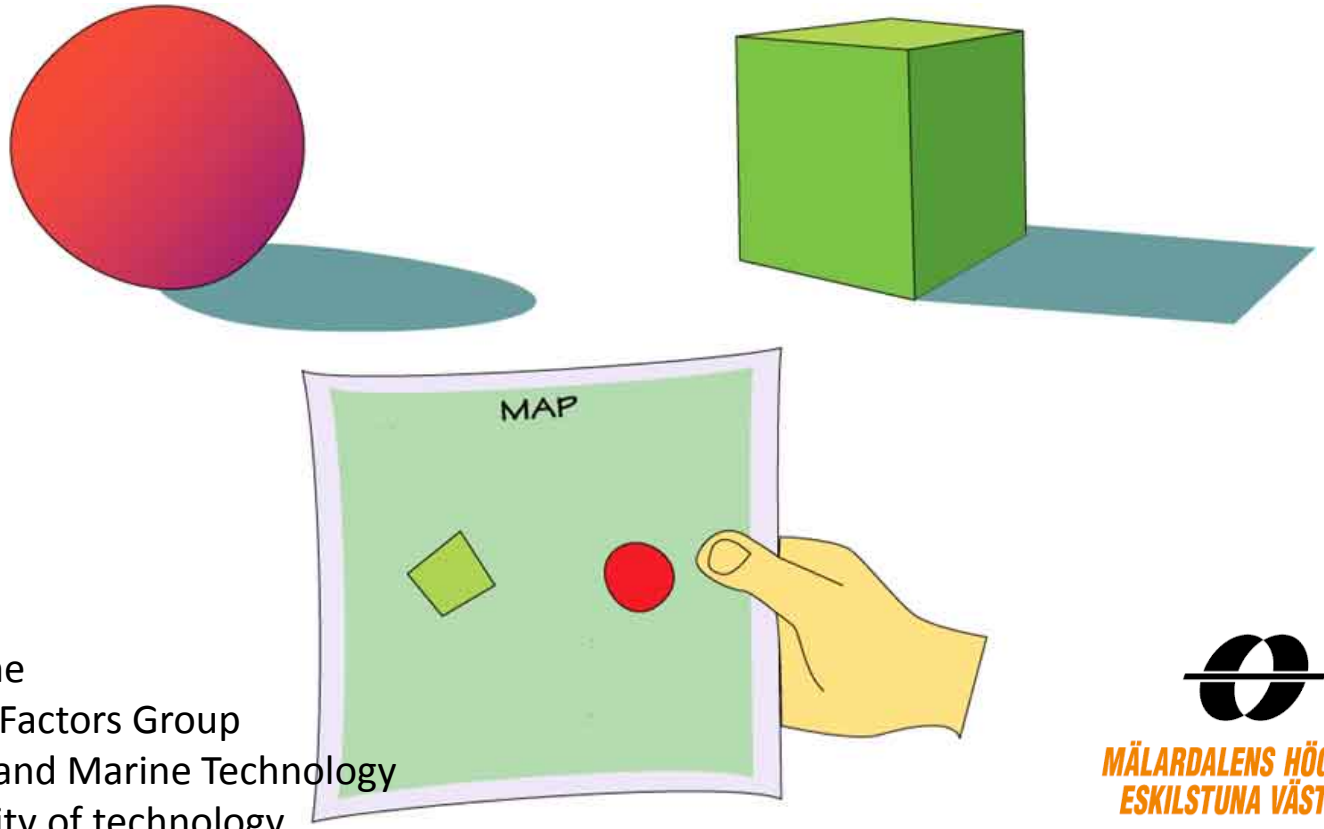
3D Nautical Charts : Cognitive Off-Loading Using an Egocentric Presentation Mode



Dr Thomas Porathe
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Dep. Of Shipping and Marine Technology
Chalmers University of technology
Göteborg, Sweden

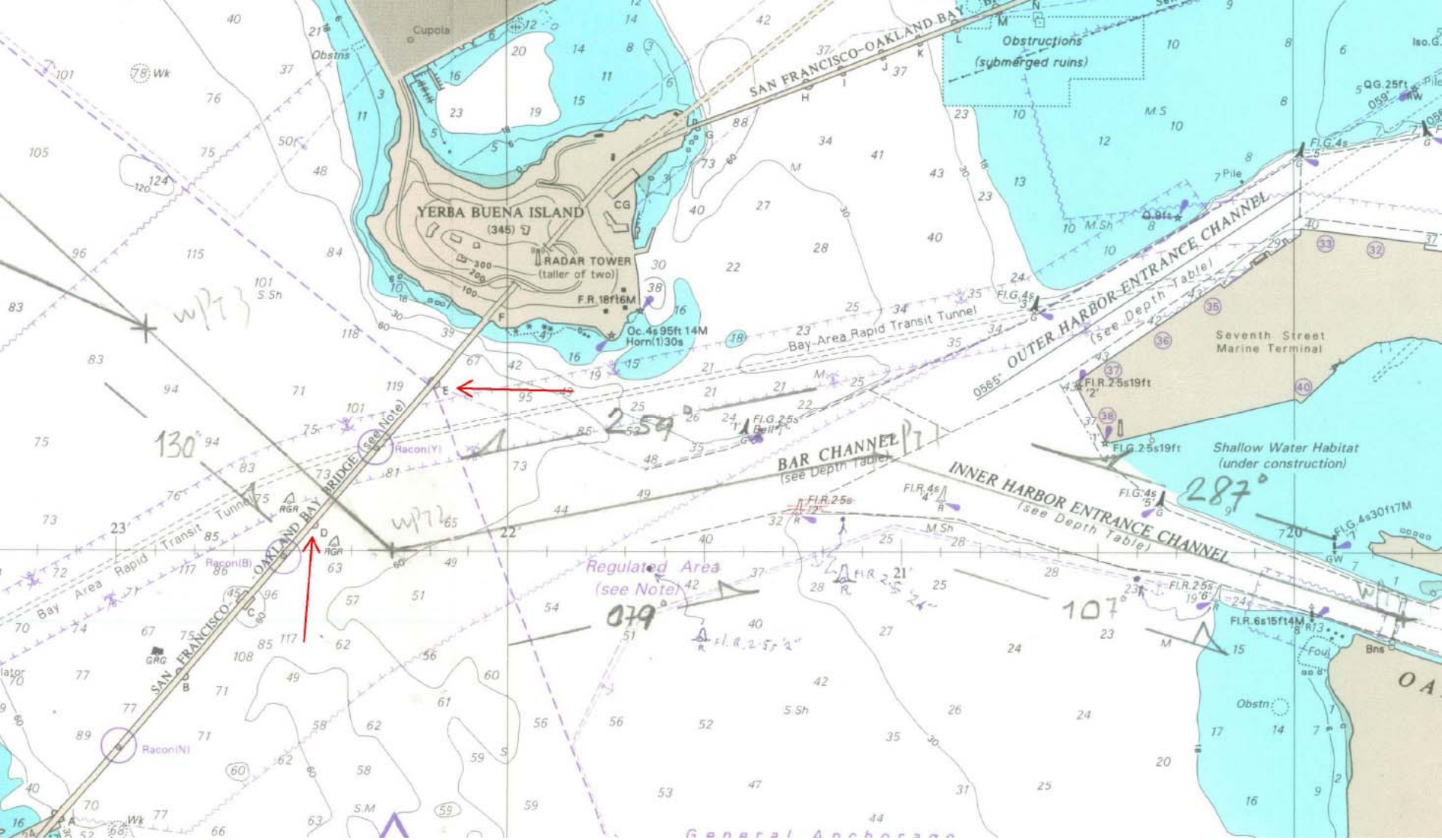
MÄLARDALENS HÖGSKOLA
ESKILSTUNA VÄSTERÅS

CHALMERS

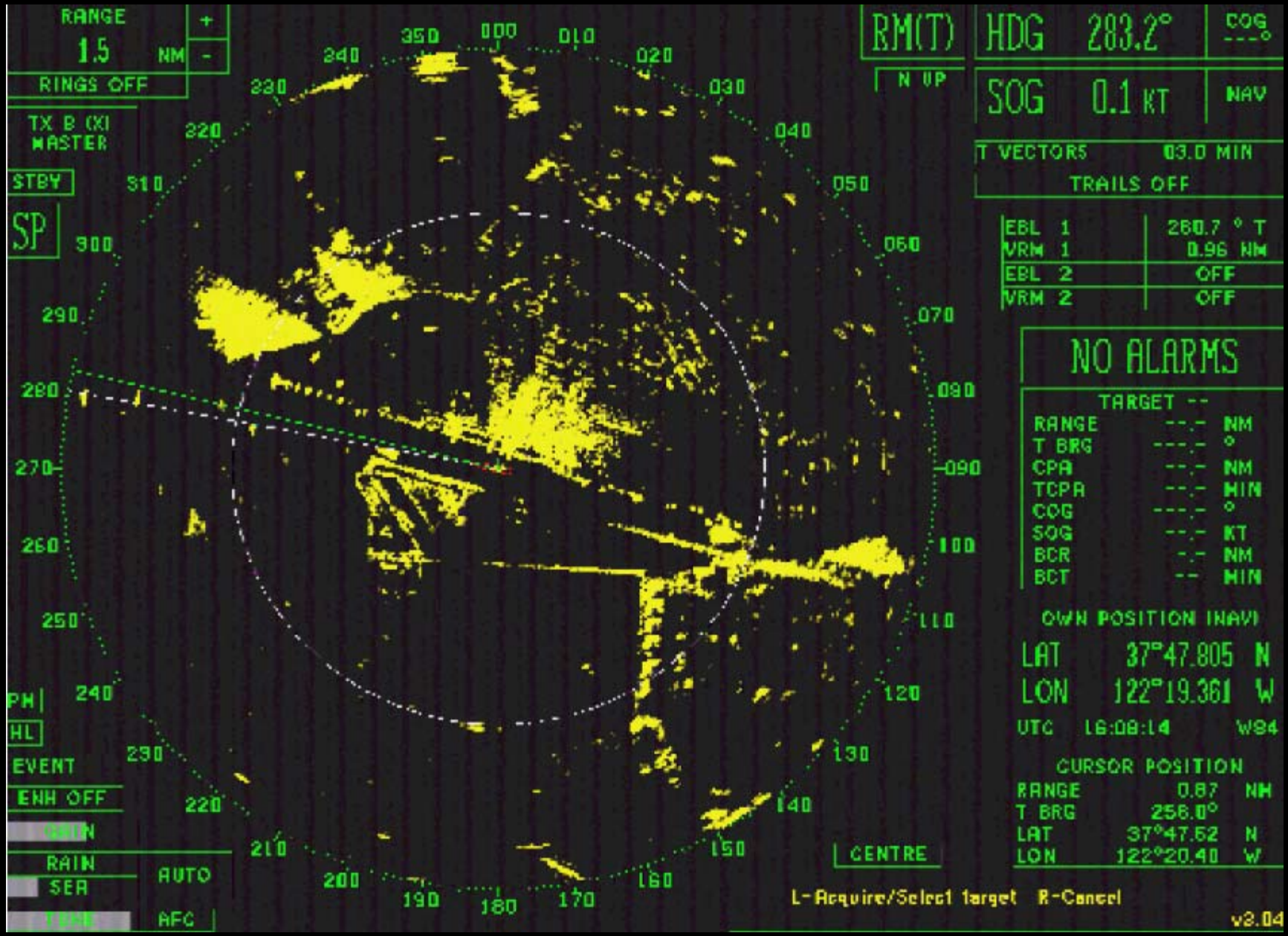
There is a certain type of accidents characterized by a sudden loss of situation awareness

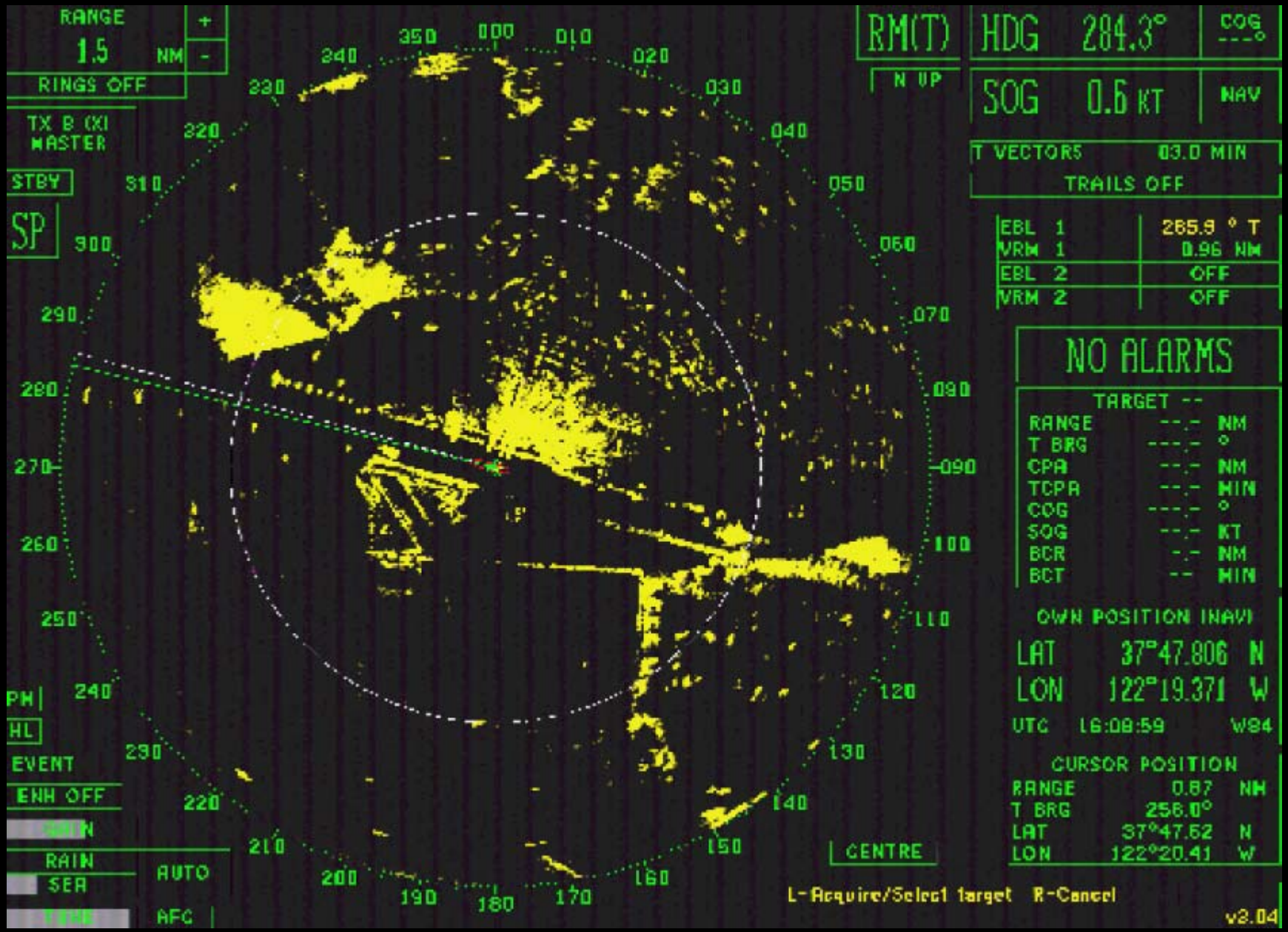
thomas.porathe@.chalmers.se

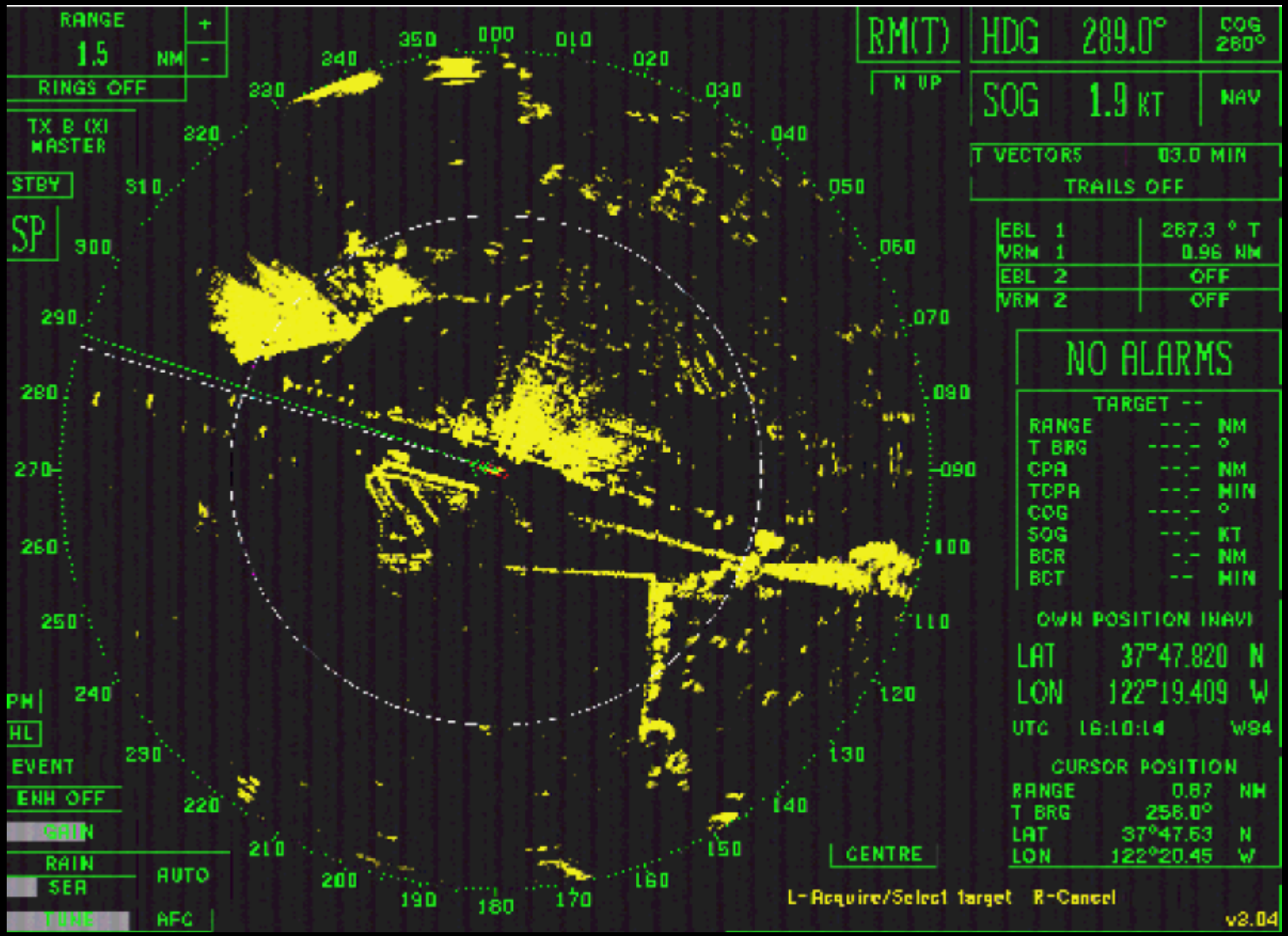
Cosco Busan , collision with the San Fransisco-Oakland Bay Bridge, 2007

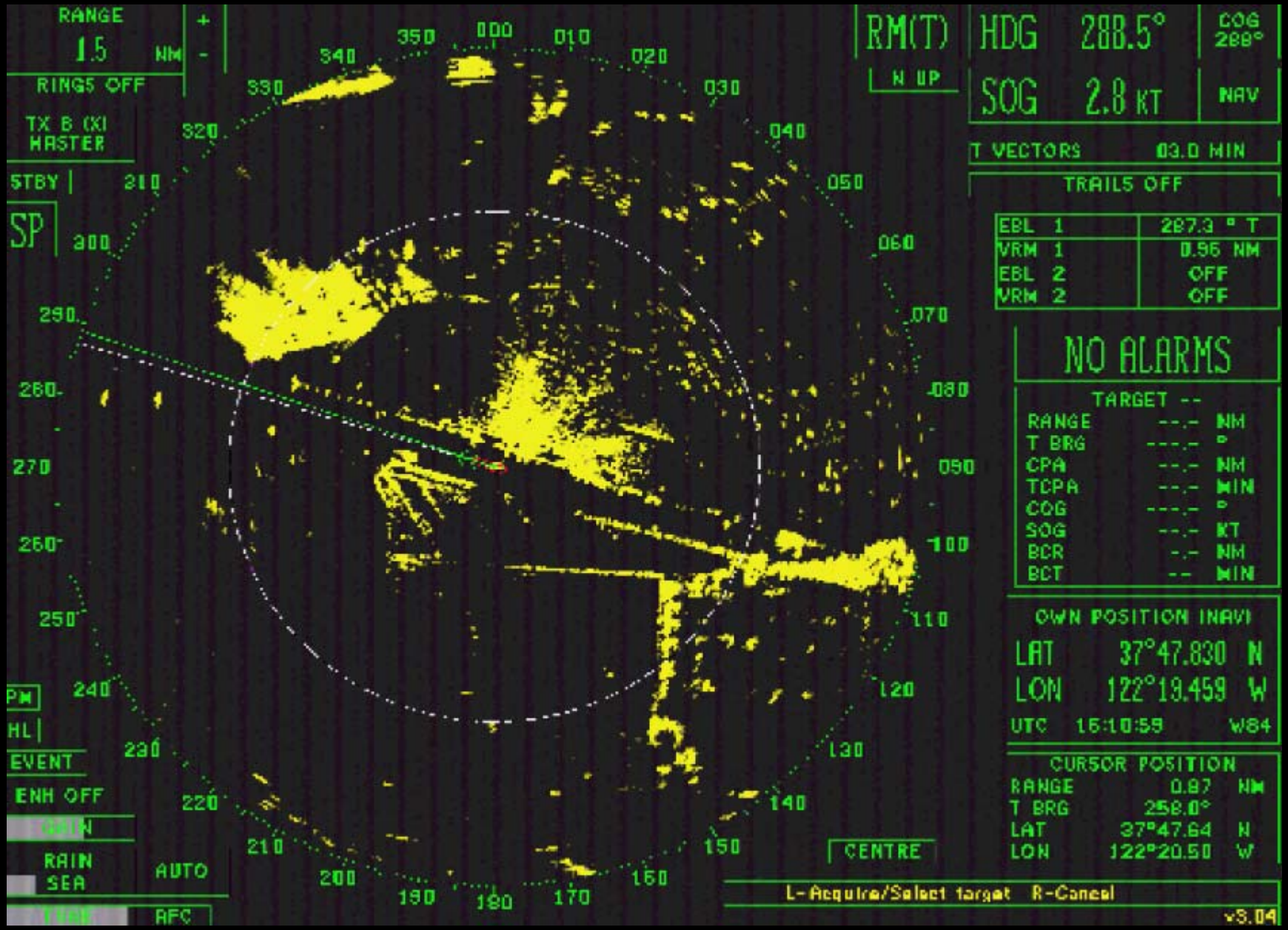

SAN FRANCISCO-OAKLAND BAY
Obstructions
(submerged ruins)
YERBA BUENA ISLAND
(345)
CG
RADAR TOWER
(taller of two)
F.R.18ft16M
Oc.4s 95ft 14M
Horn(1)30s
Bay Area Rapid Transit Tunnel
OUTER HARBOR ENTRANCE CHANNEL
(see Depth Table)
Seventh Street
Marine Terminal
Fl.R.2.5s19ft
Fl.G.2.5s19ft
Shallow Water Habitat
(under construction)
BAR CHANNEL
(see Depth Table)
INNER HARBOR ENTRANCE CHANNEL
(see Depth Table)
Fl.R.2.5s
Fl.R.4s
Fl.G.4s
Fl.G.4s30ft7M
Fl.R.6s15ft14M
Regulated Area
(see Note)
SAN FRANCISCO-OAKLAND BAY BRIDGE (see Note)
Bay Area Rapid Transit Tunnel
Racon(Y)
Racon(B)
Racon(N)
Cupola
Obstns
Pile
Obstn
Wk
S.Sh
M.Sh
S.M
General Anchorage
130°
259°
079°
287°
107°

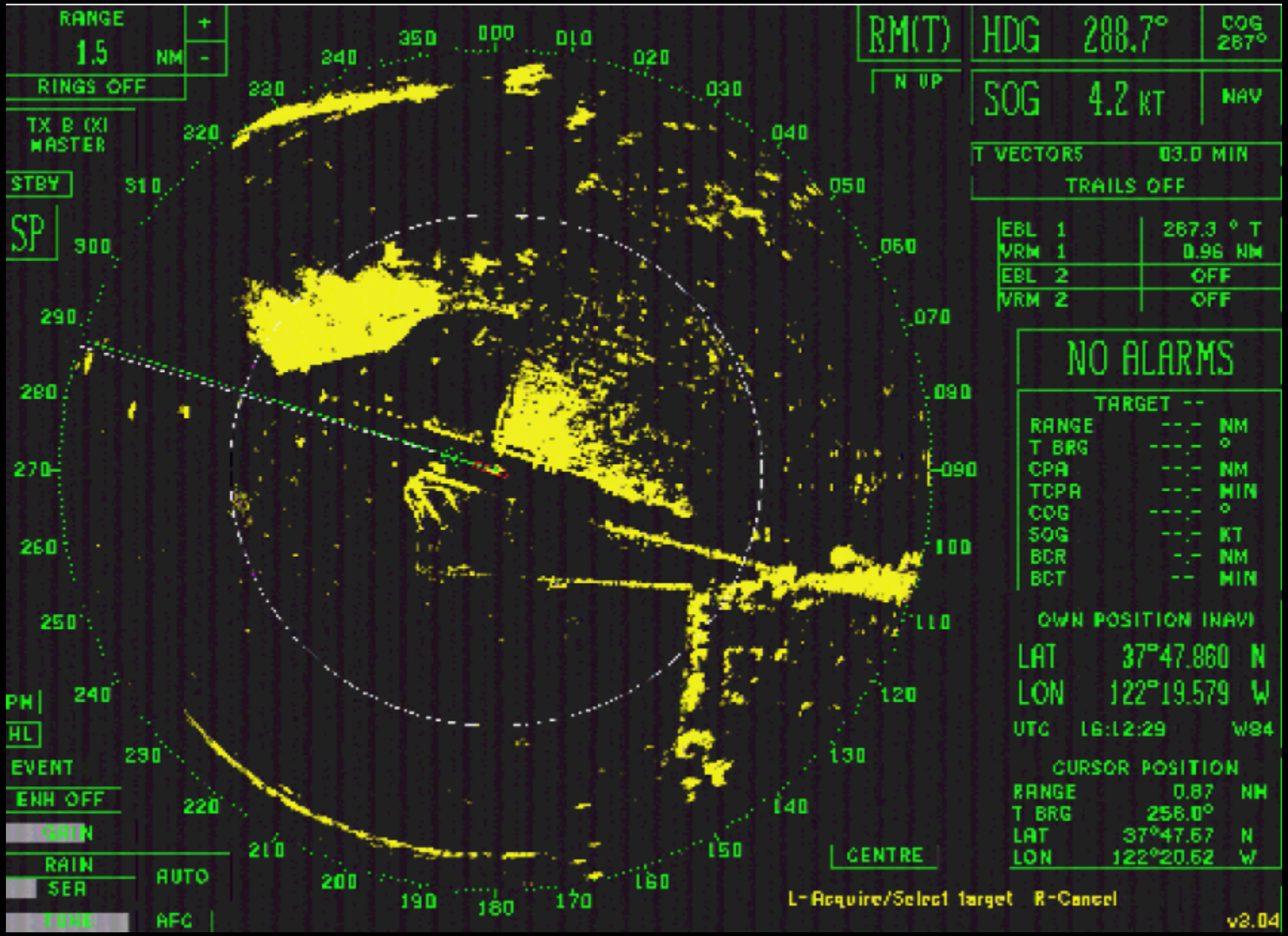
Cosco Busan Bridge - Photo 3


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
GAIN
RAIN
SEA
TUNE
AUTO
AFC
RM(T)
N UP
HDG 283.2°
COG ---°
SOG 0.1 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 260.7 ° T
VRM 1 0.96 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.805 N
LON 122°19.361 W
UTC 16:08:14 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.52 N
LON 122°20.40 W
CENTRE
L-Acquire/Select Target R-Cancel
v3.04

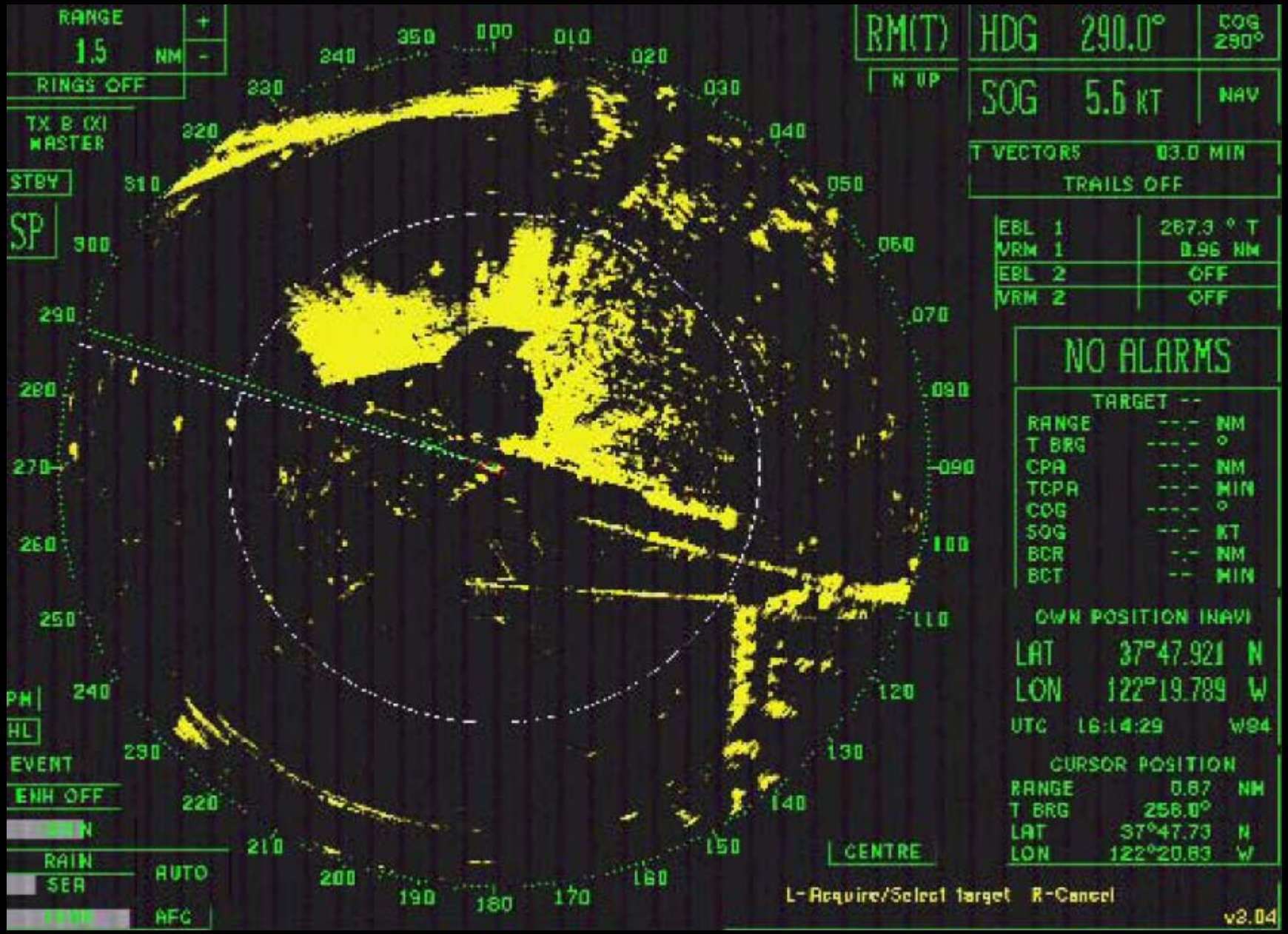

RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 284.3°
COG ---°
SOG 0.6 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 265.9 ° T
VRM 1 0.96 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.806 N
LON 122°19.371 W
UTC 16:08:59 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.52 N
LON 122°20.41 W
CENTRE
L-Acquire/Select target R-Cancel
v2.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
GAIN
RAIN
SEA
TUNE
AUTO
AFC
RM(T)
N UP
HDG 289.0°
COG 260°
SOG 1.9 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 267.3 ° T
VRM 1 0.96 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (WAAS)
LAT 37°47.820 N
LON 122°19.409 W
UTC 16:10:14 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.53 N
LON 122°20.45 W
CENTRE
L-Acquire/Select target R-Cancel
v2.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
GAIN
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 288.5°
COG 288°
SOG 2.8 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 287.3 ° T
VRM 1 0.96 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.830 N
LON 122°19.459 W
UTC 15:10:59 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.64 N
LON 122°20.50 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
GAIN
RAIN
SEA
TUNE
AUTO
AFC
RM(T)
N UP
HDG 288.7°
COG 267°
SOG 4.2 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 267.3 ° T
VRM 1 0.96 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.860 N
LON 122°19.579 W
UTC 16:12:29 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.67 N
LON 122°20.62 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
GAIN
RAIN
SEA
AUTO
TUNE
AFC
RM(T)
N UP
HDG 289.8°
COG 287°
SOG 5.0 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 287.3 ° T
VRM 1 0.96 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.891 N
LON 122°19.679 W
UTC 16:13:29 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.70 N
LON 122°20.72 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 290.0°
COG 290°
SOG 5.6 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 267.3 ° T
VRM 1 0.96 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.921 N
LON 122°19.789 W
UTC 16:14:29 W84
CURSOR POSITION
RANGE 0.67 NM
T BRG 256.0°
LAT 37°47.73 N
LON 122°20.63 W
CENTRE
L-Acquire/Select target R-Cancel
v2.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 287.8°
COG 291°
SOG 6.0 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 287.3 ° T
VRM 1 0.56 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.949 N
LON 122°19.910 W
UTC 16:15:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.76 N
LON 122°20.95 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
RFC
RM(T)
N UP
HDG 288.2°
COG 288°
SOG 6.4 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 287.3 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.979 N
LON 122°20.039 W
UTC 16:16:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.79 N
LON 122°21.09 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PH
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 286.5°
COG 269°
SOG 6.8 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 267.3 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION INAVI
LAT 37°48.018 N
LON 122°20.170 W
UTC 16:17:29 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.83 N
LON 122°21.21 W
CENTRE
L-Acquire/Select target R-Cancel
v2.04


RANGE
1.5 NM
+
-
RINGS OFF
TX 6 (K)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 282.5°
COG 287°
SOG 7.1 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 287.3 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°48.055 N
LON 122°20.322 W
UTC 15:18:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.87 N
LON 122°21.36 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (K)
MASTER
STBY
SP
RM(T)
N UP
HDG 282.5°
COG 261°
SOG 7.4 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 264.6 ° T
VRM 1 0.23 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°48.075 N
LON 122°20.472 W
UTC 16:19:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.65 N
LON 122°21.51 W
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
CENTRE
L-Acquire/Select target R-Cancel
v2.04

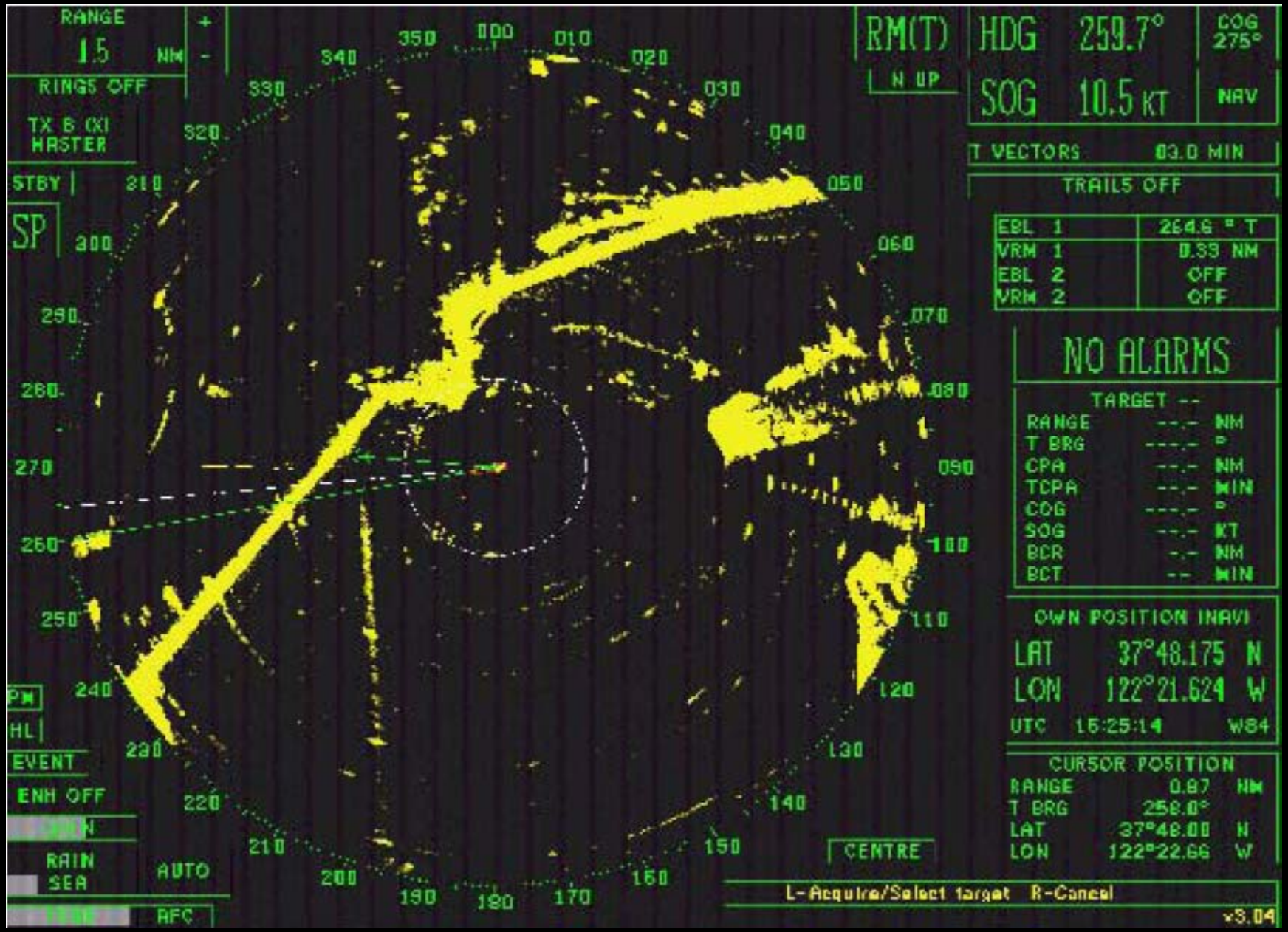

RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
RM(T)
N UP
HDG 283.2°
COG 276°
SOG 7.7 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 264.6 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (WAVI
LAT 37°48.095 N
LON 122°20.631 W
UTC 16:20:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.51 N
LON 122°21.57 W
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
CENTRE
L-Acquire/Select target R-Cancel
v2.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (K)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
RM(T)
N UP
HDG 283.5°
COG 279°
SOG 8.6 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 264.6 °T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°48.115 N
LON 122°20.811 W
UTC 16:21:29 WGS4
CURSOR POSITION
RANGE 0.97 NM
T BRG 258.0°
LAT 37°47.93 N
LON 122°21.85 W
CENTRE
L-Acquire/Select target R-Cancel


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 283.8°
COG 279°
SOG 9.4 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 264.6 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION INAVI
LAT 37°48.146 N
LON 122°21.011 W
UTC 16:22:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.96 N
LON 122°22.05 W
CENTRE
L-Acquire/Select target R-Cancel
v2.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (K)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 283.0°
COG 279°
SOG 10.2 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 264.6 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°48.165 N
LON 122°21.221 W
UTC 15:23:29 W84
CURSOR POSITION
RANGE 0.97 NM
T BRG 258.0°
LAT 37°47.99 N
LON 122°22.26 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04

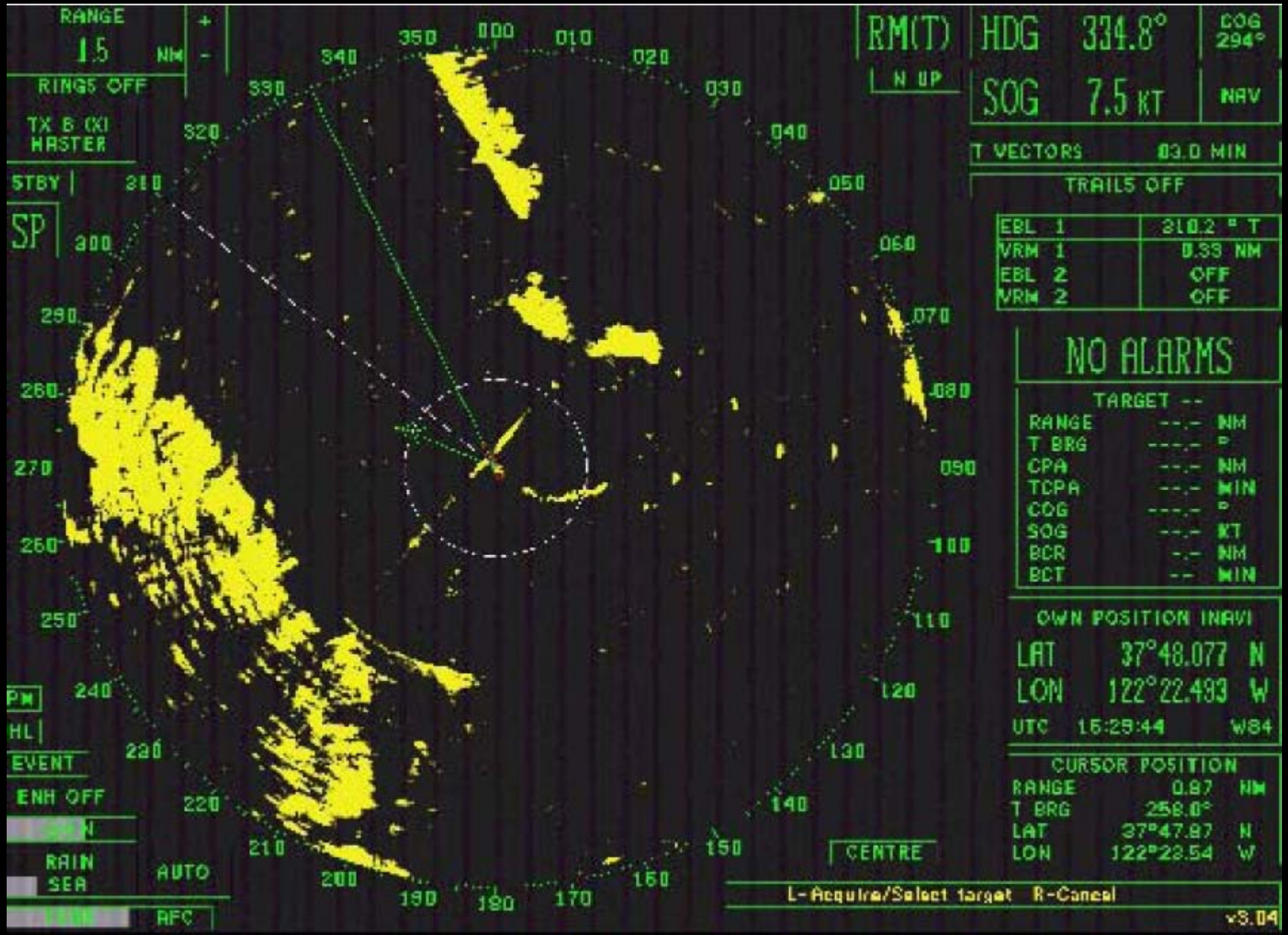

RANGE
1.5 NM
RINGS OFF
TX B (X)
MASTER
STBY
SP
RM(T)
HDG 275.5°
COG 279°
N UP
SOG 10.8 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 264.6 ° T
VRM 1 0.23 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION INAVI
LAT 37°48.189 N
LON 122°21.453 W
UTC 16:24:29 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°46.01 N
LON 122°22.49 W
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
CENTRE
L-Acquire/Select target R-Cancel
v2.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
N
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 259.7°
COG 275°
SOG 10.5 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 264.6 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°48.175 N
LON 122°21.624 W
UTC 15:25:14 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°48.00 N
LON 122°22.66 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 241.2°
COG 248°
SOG 10.5 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 310.2 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION INAVI
LAT 37°48.069 N
LON 122°21.878 W
UTC 16:26:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.90 N
LON 122°22.92 W
CENTRE
L-Acquire/Select target R-Cancel
v8.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
RM(T)
N UP
HDG 253.8°
COG 234°
SOG 10.6 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 310.2 ° T
VRM 1 0.23 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --:-- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.980 N
LON 122°22.083 W
UTC 16:27:29 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 256.0°
LAT 37°47.61 N
LON 122°23.12 W
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (K)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 285.5°
COG 249°
SOG 9.3 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 310.2 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°47.967 N
LON 122°22.301 W
UTC 15:28:29 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.79 N
LON 122°23.34 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
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RINGS OFF
TX B (X)
MASTER
STBY
SP
PM
HL
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
RM(T)
N UP
HDG 334.8°
COG 294°
SOG 7.5 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 310.2 ° T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION INAVI
LAT 37°48.077 N
LON 122°22.493 W
UTC 15:25:44 WGS4
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.87 N
LON 122°23.54 W
CENTRE
L-Acquire/Select target R-Cancel
v3.04


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
RM(T)
N UP
HDG 330.7°
COG 319°
SOG 8.1 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 310.2 °T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
OWN POSITION (NAV)
LAT 37°48.136 N
LON 122°22.517 W
UTC 16:30:14 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.93 N
LON 122°23.57 W
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
CENTRE
L-Acquire/Select target R-Cancel
v3.04

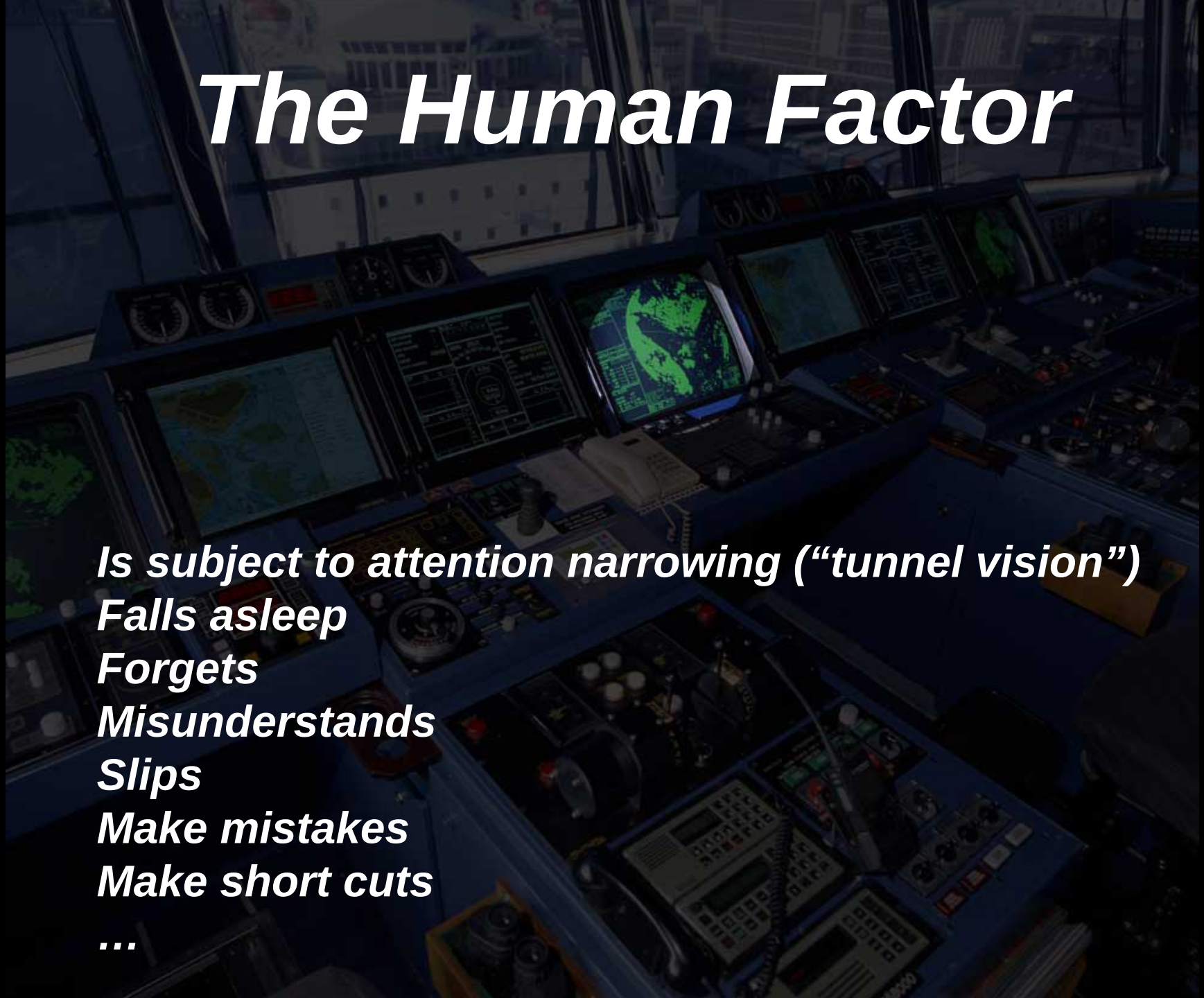

RANGE
15 NM
RINGS OFF
TX B (X)
MASTER
STBY
SP
RM(T)
N UP
HDG 330.7°
COG 319°
SOG 8.1 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 310.2 °T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
BCT -- MIN
What went wrong?
OWN POSITION (NAV)
LAT 37°48.136 N
LON 122°22.517 W
UTC 16:30:14 W84
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.93 N
LON 122°23.57 W
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
CENTRE
L-Acquire/Select target R-Cancel
v3.04

The Human Factor

The Human Factor

Is subject to attention narrowing (“tunnel vision”)

The Human Factor



Is subject to attention narrowing (“tunnel vision”)
Falls asleep
Forgets
Misunderstands
Slips
Make mistakes
Make short cuts
…

The bad news

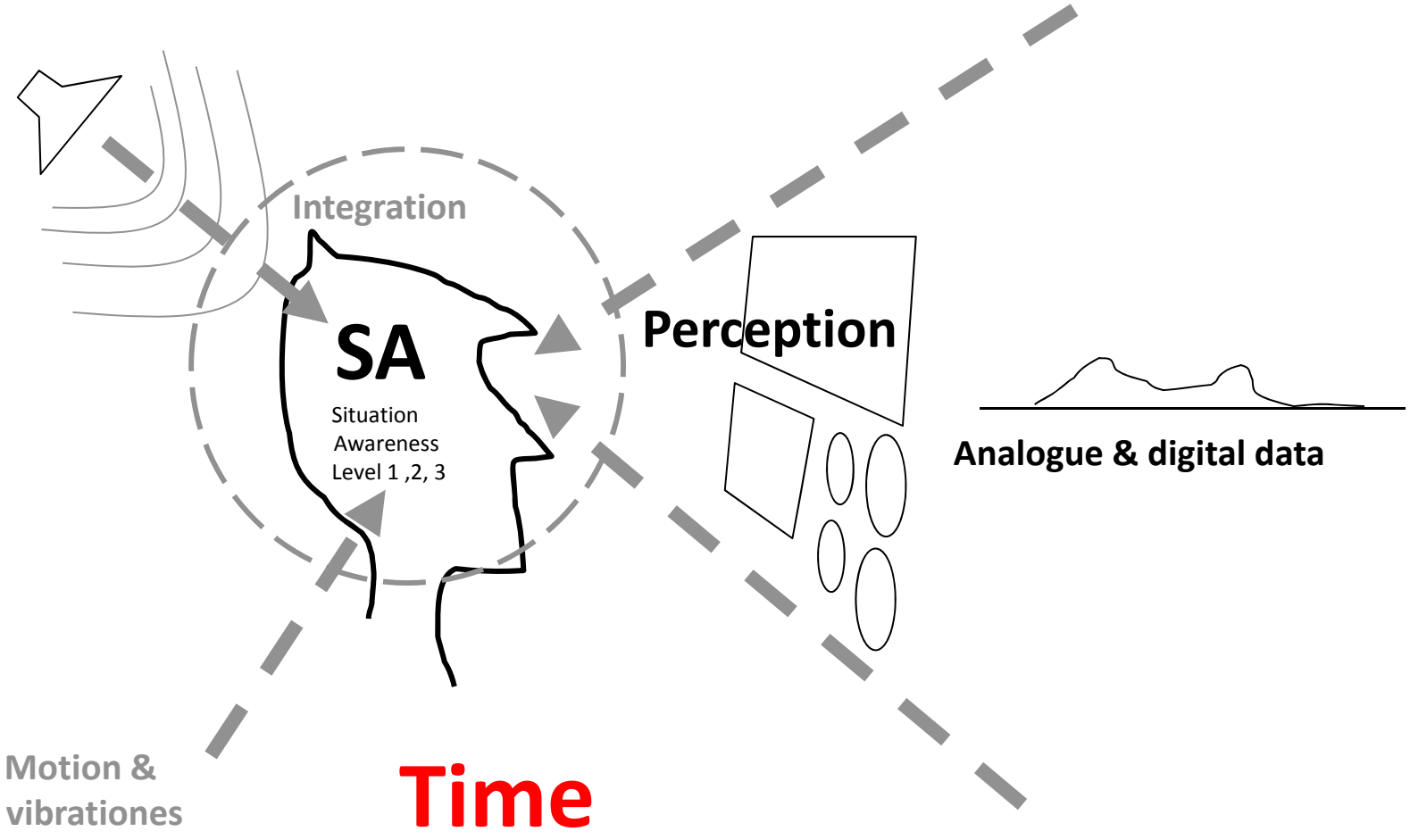
• Human error continues to be a dominant factor in approximately 80 to 85% of maritime accidents;

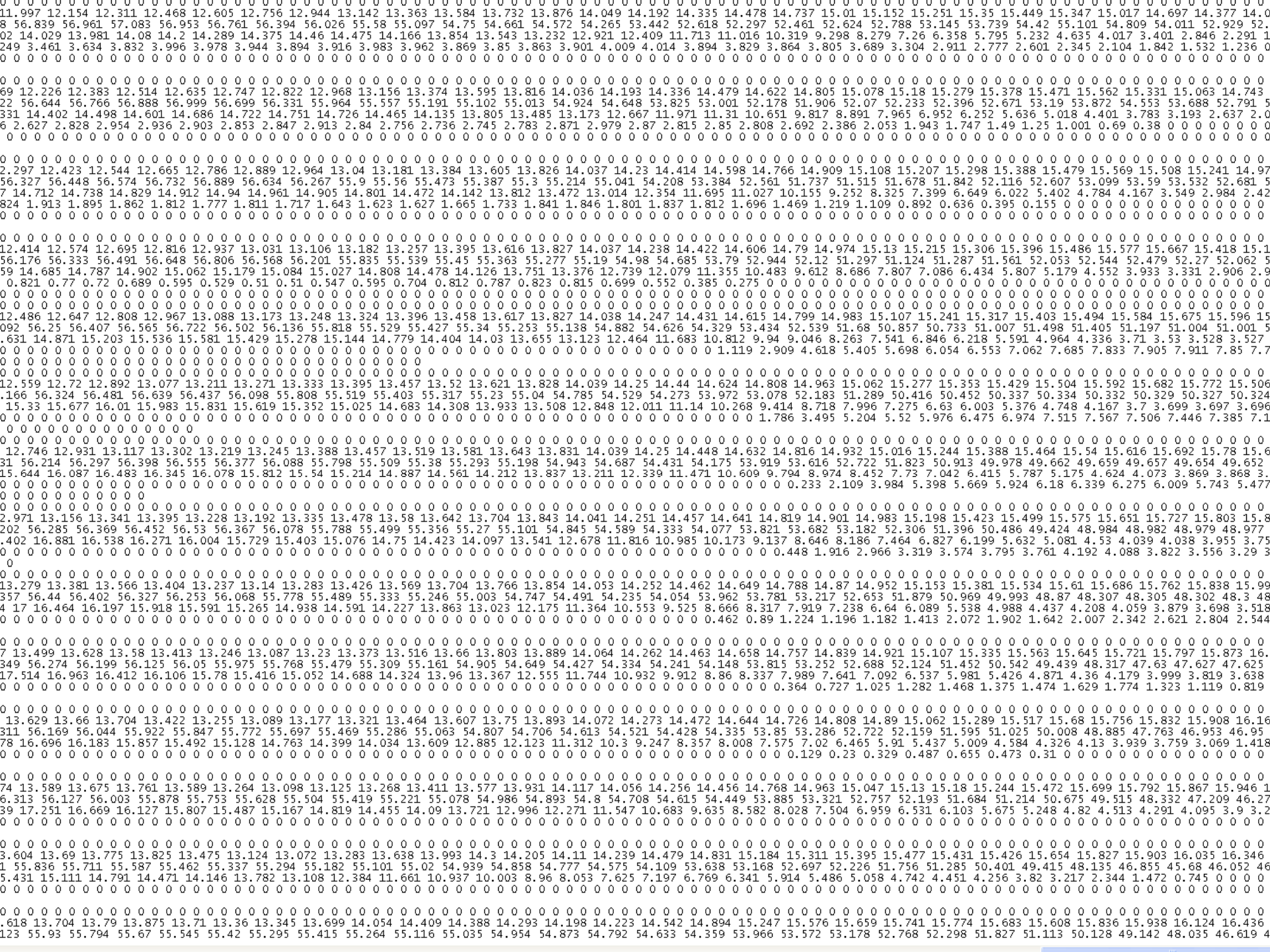
• Failures of situation awareness and situation assessment overwhelmingly predominate, being a causal factor in the majority of those accidents attributed to human error;

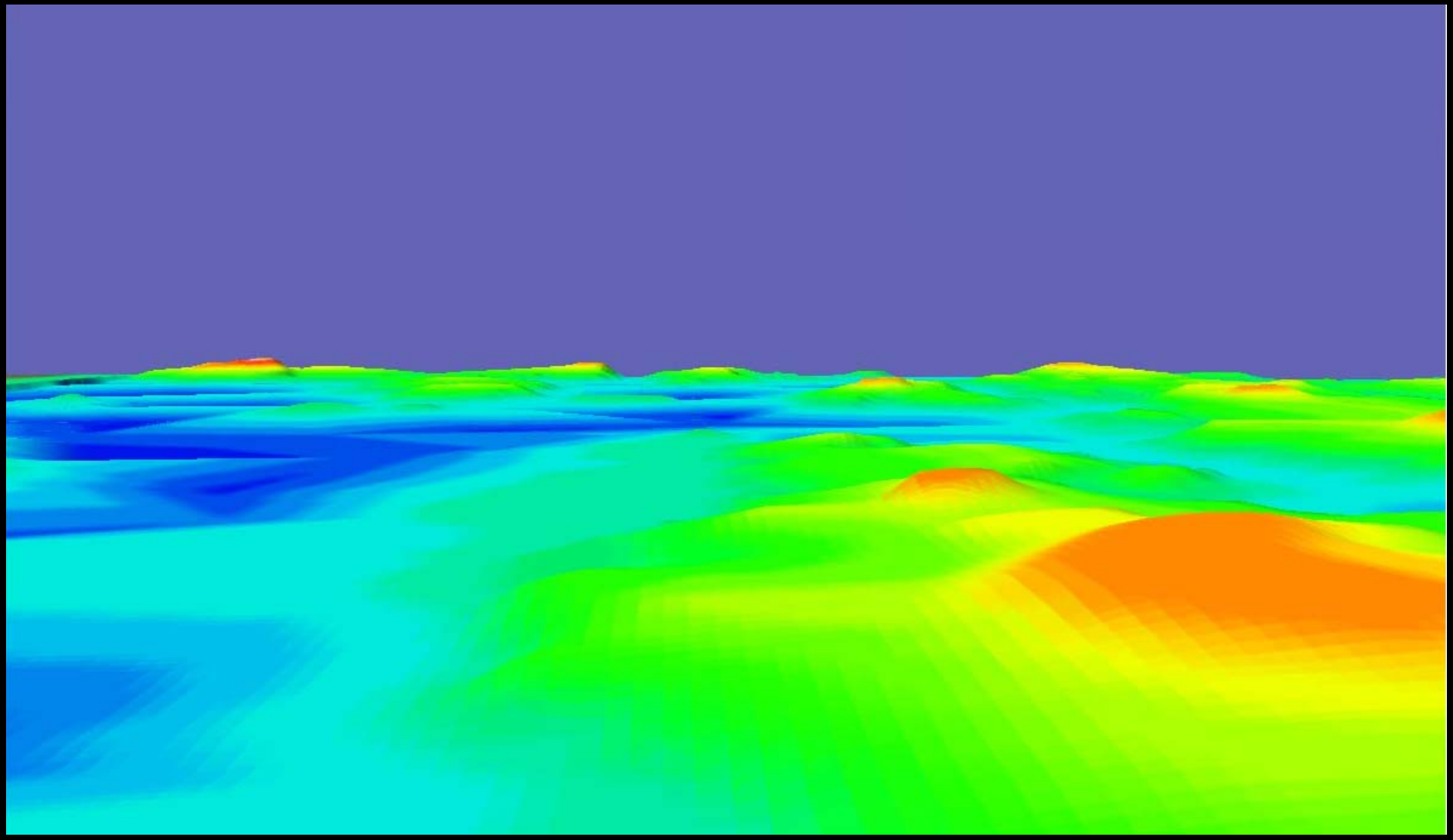
• Human fatigue and task omission seem closely related to failures of situation awareness and the human errors and accidents that result.

(Baker & McCaffery, 2005)

Baker, C. C., & McCafferty, D. B. (2005). *Accident database review of human element concerns: What do the results mean for classification?* Paper presented at The International Conference Human Factors in Ship Design and Operation, RINA Feb, 2005


Integration
SA
Situation
Awareness
Level 1 ,2, 3
Perception
Analogue & digital data
Motion &
vibrationes
Time





Bev Doolittle (1984). *The Forest has Eyes*

Information design – solving problems

"Solving a problem simply means representing it so as to make the solution transparent."

(Simon, 1996)

Simon, H. (1996). *The Sciences of the Artificial. Cambridge*, MA: The MIT Press.


RANGE
1.5 NM
+
-
RINGS OFF
TX B (X)
MASTER
STBY
SP
RM(T)
N UP
HDG 330.7°
COG 319°
SOG 8.1 KT
NAV
T VECTORS 03.0 MIN
TRAILS OFF
EBL 1 310.2 °T
VRM 1 0.33 NM
EBL 2 OFF
VRM 2 OFF
NO ALARMS
TARGET --
RANGE --.- NM
T BRG ---.- °
CPA --.- NM
TCPA --.- MIN
COG ---.- °
SOG --.- KT
BCR -.- NM
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OWN POSITION (NAV)
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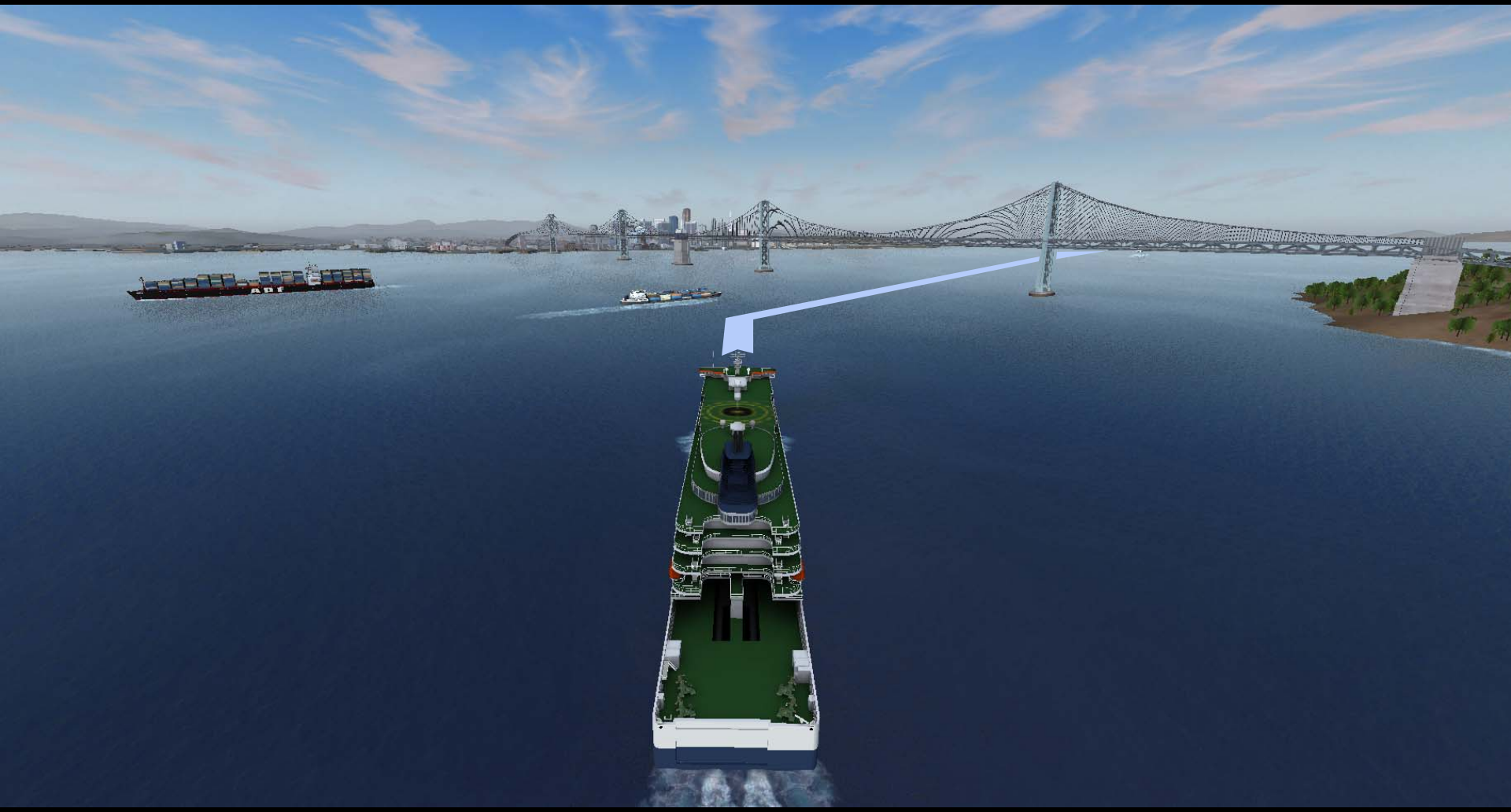
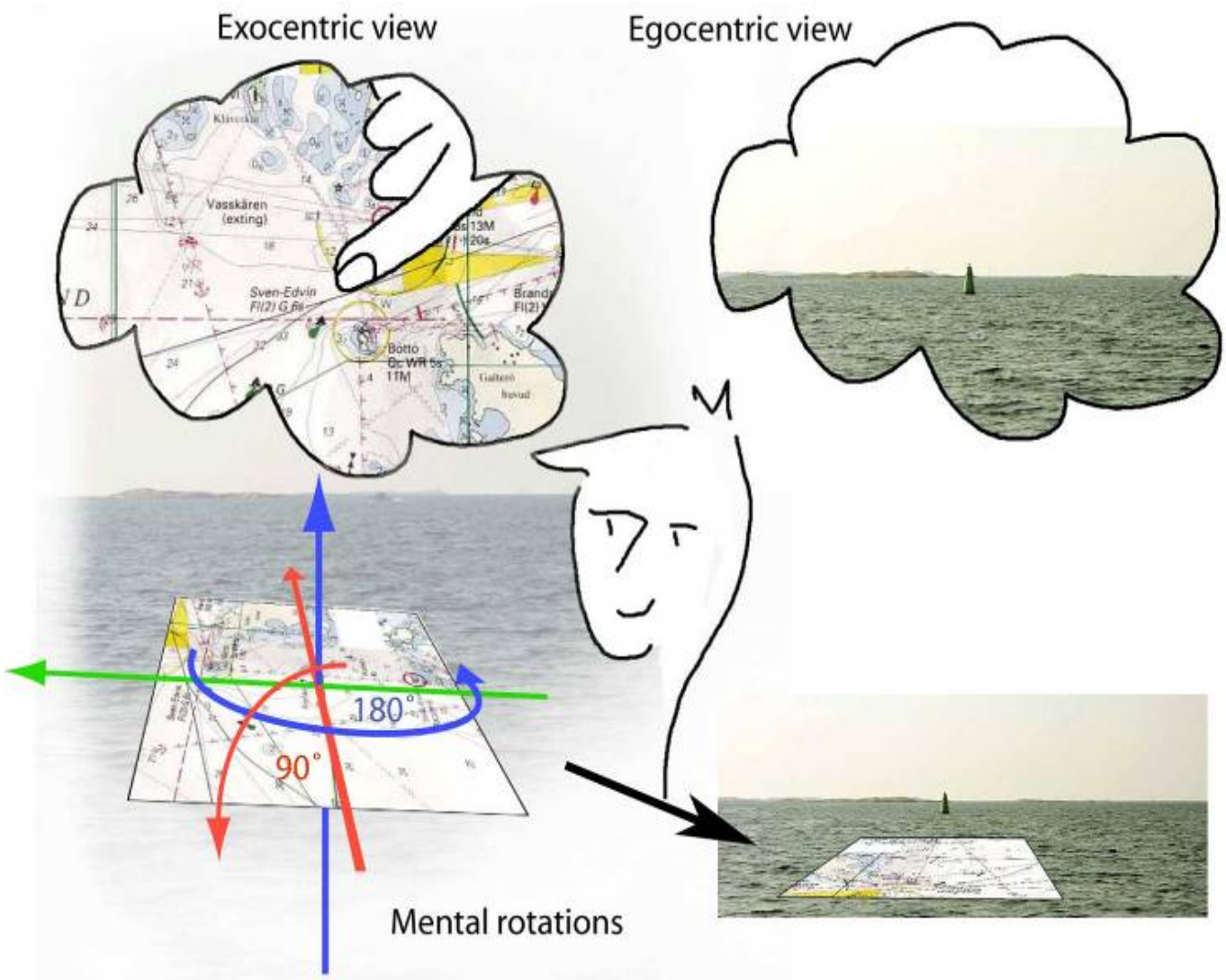
CURSOR POSITION
RANGE 0.87 NM
T BRG 258.0°
LAT 37°47.93 N
LON 122°23.57 W
EVENT
ENH OFF
RAIN
SEA
AUTO
AFC
CENTRE
L-Acquire/Select target R-Cancel
v3.04

"Solving a problem simply means representing it so as to make the solution transparent."

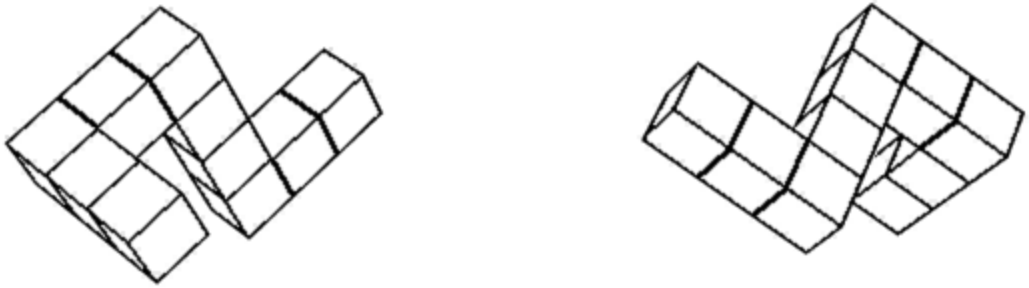
(Simon, 1996)



Ship Simulator 2008

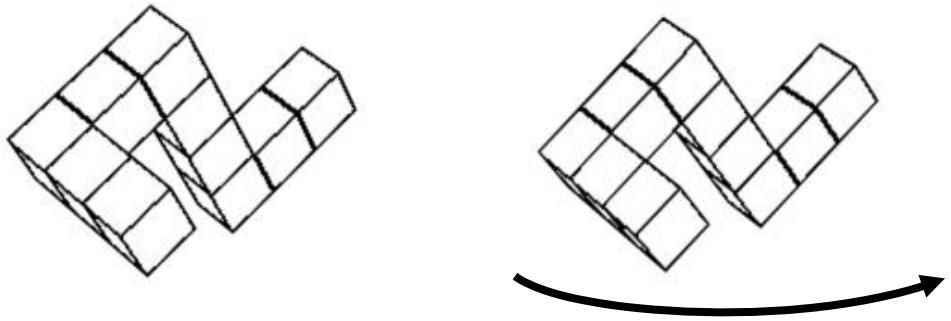

Exocentric view
Egocentric view
Vasskären
(exting)
Sven-Edvin
Botto
180°
90°
Mental rotations

Mental Rotations



Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, 171, 701-703.

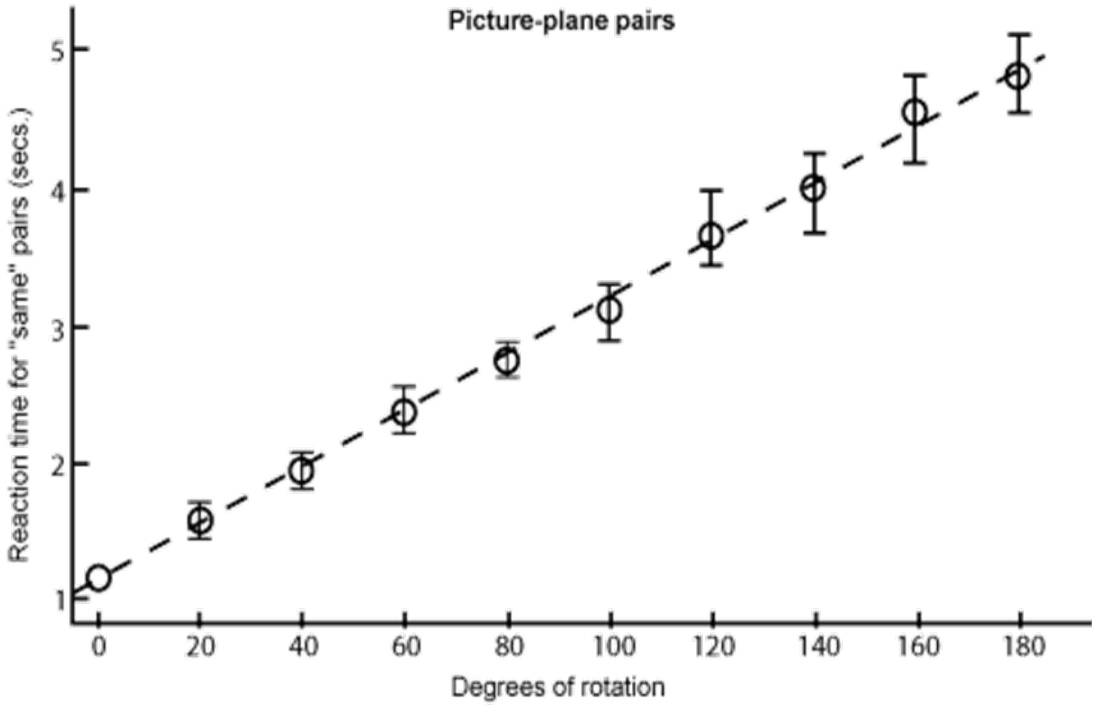
Mental Rotations



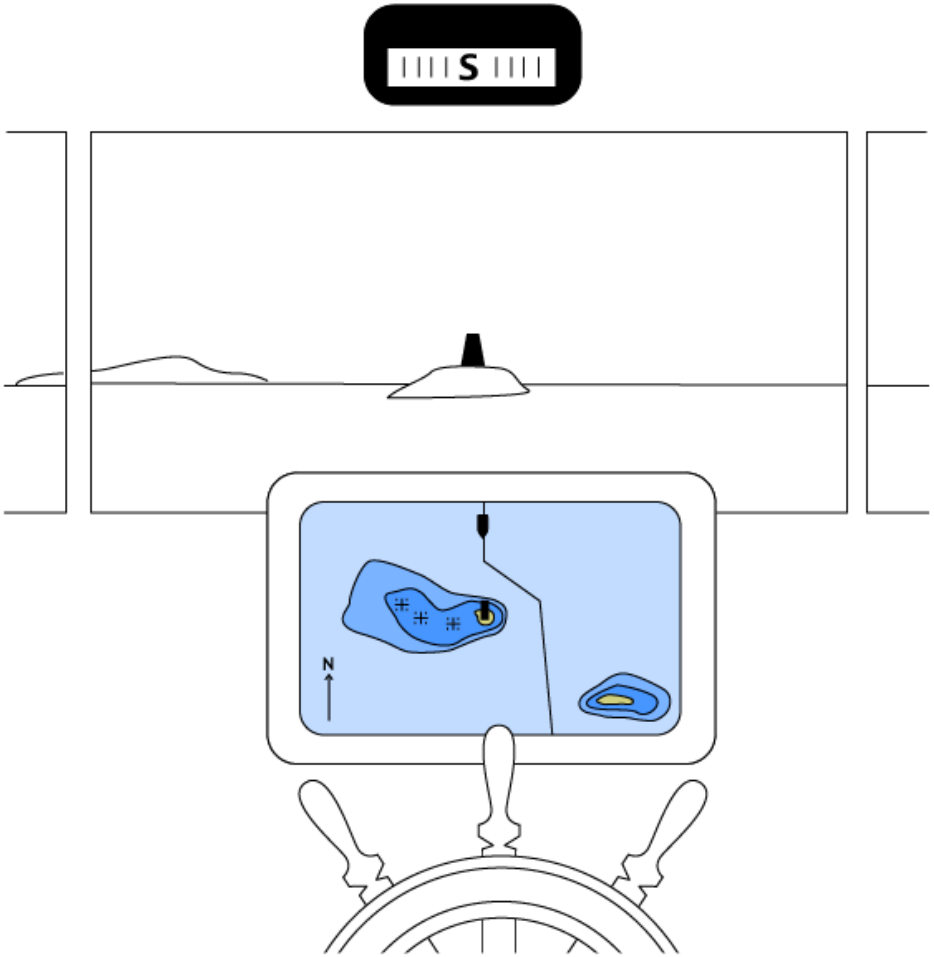
180 degrees

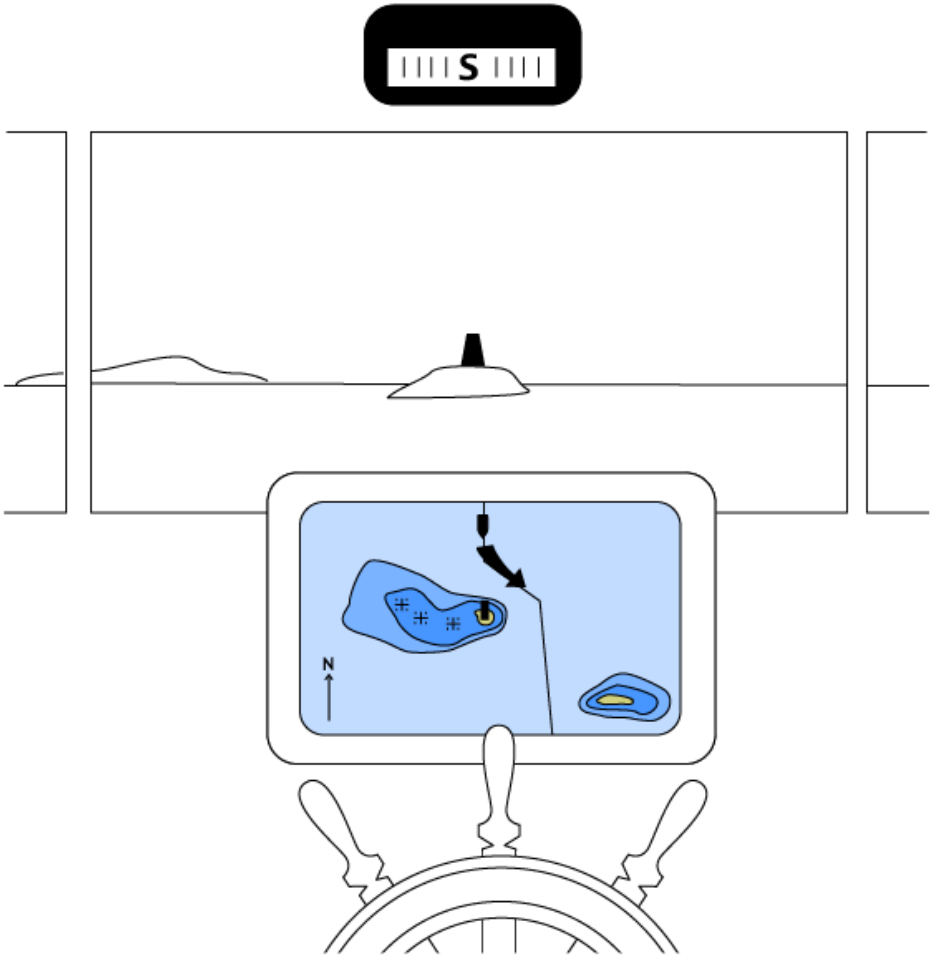
Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, 171, 701-703.

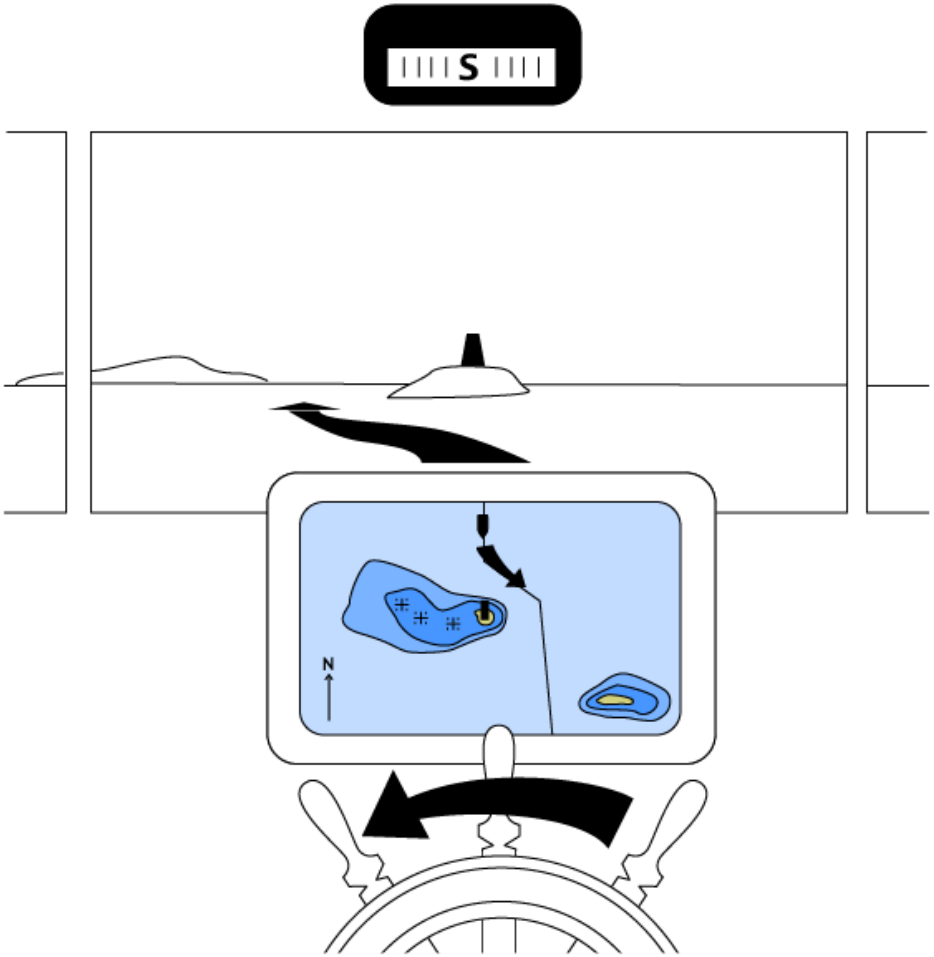
Mental Rotations

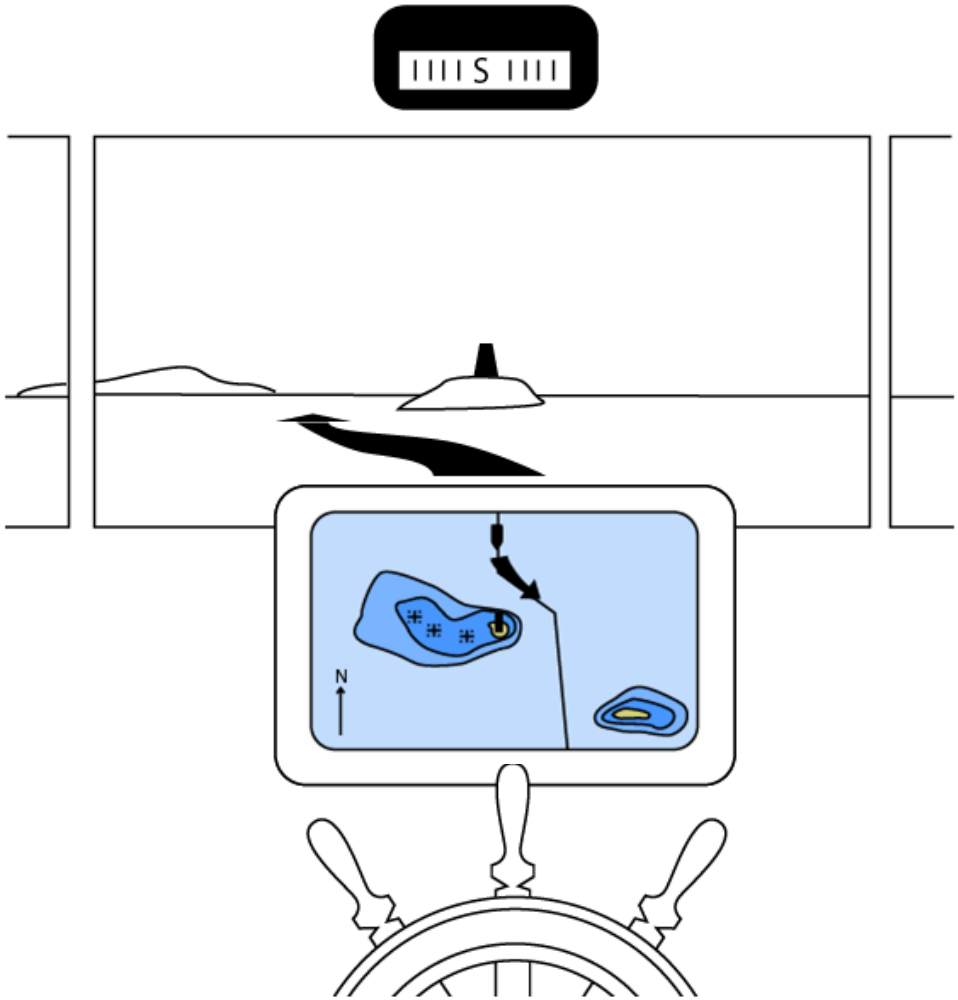


Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, 171, 701-703.


S
N


S
N


S
N


S
N

Africa in its canonical orientation

Enterprises navigating in high speed generally use maps head-up.

Fighter airplanes and helicopters

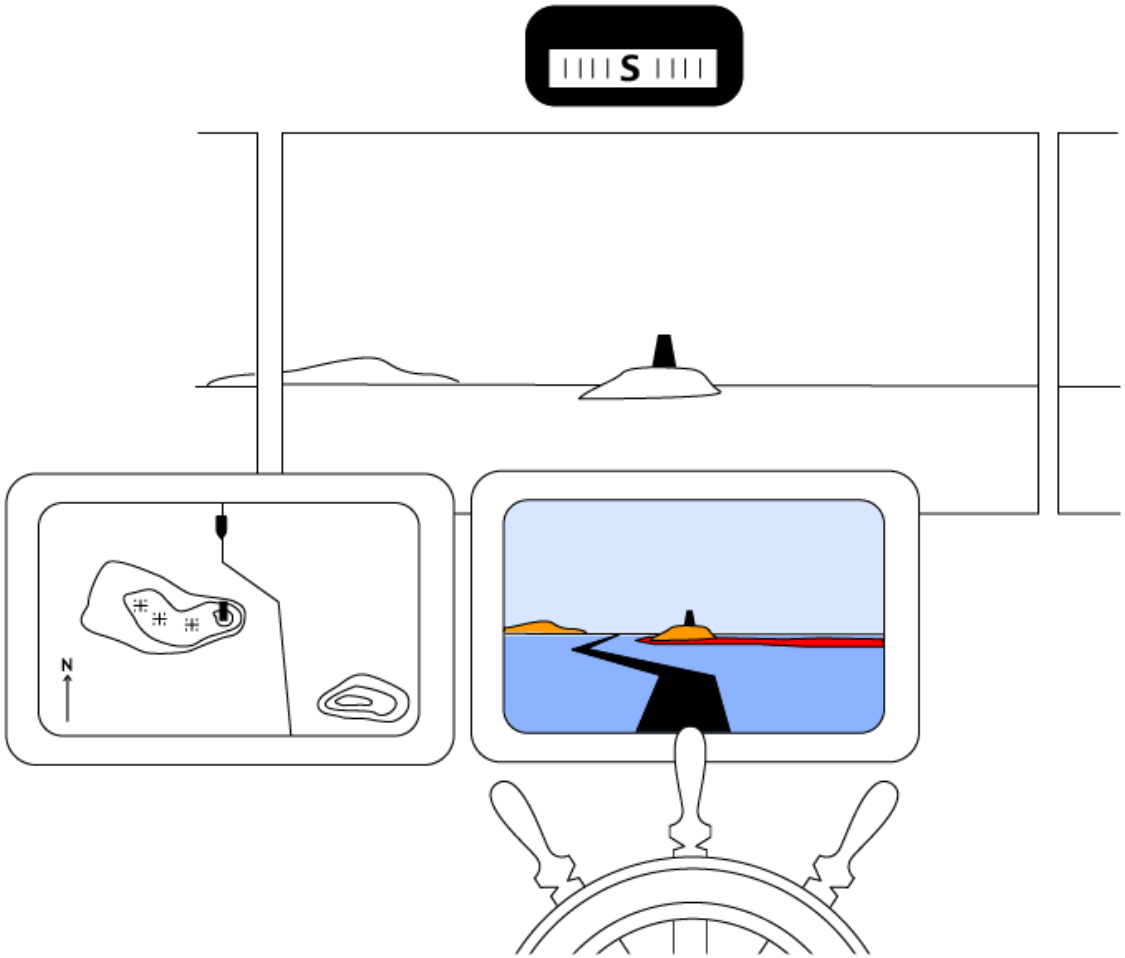
Rally and orienteering


302

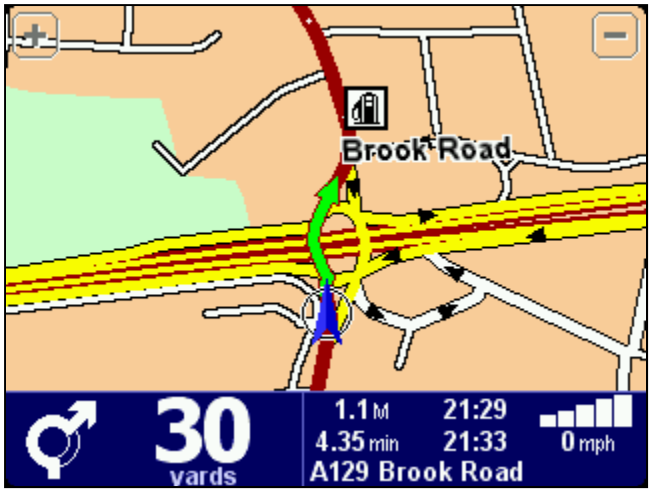

POLIS


PILOT

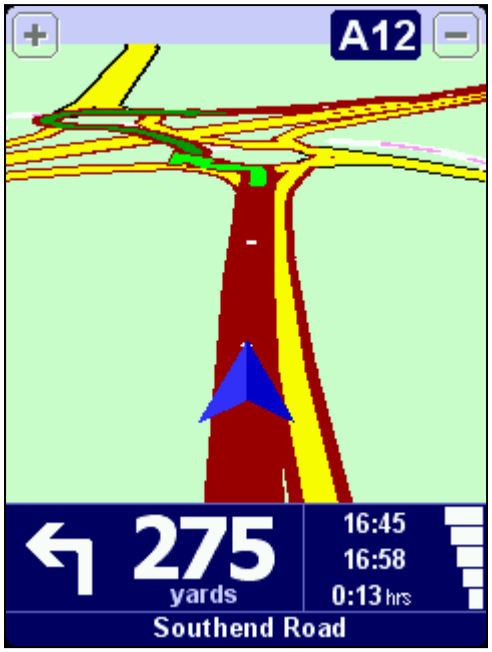
HMS Altair


S
N

North-up mode



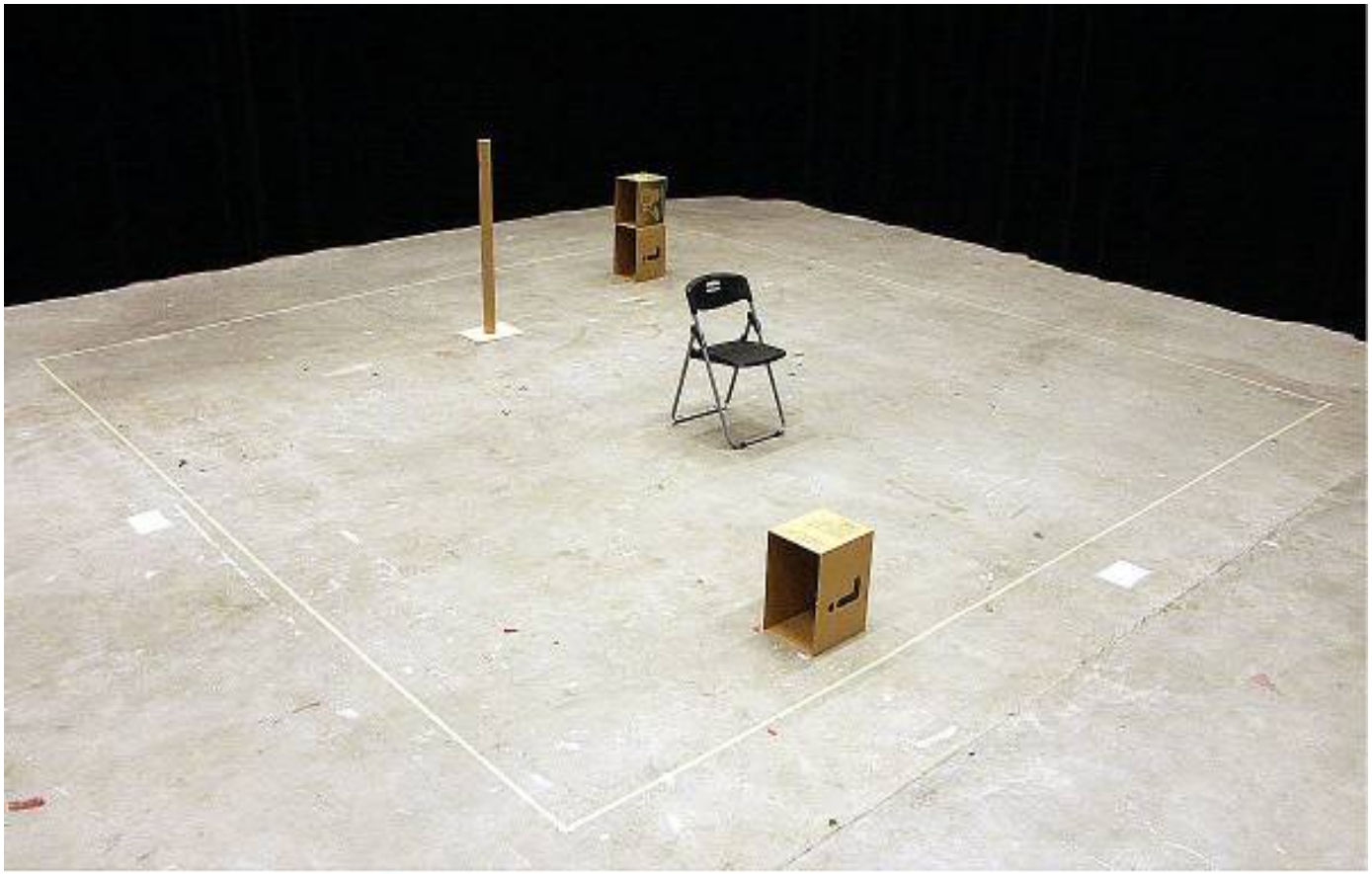
Head-up mode

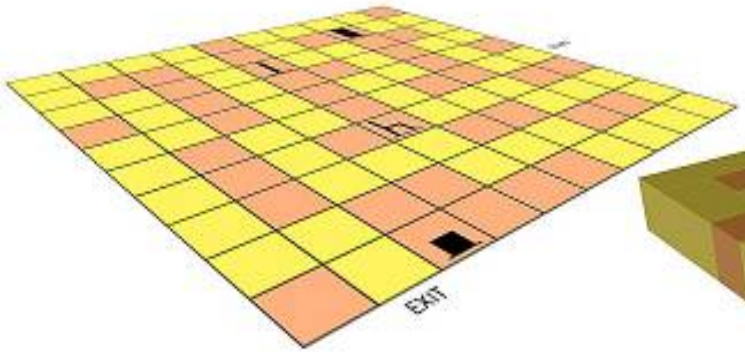


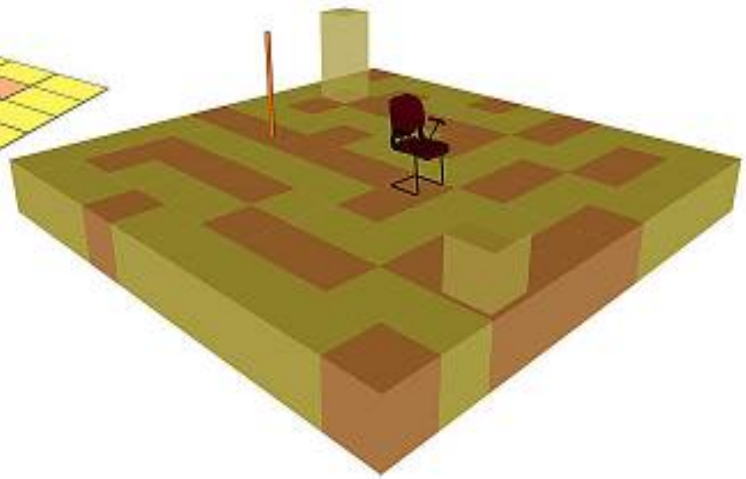
3-D egocentric mode

TomTom Navigator
HP Edition

Experimental results




EXIT



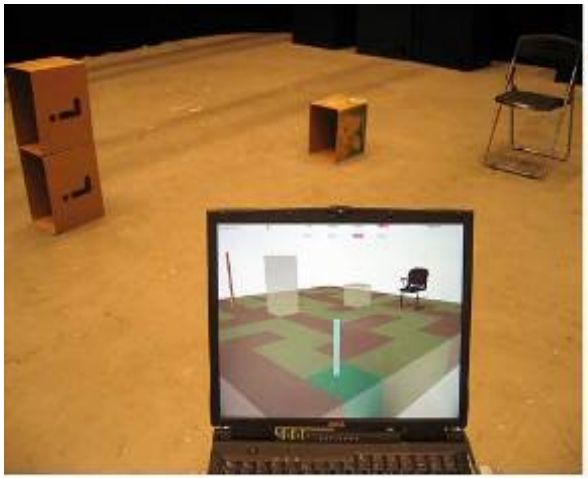
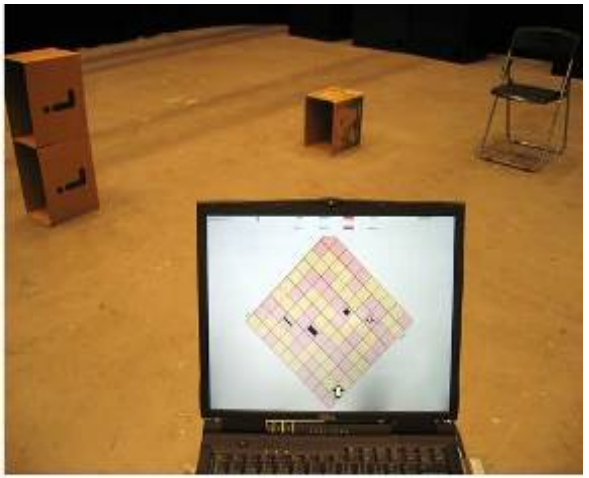
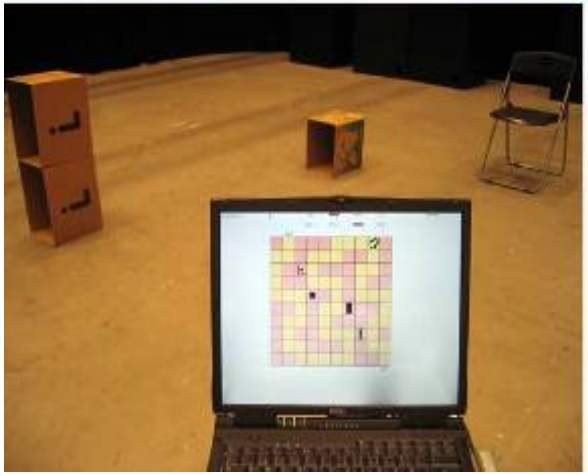
Two studies

The University group

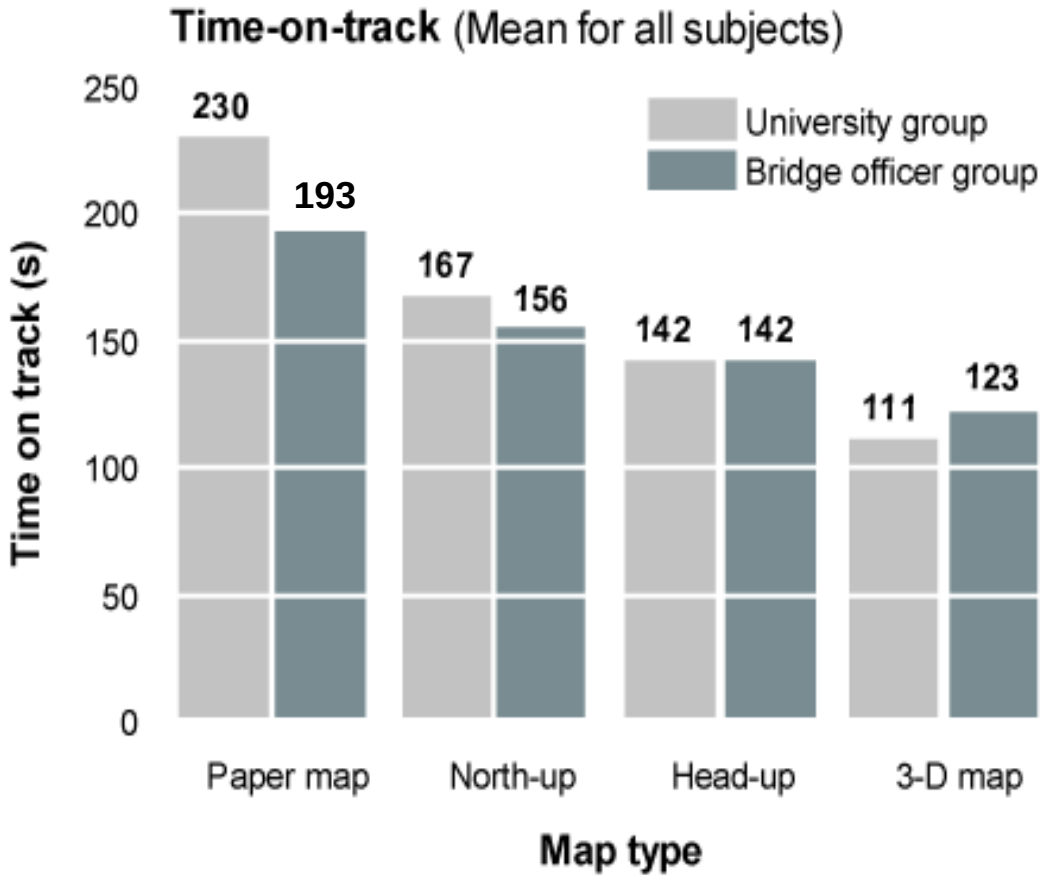
45 participants
Age: 16 - 63
21 women
24 men

The Bridge Officer group

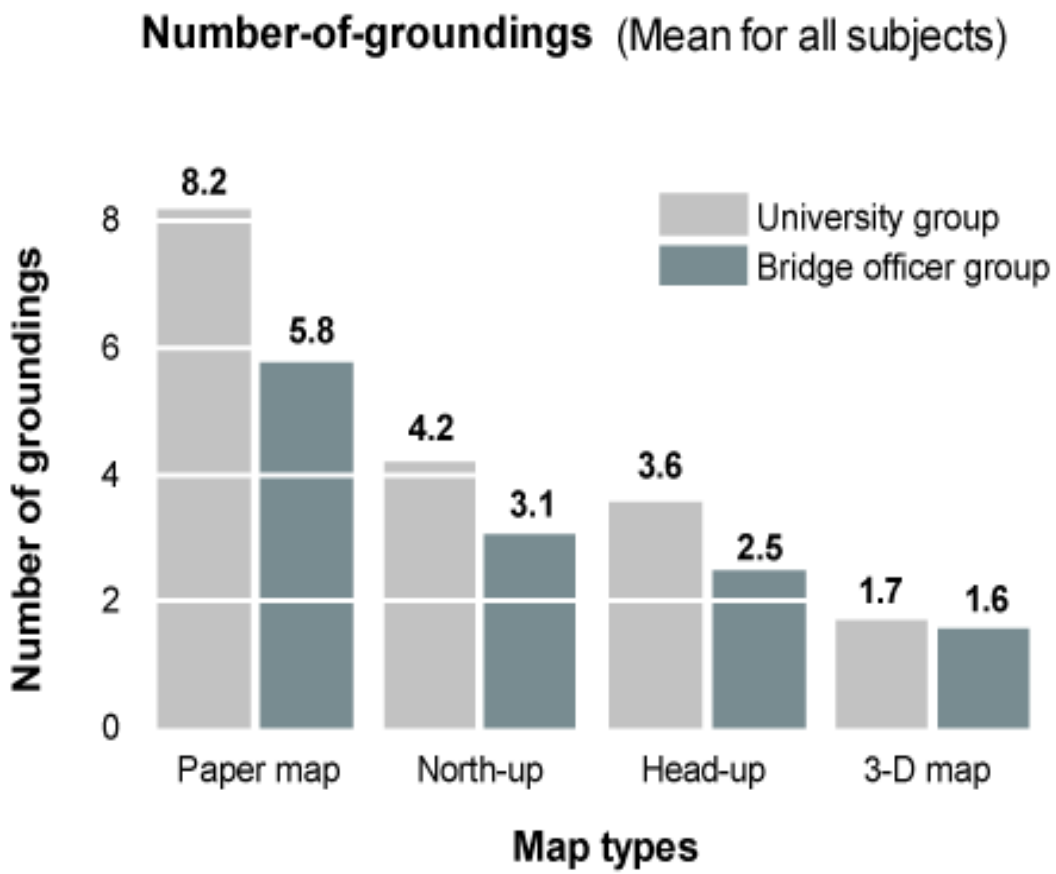
30 participants
Age: 22 – 54, all men
18 combat boat drivers,
6 Experienced, active bridge crew members
6 Cadets

Independent variables	Dependent variables
Map types (Paper, North-up, Head-up, 3-D)	Time on track
Gender	Number of groundings
Age	Subjective ranking of user-friendliness
Navigational experience	Score on figure rotation test
Self taxed sense of direction	



Prison, J., & Porathe, T. (2007). Navigation with 2-D and 3-D Maps: A Comparative Study with Maritime Personnel. *Proceedings of the 39th Nordic Ergonomics Society Conference*, 1-3 October 2007.



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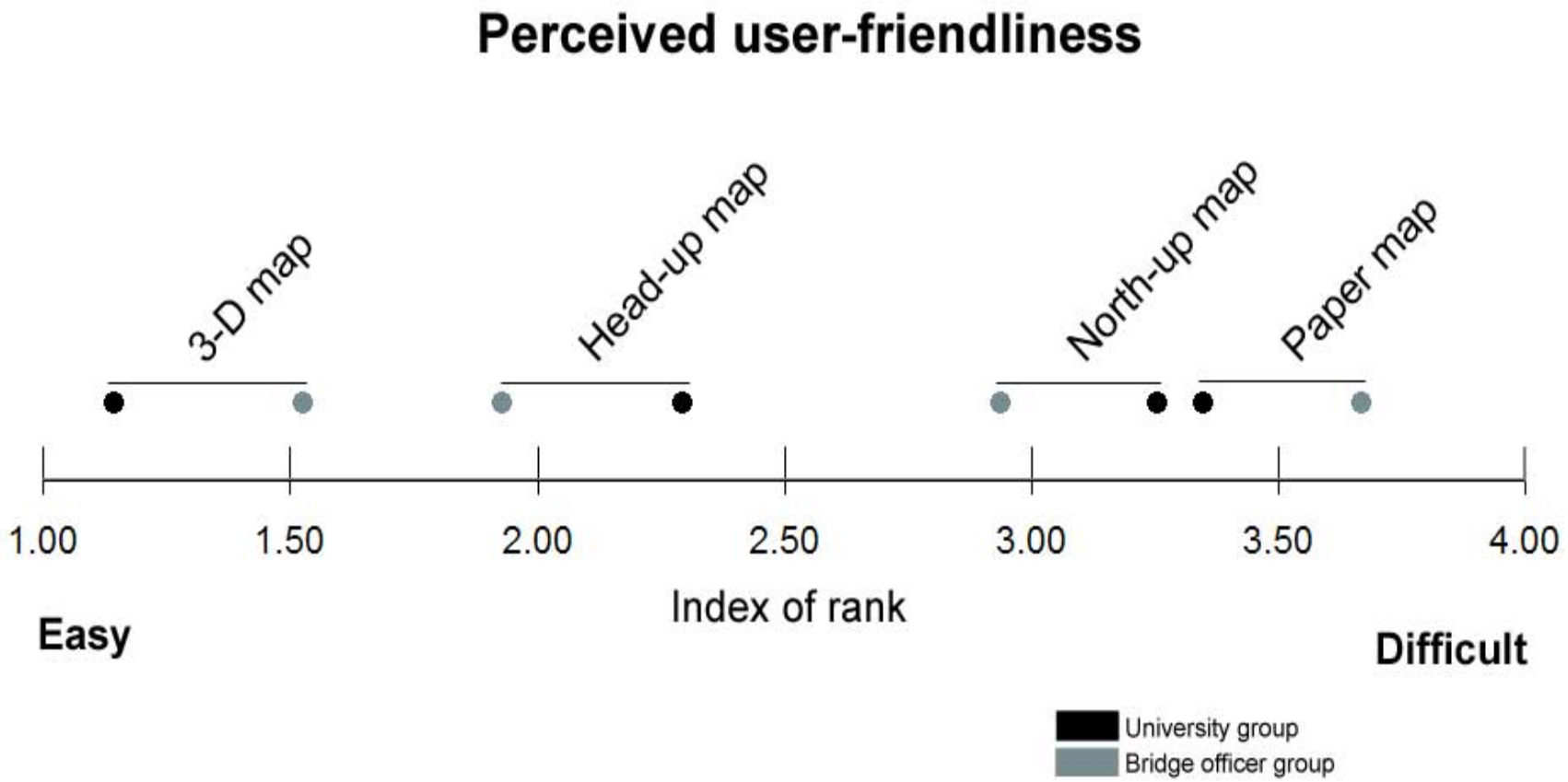


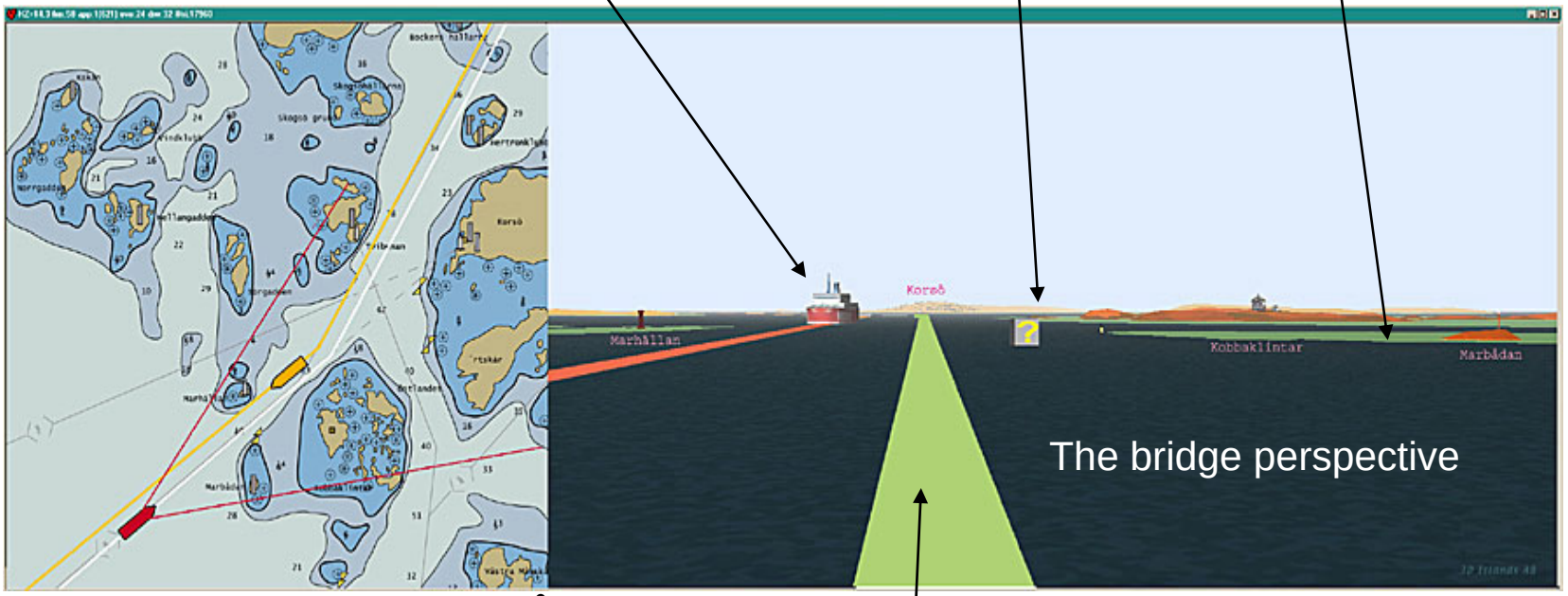
Prison, J., & Porathe, T. (2007). Navigation with 2-D and 3-D Maps: A Comparative Study with Maritime Personnel. *Proceedings of the 39th Nordic Ergonomics Society Conference*, 1-3 October 2007.

We will redo this experiment with Chinese mariners at Dalian Maritime University in November 2011.

Unidentified radar returns

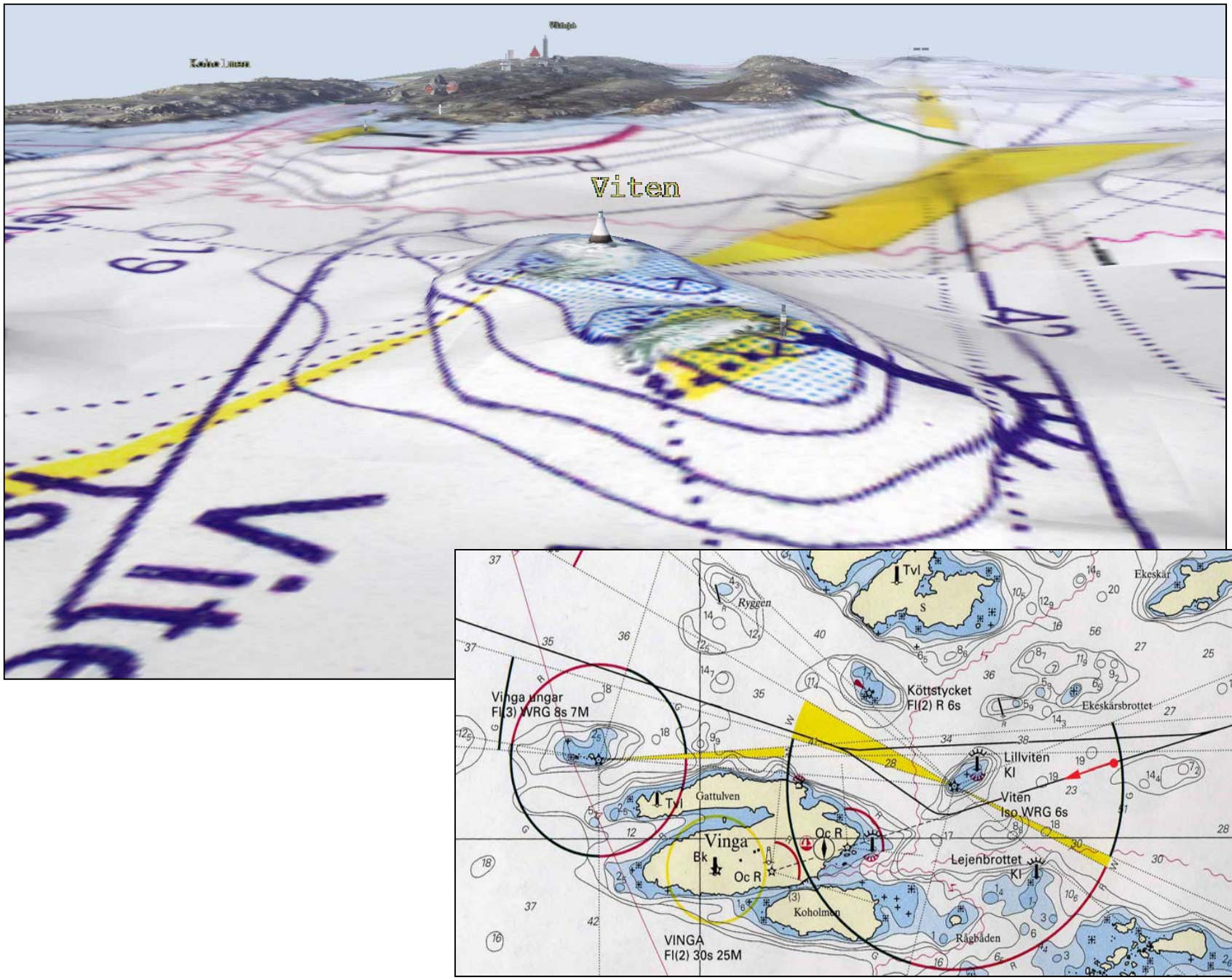
AIS targets

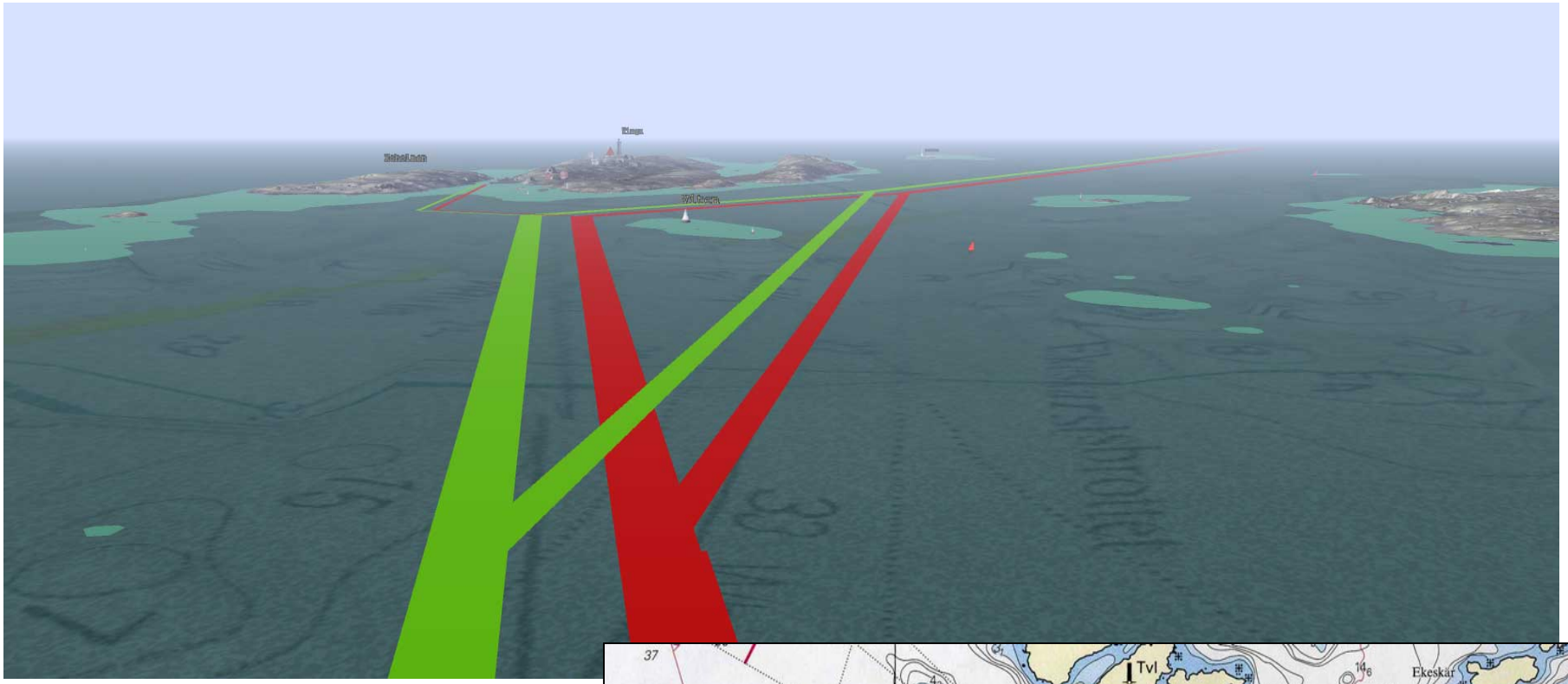
Dynamic NoGo areas

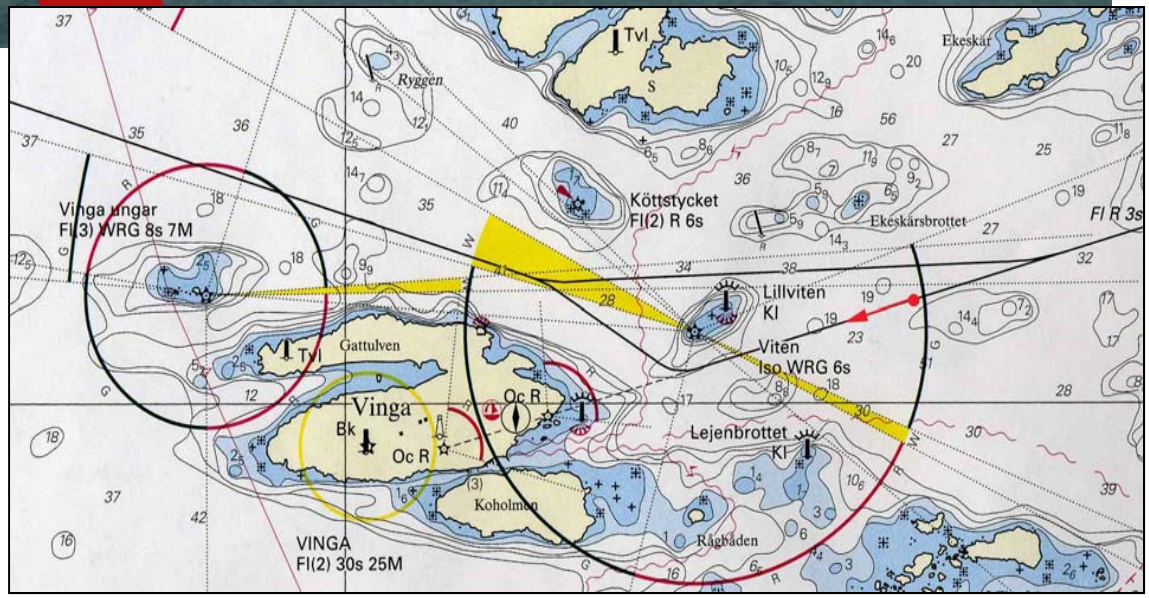


The entrance to Mariehamn, Åland

Traffic separated seaways


Viten
Vinga lingar
Fl(3) WRG 8s 7M
Köttstycket
Fl(2) R 6s
Ekeskärsbrottet
Fl R 3s
Lillviten
Kl
Viten
Iso WRG 6s
Gattulven
Vinga
Bk
Oc R
Oc R
Lejenbrottet
Kl
Koholmen
Rågbåden
VINGA
Fl(2) 30s 25M
Ryggen
Tvl
Tvl
Ekeskär




Tvl
Ryggen
Ekeskär
Köttstycket
Fl(2) R 6s
Ekeskärsbrottet
Fl R 3s
Vinga ungar
Fl(3) WRG 8s 7M
Lillviten
Kl
Viten
Iso WRG 6s
Gattulven
Tvl
Vinga
Bk
Oc R
Oc R
Lejenbrottet
Kl
Koholmen
Rågbåden
VINGA
Fl(2) 30s 25M

Visual iconicity

Hamnen.biz - Arrivals & Departures - Windows Internet Explorer

https://www.ebusiness.portgot.se/arrdepjava/

File Edit View Favorites Tools Help

Istanbul Ferryboats, Turkey | Hamnen.biz - Arrivals & D...

Hamnen.biz - Arrivals & Departures

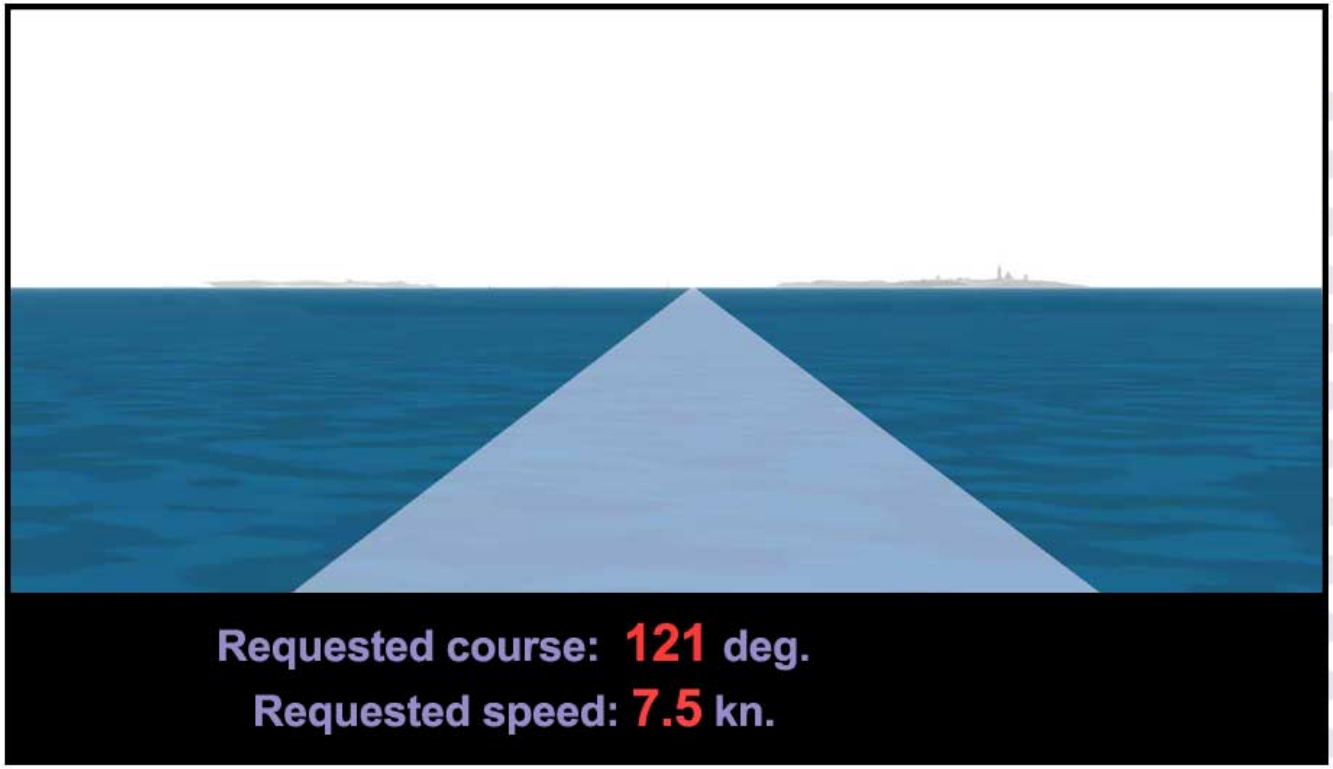
PORT OF GÖTEBORG AB

Close Window

Welcome to the Port of Göteborg

M/S Breeze

Please follow the white leading line to you berhing place:



Done | Internet | 100%

Hamnen.biz - Arrivals & Departures - Windows Internet Explorer

https://www.ebusiness.portgot.se/arrdepjava/

File Edit View Favorites Tools Help

Istanbul Ferryboats, Turkey | Hamnen.biz - Arrivals & D...

PORT OF GÖTEBORG AB

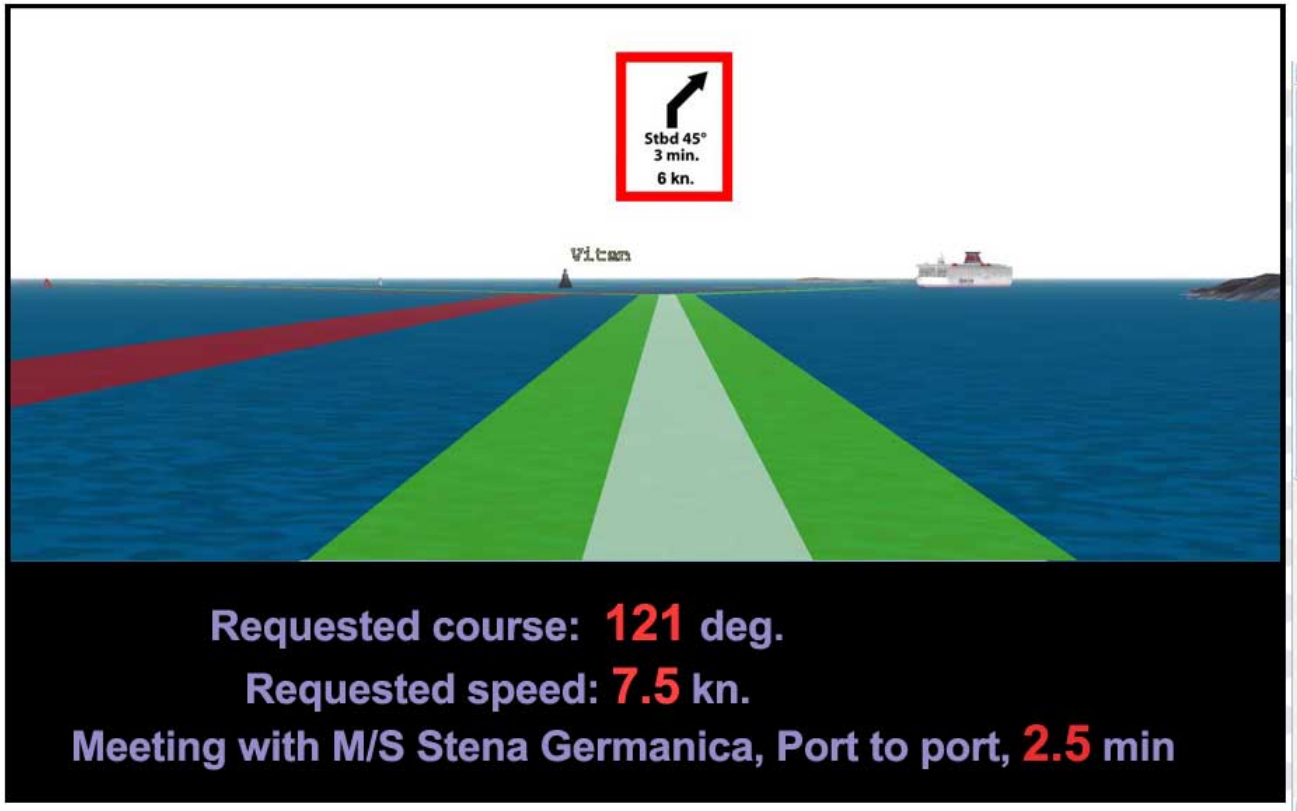
Hamnen.biz - Arrivals & Departures

Close Window

Welcome to the Port of Göteborg

M/S Breeze

Please follow the white leading line to you berhing place:



Requested course: 121 deg.

Requested speed: 7.5 kn.

Meeting with M/S Stena Germanica, Port to port, 2.5 min

Done | Internet | 100%

Hamnen.biz - Arrivals & Departures - Windows Internet Explorer

https://www.ebusiness.portgot.se/arrdepjava/

File Edit View Favorites Tools Help

Istanbul Ferryboats, Turkey | Hamnen.biz - Arrivals & D...

PORT OF GÖTEBORG AB

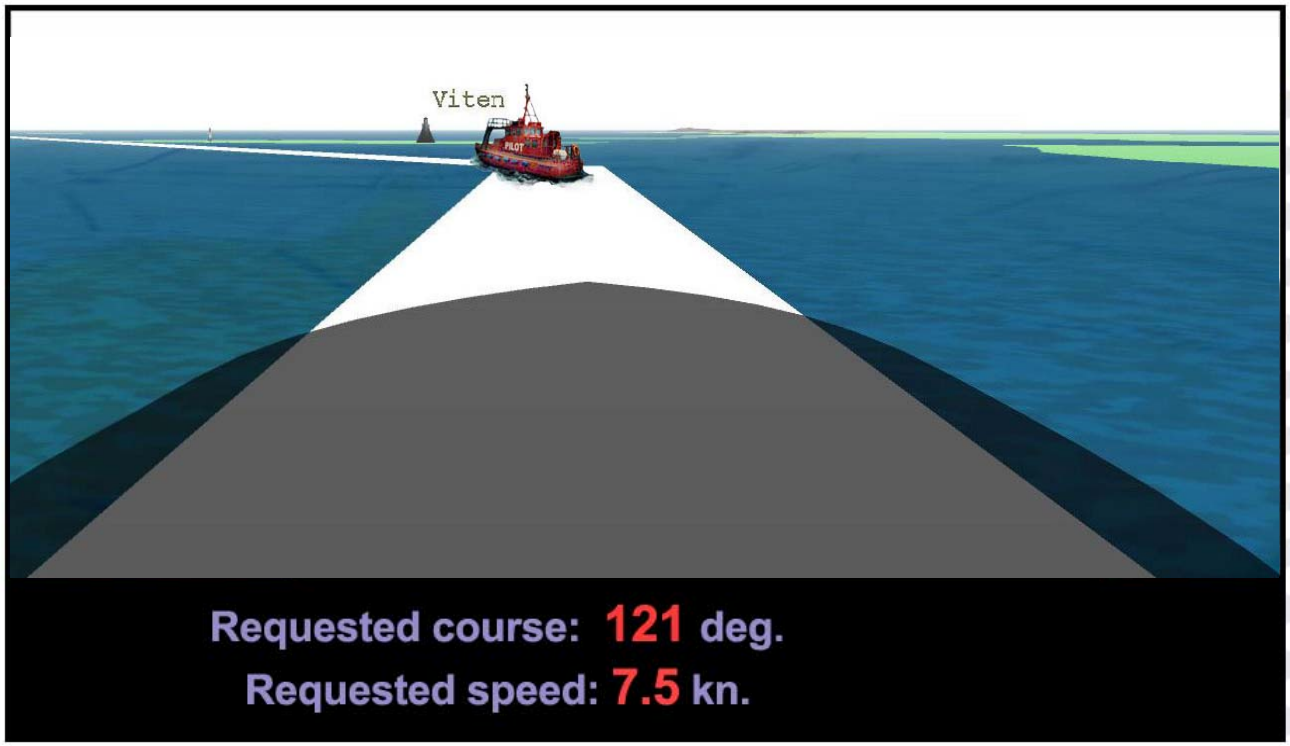
Hamnen.biz - Arrivals & Departures

Close Window

Welcome to the Port of Göteborg

M/S Breeze

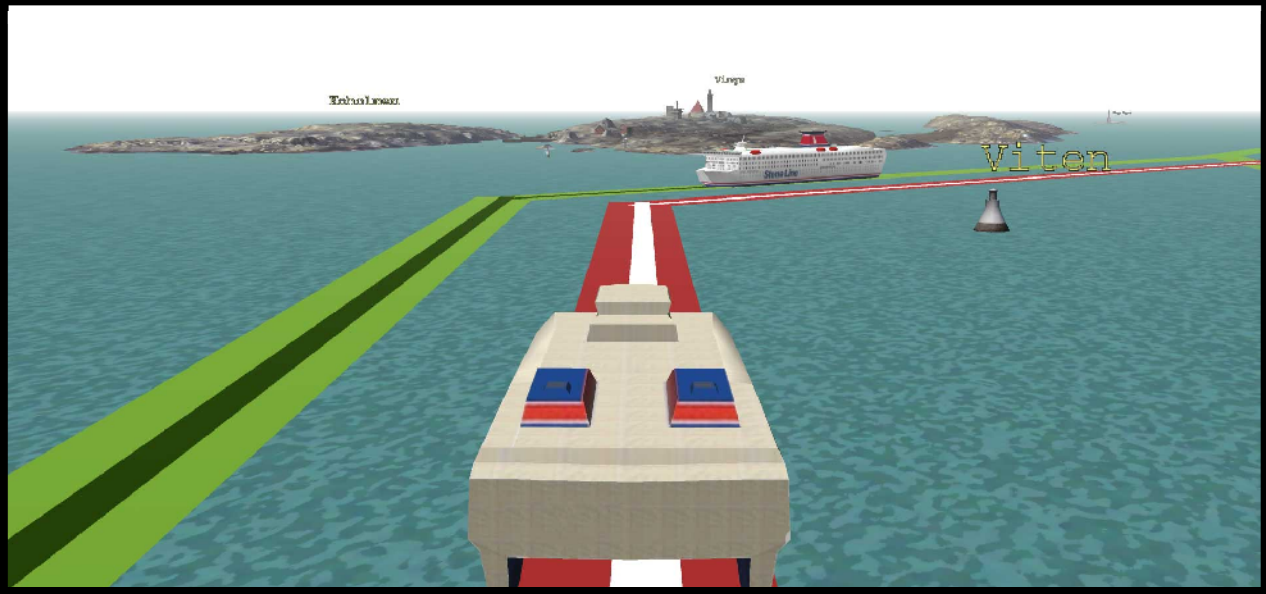
Please follow the white leading line to you berhing place:



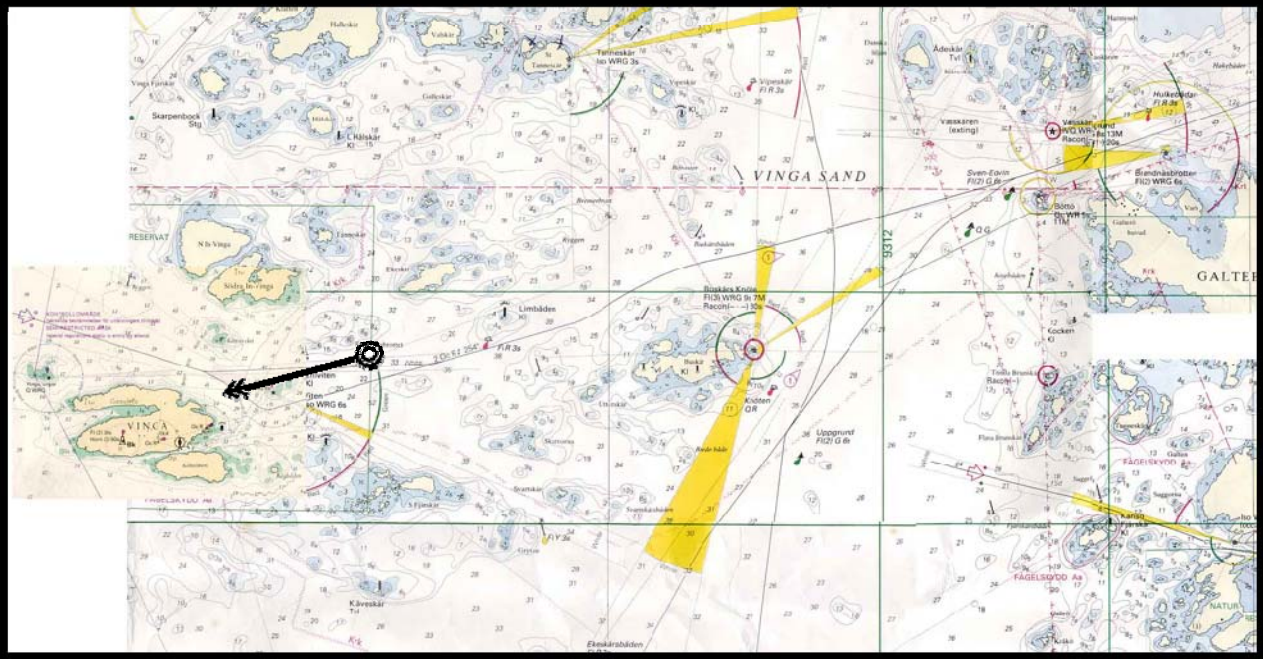
Requested course: 121 deg.

Requested speed: 7.5 kn.

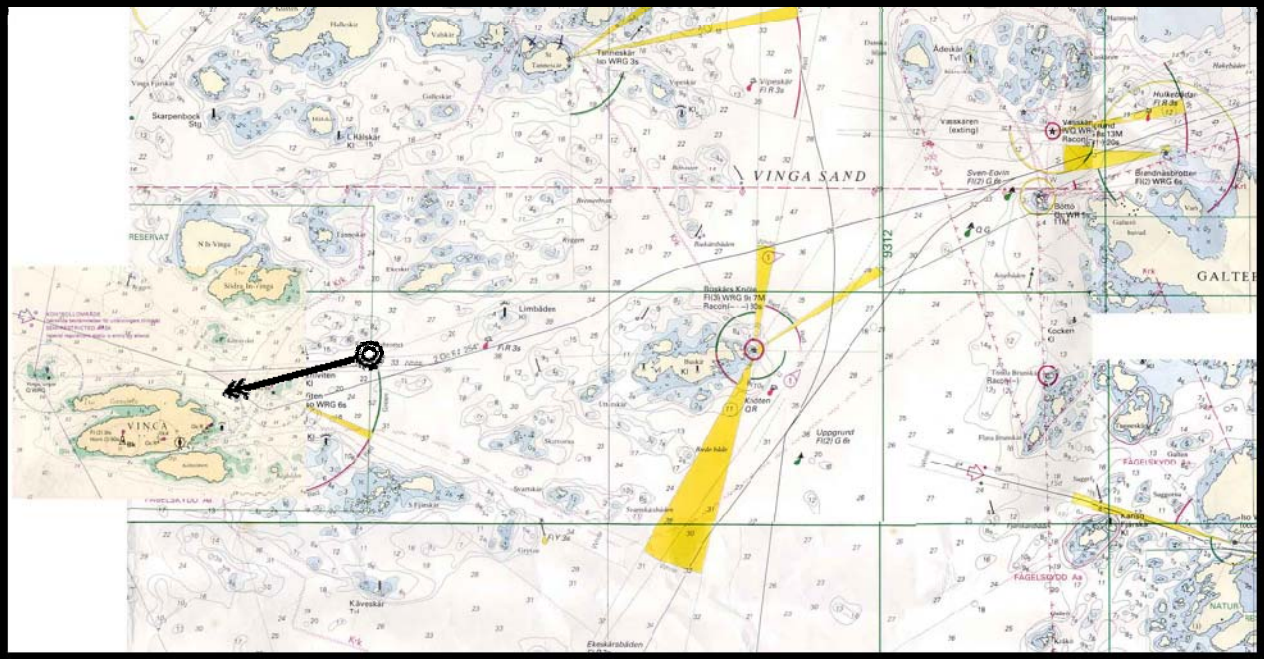
Done | Internet | 100%



Tethered view



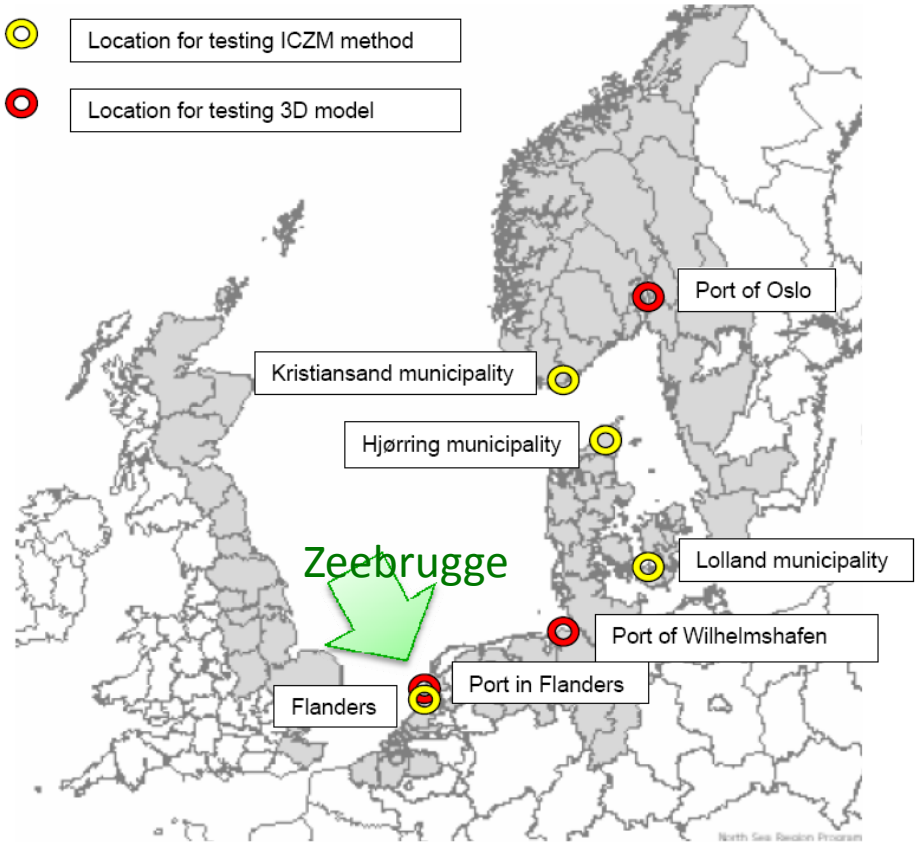
The 3D chart as a HUD in the windscreen



BLAST

(Bringing Land And Sea Thogether)

The Interreg IVB North Sea Region Programme



1	Lead Partner – Norwegian Hydrographic Service
2	Norwegian Coastal Administration
3	National Survey and Cadastre (KMS)
4	Danish Coastal Authority
5	Local Government Denmark
6	National Space Institute
7	Aalborg University
8	Federal Maritime & Hydrographic Agency
9	Jeppesen GmbH
10	T-Kartor AB
11	Malardalen University
12	Natural Environment Research Council
13	Seazone Solutions Ltd.
14	UK Hydrographic Office
15	Agency for Maritime and Coastal Services

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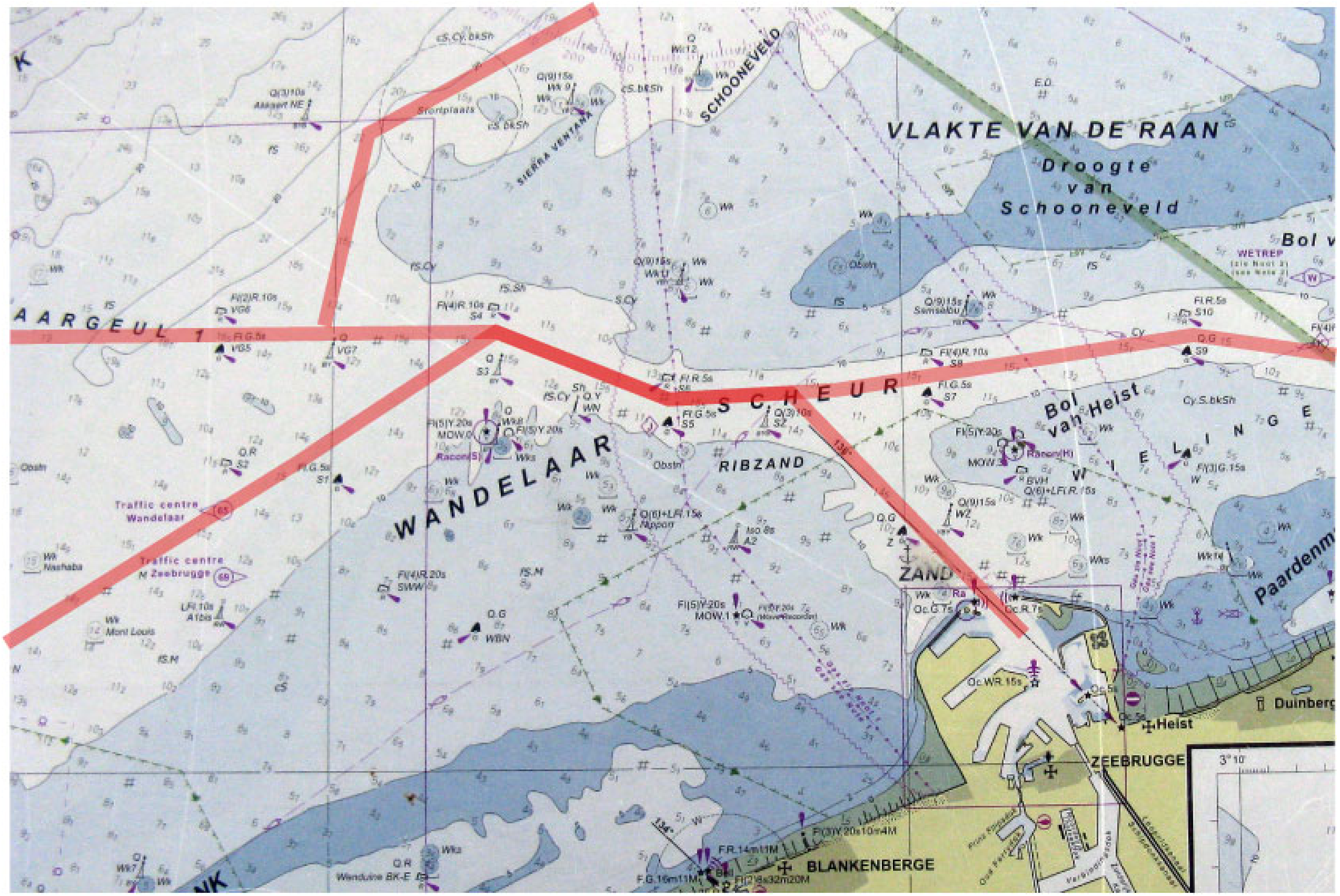
VLAKTE VAN DE RAAN
Droogte van Schooneveld
SCHOONEVELD
WANDELAAR
SCHEUR
RIBZAND
Bol van Heist
WIELINGEN
ZEEBRUGGE
BLANKENBERGE
Heist
Traffic centre Wandelaar
Traffic centre Zeebrugge
Paardenm

Kongsberg Polaris simulator
Antwerp maritime academy

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Onboard the Belgian hydro-graphic survey ship “Ter Streep”

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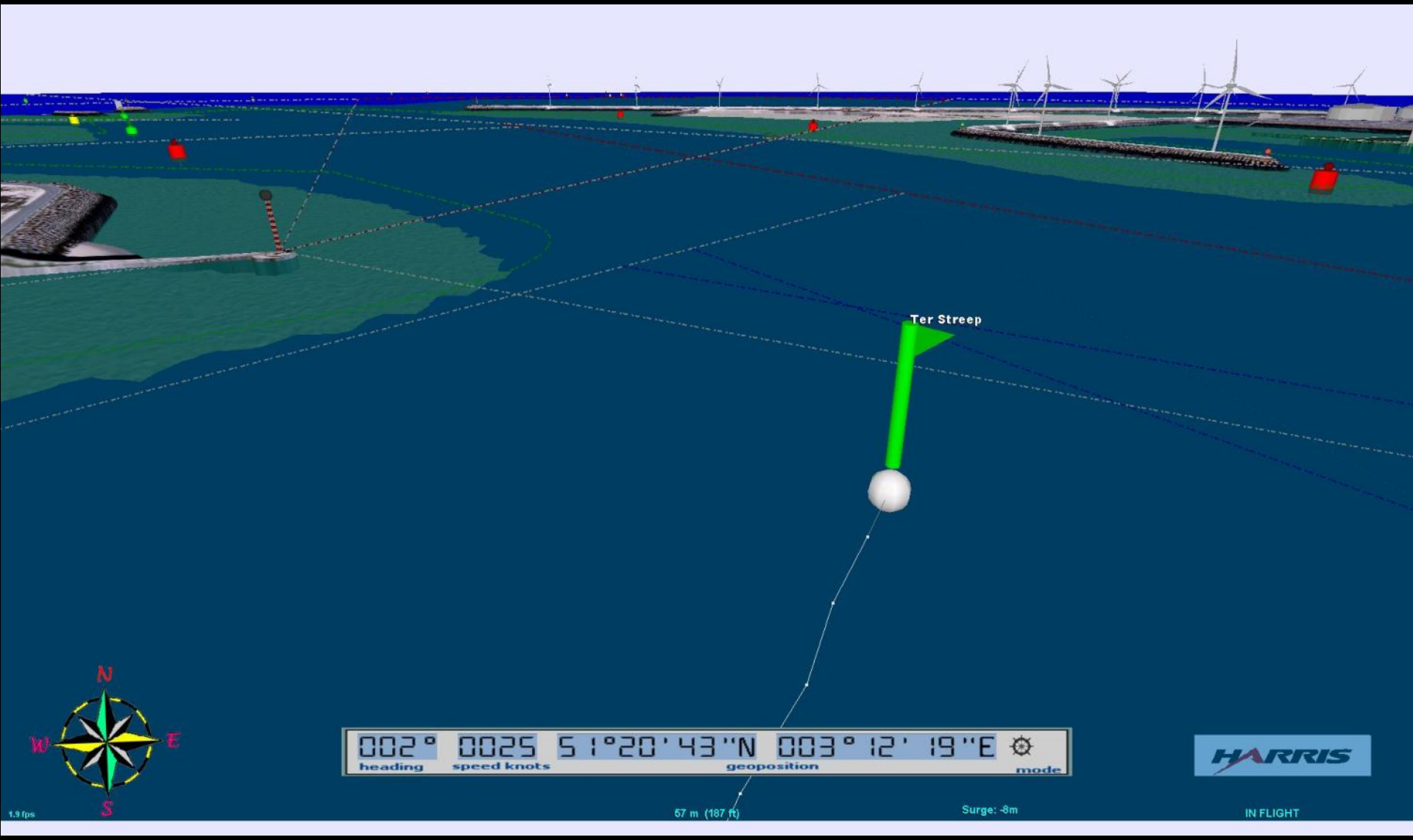
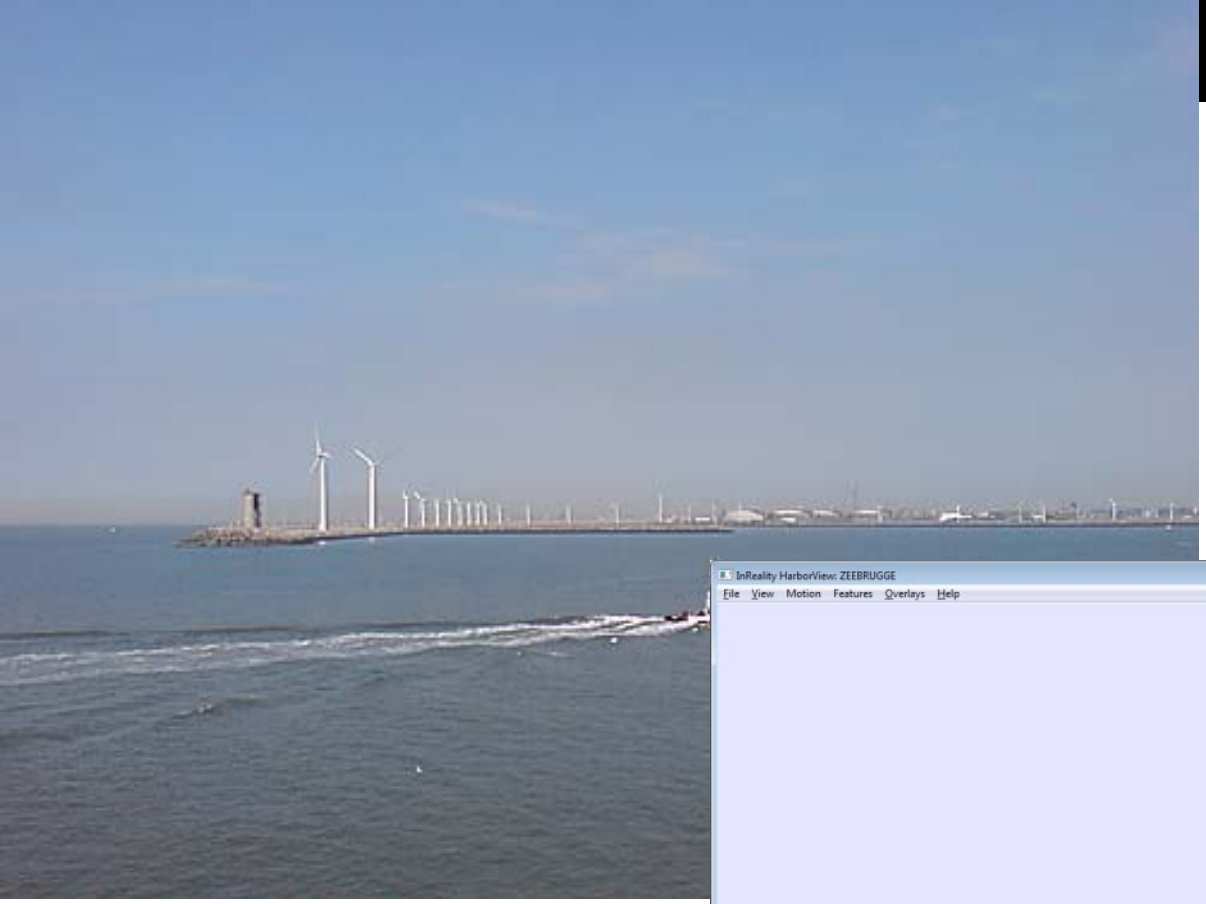
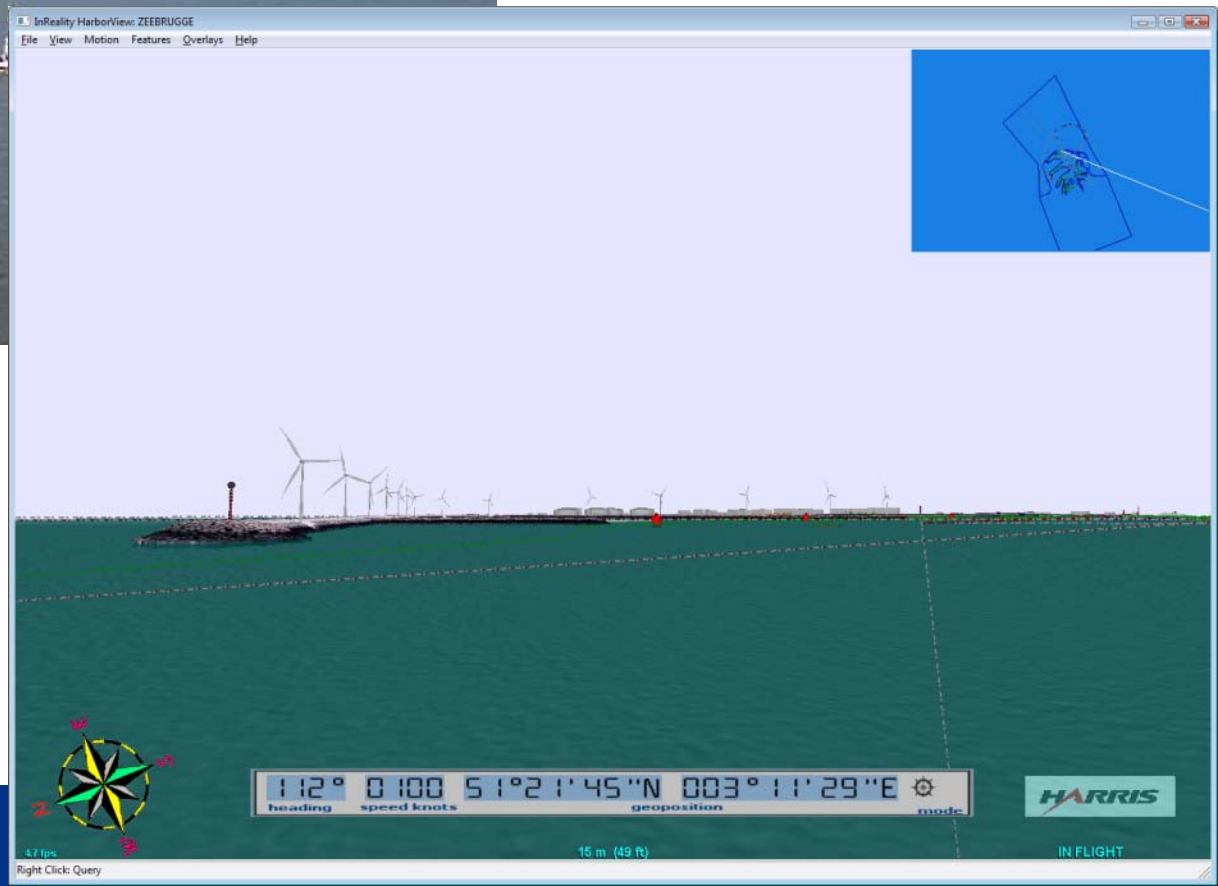
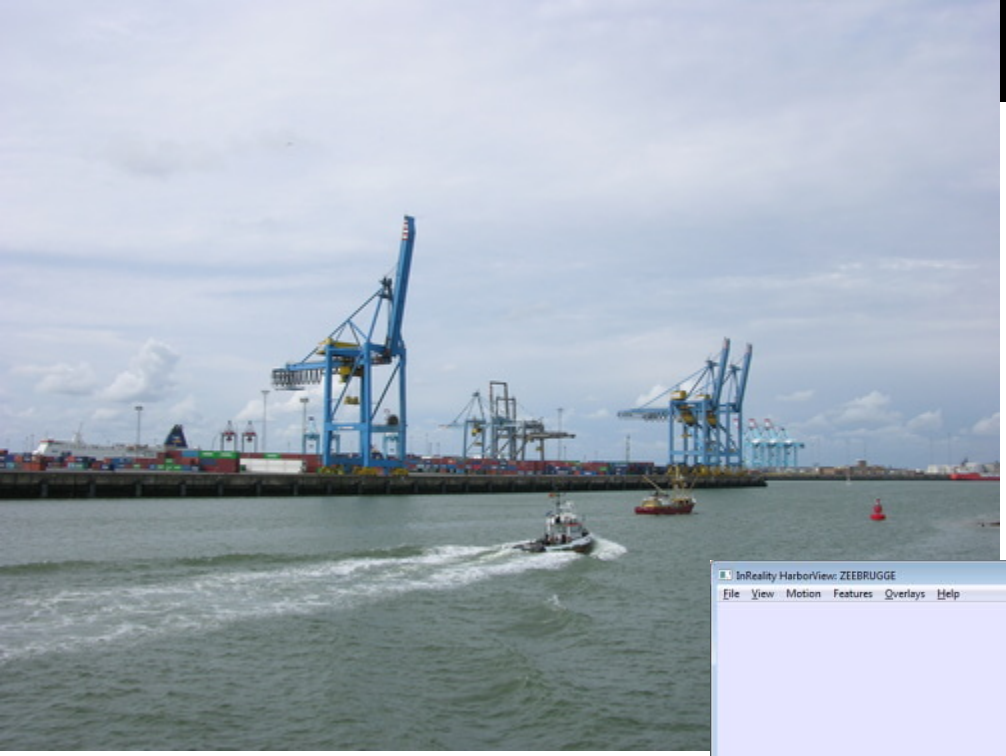

Ter Streep
N
W
E
S
002°
0025
51°20'43"N
003°12'19"E
heading
speed knots
geoposition
mode
HARRIS
1.9 fps
57 m (187 ft)
Surge: -8m
IN FLIGHT

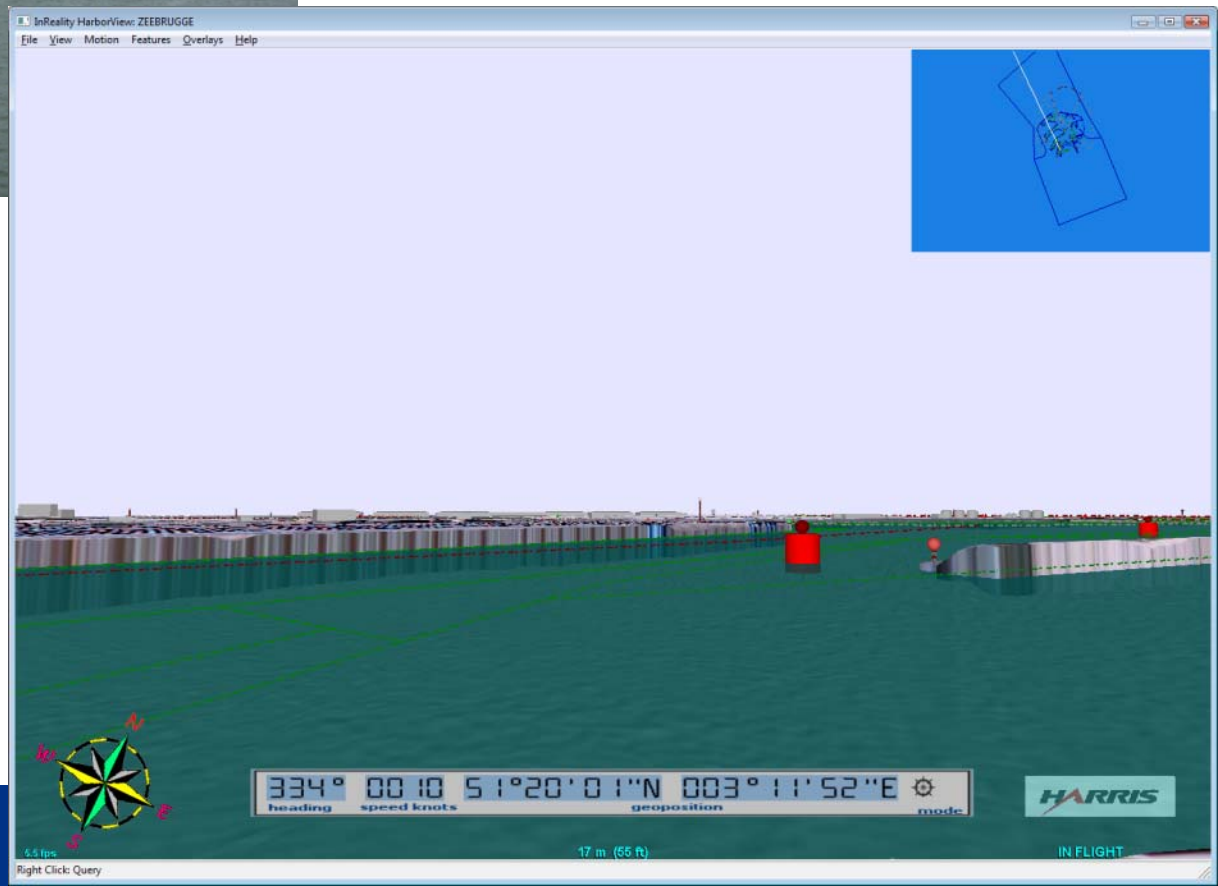


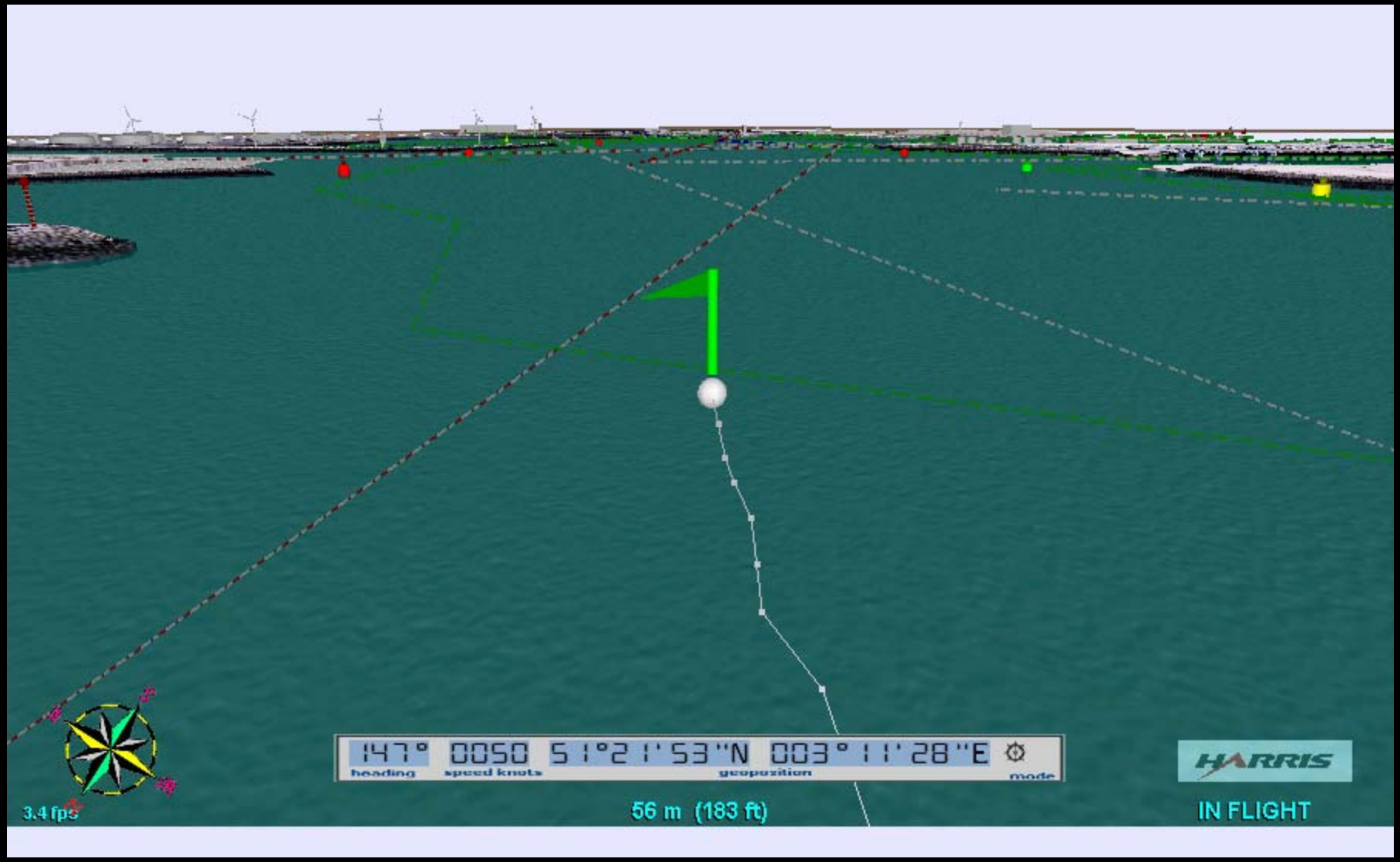


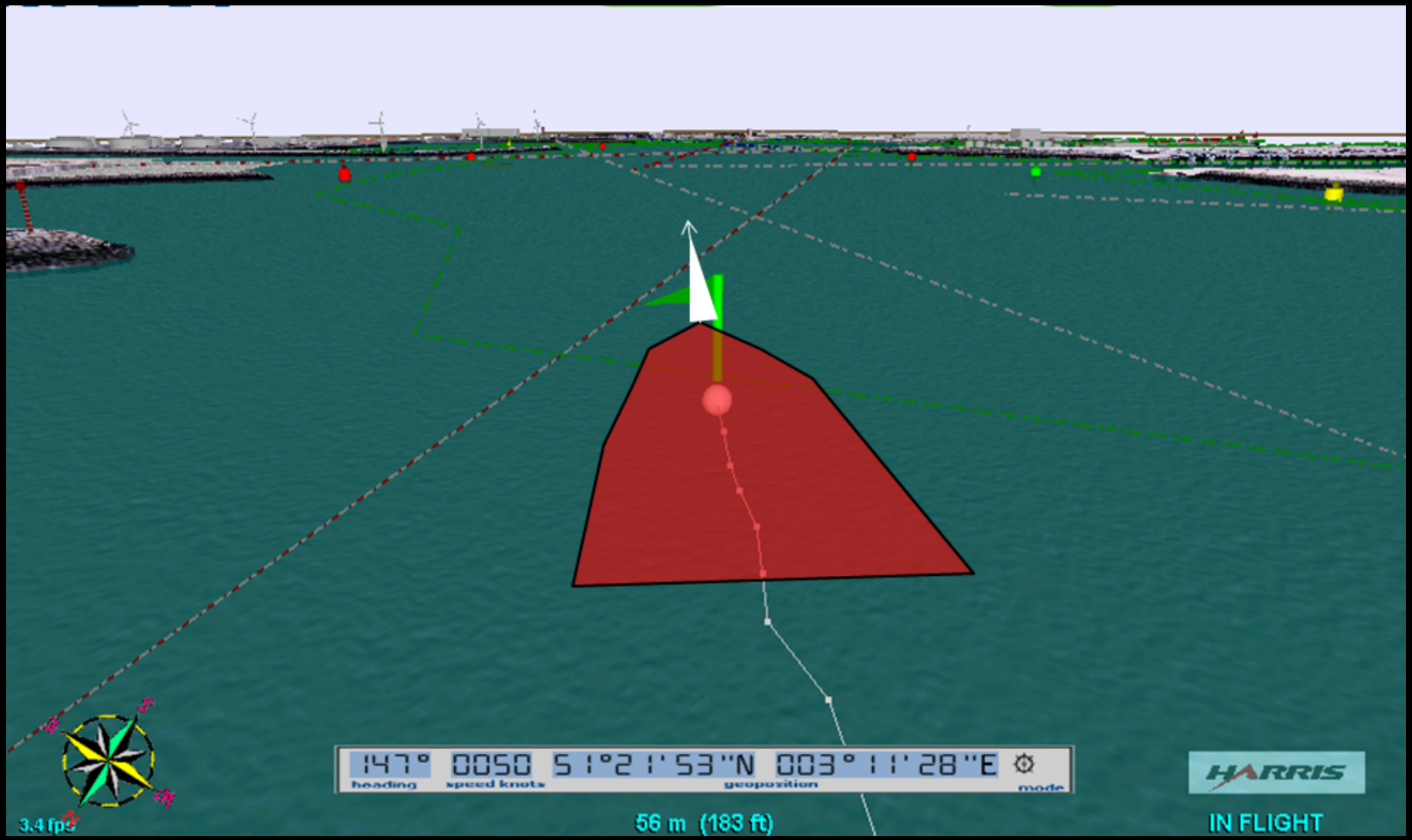
Eastern outer breakwater with wind farm



The Westhoofd quay from the corner of the military dock

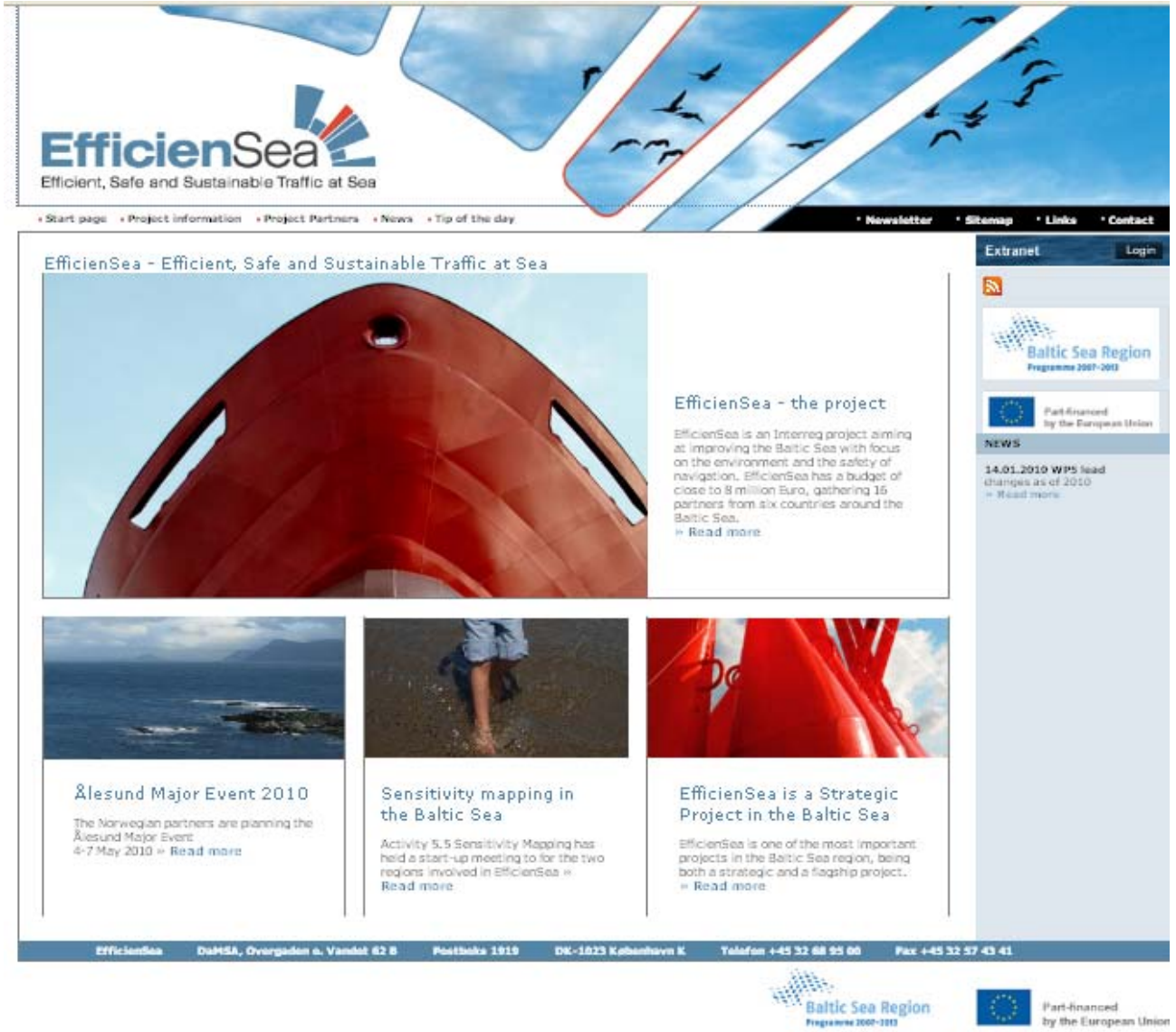


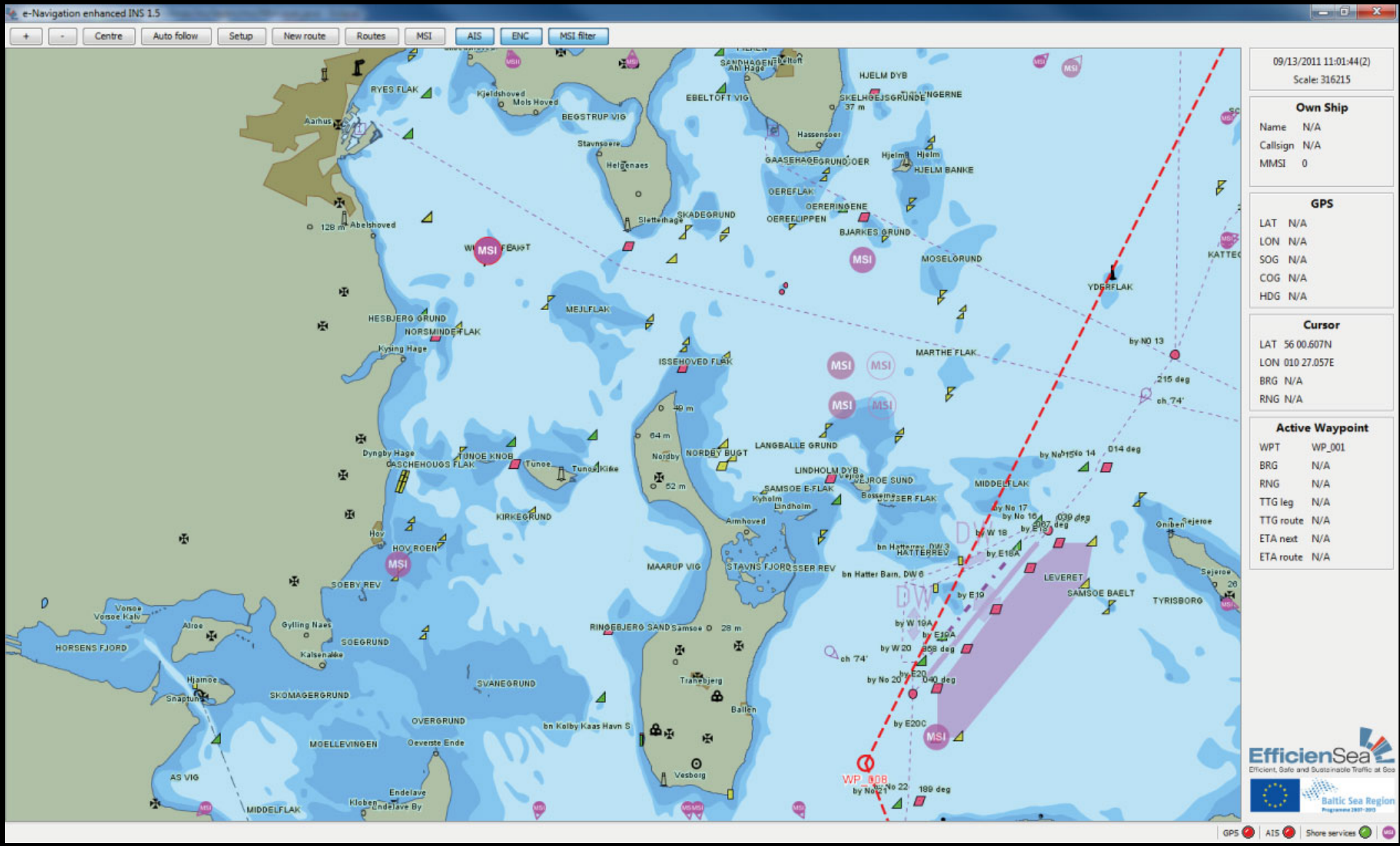

147°
heading
0050
speed knots
51°21'53"N 003°11'28"E
geoposition
mode
3.4 fps
56 m (183 ft)
HARRIS
IN FLIGHT


147°
heading
0050
speed knots
51°21'53"N
003°11'28"E
geoposition
mode
HARRIS
3.4 fps
56 m (183 ft)
IN FLIGHT

2009 - 2012

- Danish Maritime Safety Administration (project leader)
- Norwegian Coastal Administration
- Moere Romsdal County, Norway
- Swedish Maritime Administration
- Swedish Transport Agency
- SSPA, Sweden
- Chalmers University of Technology Sweden
- Maritime University Szczecin, Poland
- National Institute of Technology, Poland
- Gdynia Maritime University, Poland
- Maritime Institute in Gdansk, Poland
- Maritime Office Gdynia, Poland
- Kymenlaakso University, Finland
- Finnish Maritime Administration
- Helsinki University of Technology, Finland
- Estonian Maritime Administration

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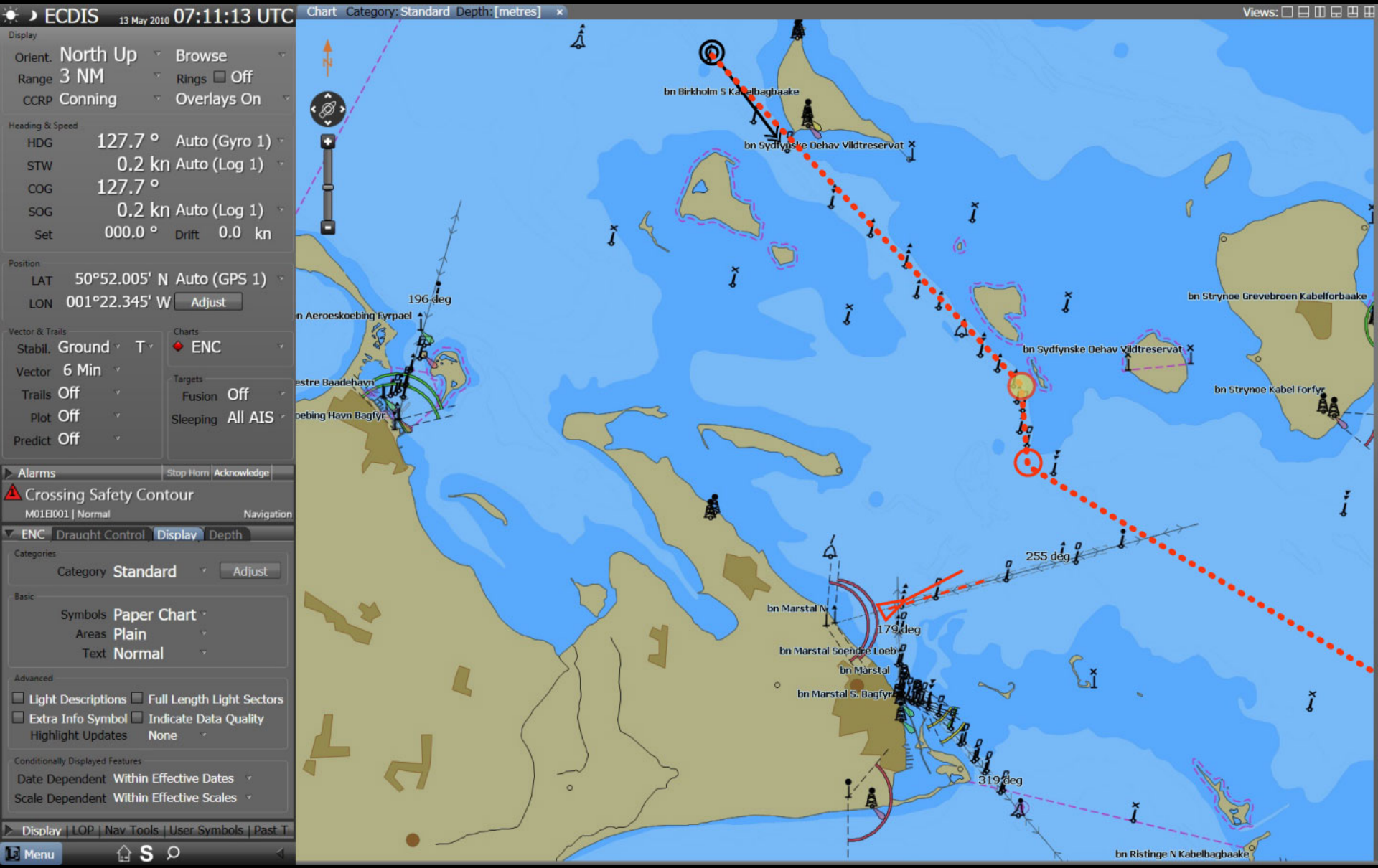
+
-
Centre
Auto follow
Setup
New route
Routes
MSI
AIS
ENC
MSI filter
09/13/2011 11:01:44(2)
Scale: 316215
Own Ship
Name N/A
Callsign N/A
MMSI 0
GPS
LAT N/A
LON N/A
SOG N/A
COG N/A
HDG N/A
Cursor
LAT 56 00.607N
LON 010 27.057E
BRG N/A
RNG N/A
Active Waypoint
WPT WP_001
BRG N/A
RNG N/A
TTG leg N/A
TTG route N/A
ETA next N/A
ETA route N/A
RYES FLAK
Aarhus
Kjelshoved
Mols Hoved
BEGSTRUP VIG
Stavnsoere
Helgenaes
EBELTOFT VIG
HJELM DYB
SKELHOEJSGRUNDE
Hassensoer
GAASEHAGEGRUND
HJELM BANKE
OEREFLAK
OEREFLIPPEN
BJARKES GRUND
MOSELGRUND
YDERFLAK
Abelshoved
SKADEGRUND
MEJLFLAK
HESBJERG GRUND
NORSMINDE FLAK
Kysing Hage
ISSEHOVED FLAK
MARTHE FLAK
LANGBALLE GRUND
NORDBY BUGT
LINDHOLM DYB
SEJROE SUND
MIDDELFLAK
SAMSOE E-FLAK
KIRKEGRUND
HOV ROEN
MAARUP VIG
STAVNS FJORD
HATTERREV
LEVERET
SAMSOE BAELT
TYRISBORG
SOEBY REV
HORSENS FJORD
SOEGRUND
RINGEBJERG SAND
SVANEGRUND
SKOMAGERGRUND
OVERGRUND
MOELLEVINGEN
AS VIG
MIDDELFLAK
Vesborg
Ballen
WP_008
EfficienSea
Efficient, Safe and Sustainable Traffic at Sea
Baltic Sea Region
GPS
AIS
Shore services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13 May 2010 07:11:13 UTC
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Orient. North Up
Browse
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Rings Off
CCRP Conning
Overlays On
Heading & Speed
HDG 127.7 °
Auto (Gyro 1)
STW 0.2 kn
Auto (Log 1)
COG 127.7 °
SOG 0.2 kn
Auto (Log 1)
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Drift 0.0 kn
Position
LAT 50°52.005' N
Auto (GPS 1)
LON 001°22.345' W
Adjust
Vector & Trails
Stabil. Ground T
Vector 6 Min
Trails Off
Plot Off
Predict Off
Charts
ENC
Targets
Fusion Off
Sleeping All AIS
Alarms
Stop Horn
Acknowledge
Crossing Safety Contour
M01EI001 | Normal
Navigation
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Display
Depth
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Category Standard
Adjust
Basic
Symbols Paper Chart
Areas Plain
Text Normal
Advanced
Light Descriptions
Full Length Light Sectors
Extra Info Symbol
Indicate Data Quality
Highlight Updates None
Conditionally Displayed Features
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Scale Dependent Within Effective Scales
Display | LOP | Nav Tools | User Symbols | Past T
Menu
Chart Category: Standard Depth: [metres]
Views:
bn Birkholm S Kabelbagbaake
bn Sydfynske Dehav Vildtreservat
196 deg
bn Strynoe Grevebroen Kabelforbaake
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bn Strynoe Kabel Forfyr
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179 deg
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319 deg
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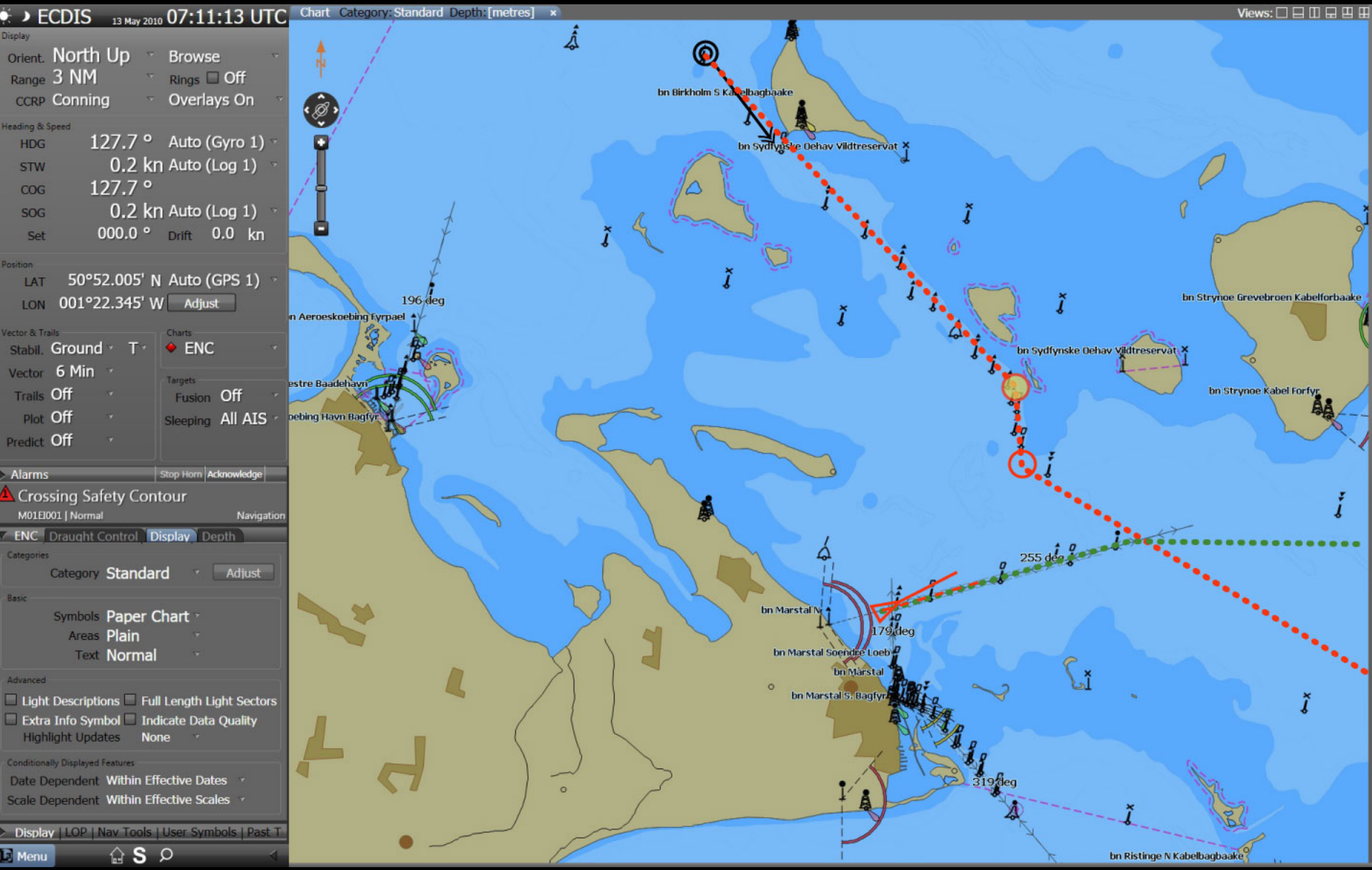
ECDIS
13 May 2010 07:11:13 UTC
Display
Orient. North Up
Browse
Range 3 NM
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HDG 127.7 °
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Set 000.0 °
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LAT 50°52.005' N
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Adjust
Vector & Trails
Stabil. Ground T
Vector 6 Min
Trails Off
Plot Off
Predict Off
Charts
ENC
Targets
Fusion Off
Sleeping All AIS
Alarms
Stop Horn
Acknowledge
Crossing Safety Contour
M01EI001 | Normal
Navigation
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Draught Control
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Depth
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Basic
Symbols Paper Chart
Areas Plain
Text Normal
Advanced
Light Descriptions
Full Length Light Sectors
Extra Info Symbol
Indicate Data Quality
Highlight Updates None
Conditionally Displayed Features
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bn Birkholm S Kabelbagbaake
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179 deg
bn Marstal Soendre Loeb
bn Marstal
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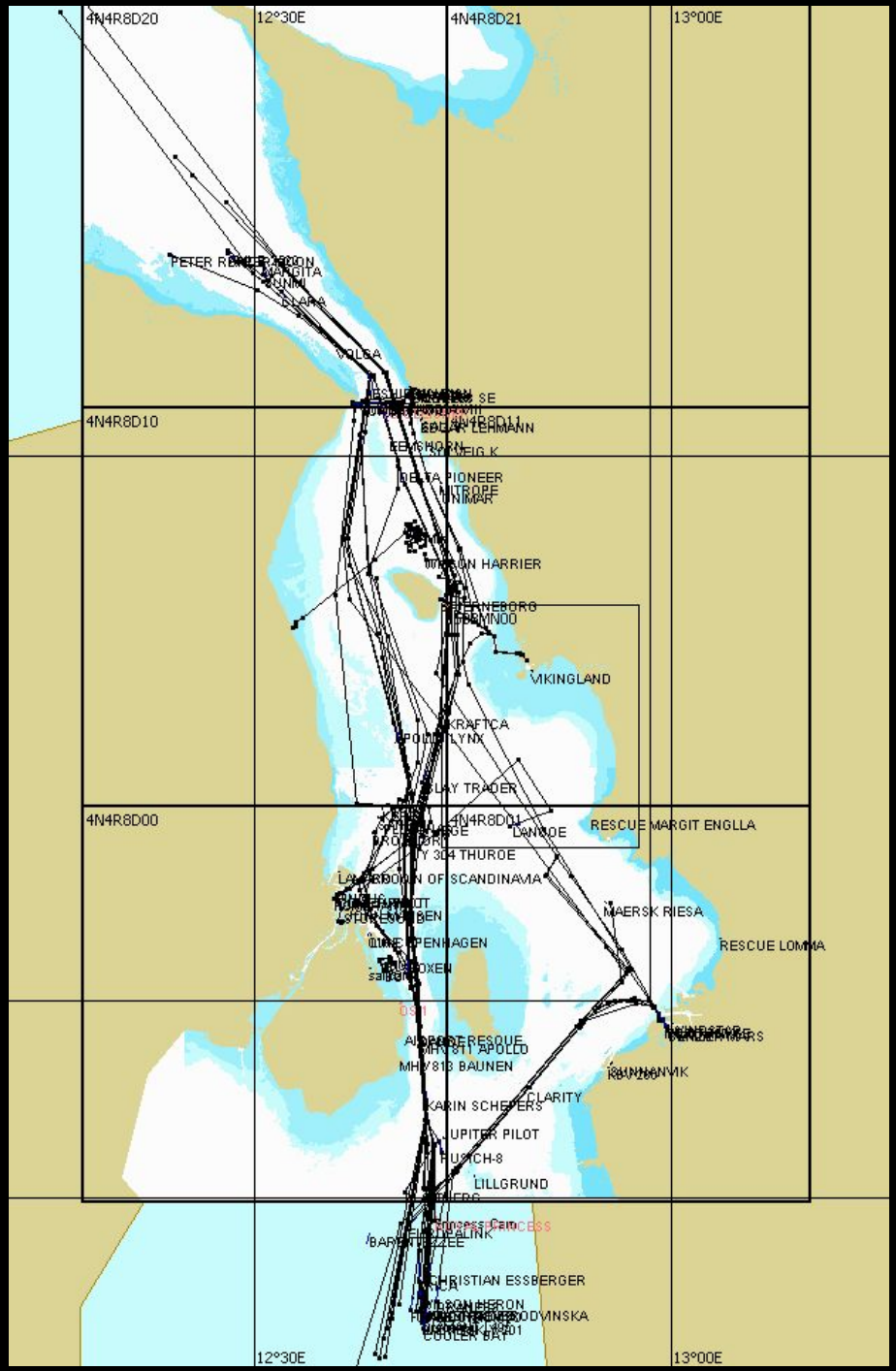
319 deg
bn Ristinge N Kabelbagbaake

http://www.marintraffic.com 2011-09-06, 21:56

thomas.porathe@.chalmers.se


4N4R8D20
12°30E
4N4R8D21
13°00E
4N4R8D10
4N4R8D00
4N4R8D01
VIKINGLAND
RESCUE MARGIT ENGLLA
MAERSK RIESA
RESCUE LOMMA
CLARITY
UPITER PILOT
LILLGRUND
CHRISTIAN ESSBERGER
12°30E
13°00E

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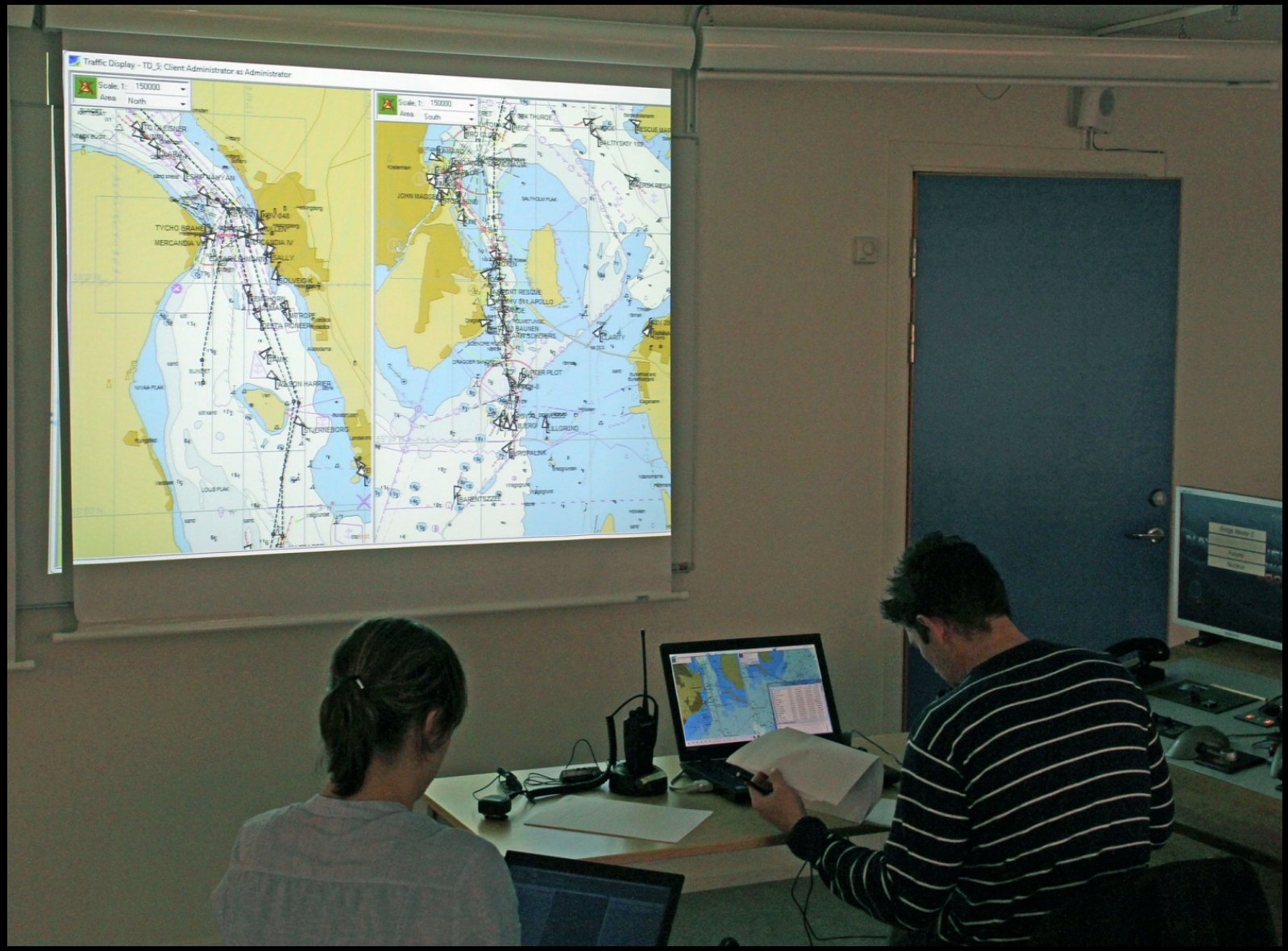
Traffic Display - TD_3: Client Administrator as Administrator
Scale: 1: 150000
Area: North
Scale: 1: 150000
Area: South


EfficienSea
TRANSAS

EfficienSea
Efficient, Safe and Sustainable Traffic at Sea

Distributing search patterns using ECDIS

Thomas Porathe
Chalmers University of Technology

Fredrik Forsman,
Swedish Sea Rescue Society

Ole Borup,
Danish Maritime Safety Administration

INTERNATIONAL MARITIME RESCUE

World Maritime Rescue Congress

Shanghai 24-28 August 2011

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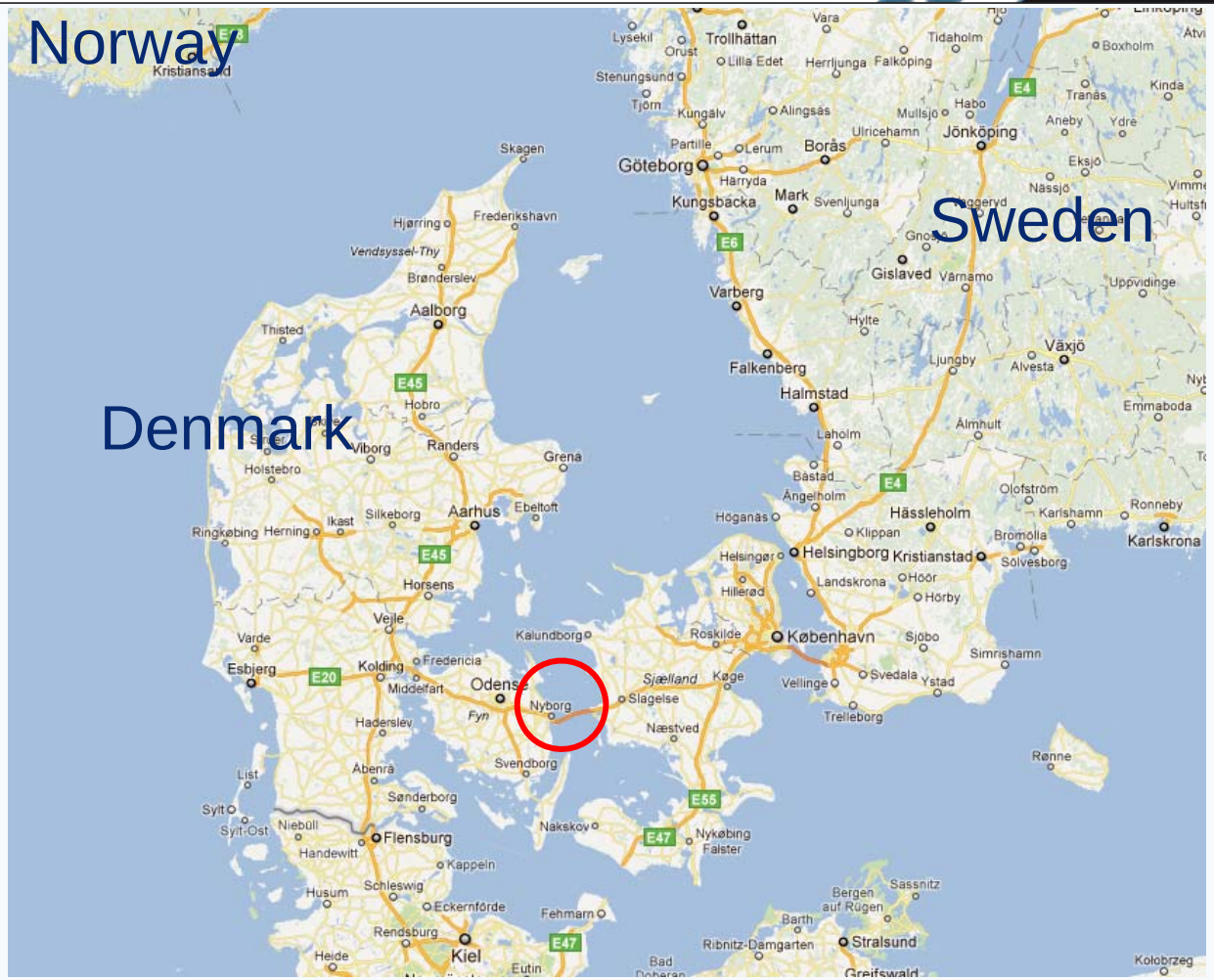

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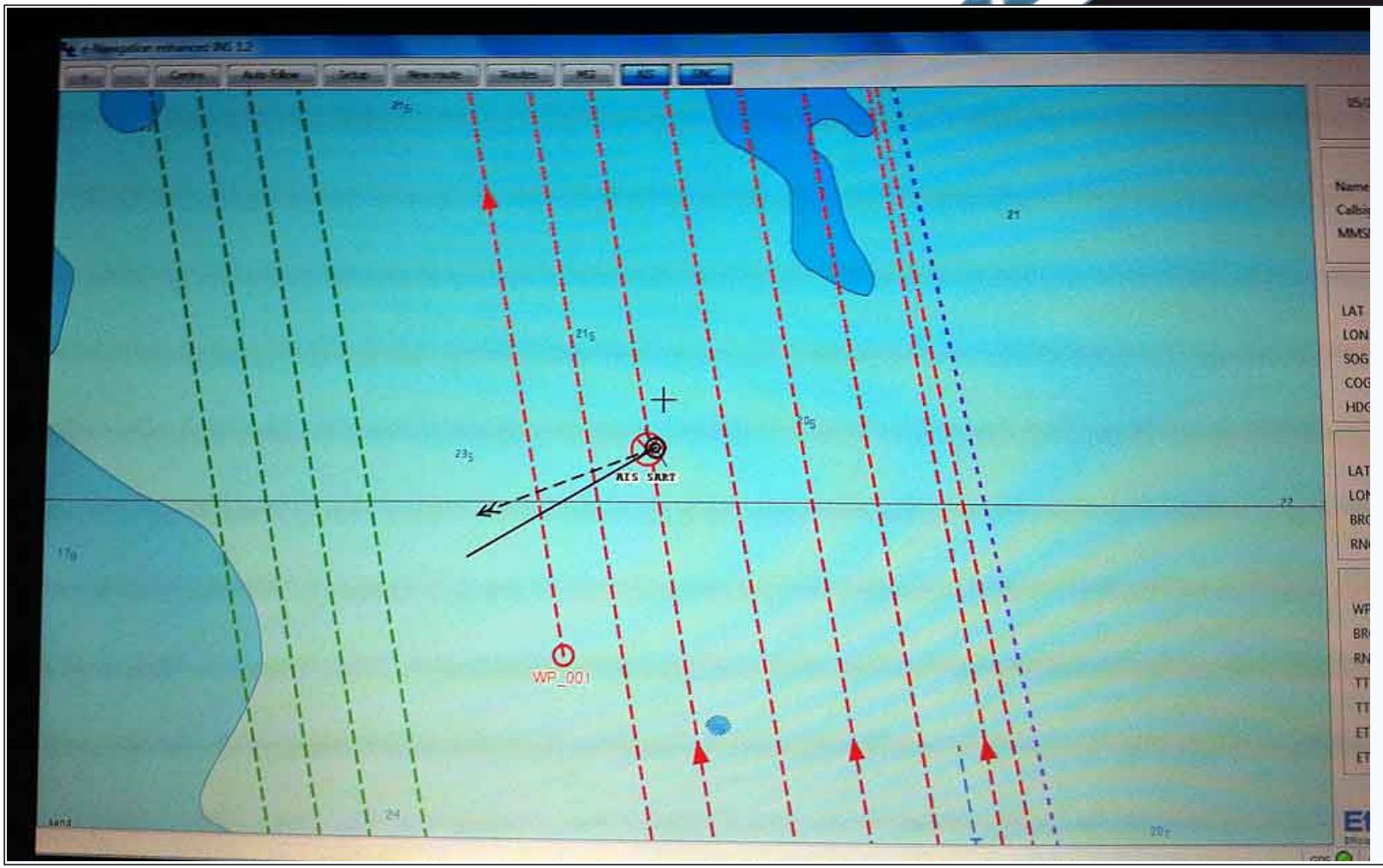

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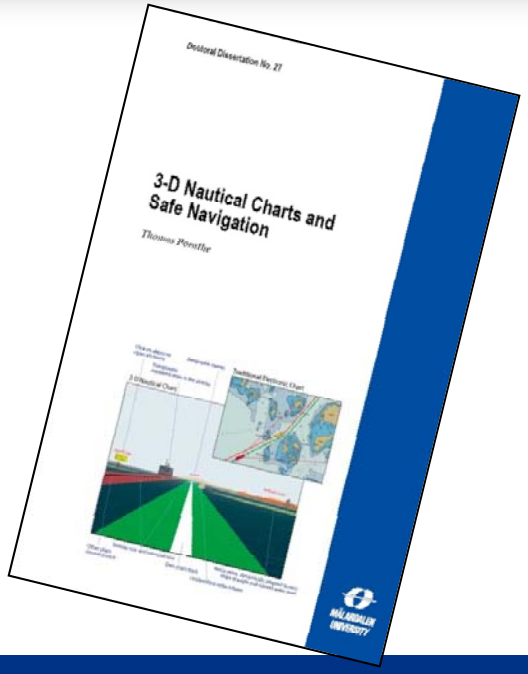
The 3D chart as a HUD in the windscreen



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www.diva-portal.org Search for author ”Porathe”

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