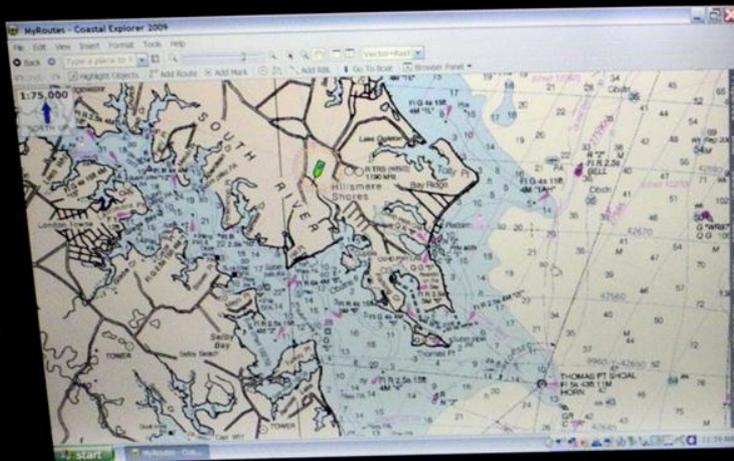




The Navigator's Art *electronic navigation*

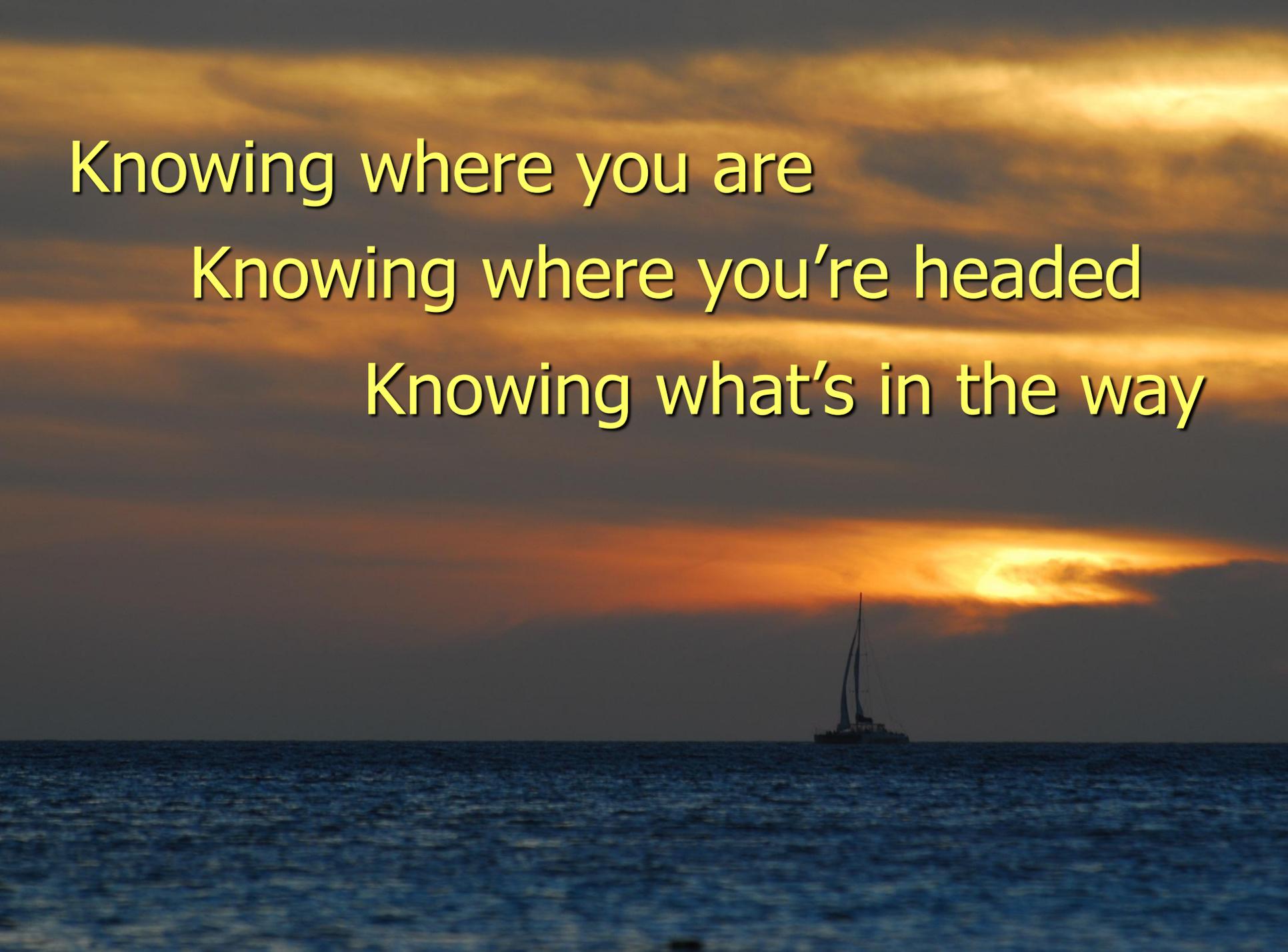
Presented by- Ralph Naranjo



Knowing where you are

Knowing where you're headed

Knowing what's in the way



A new solution to an old puzzle



Measuring certainty

▶ Visual fix



▶ Electronic fix



▶ Estimated position



▶ Dead Reckoning (DR)



NMEA Conference



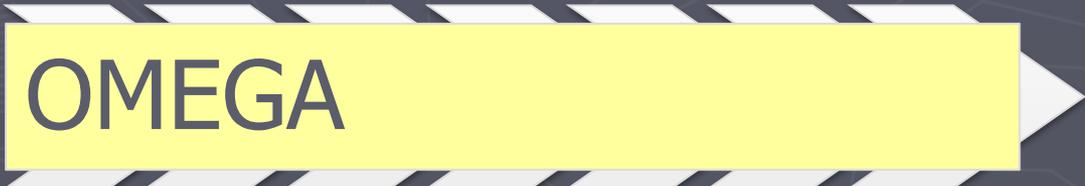
Electronic Navigation



LORAN

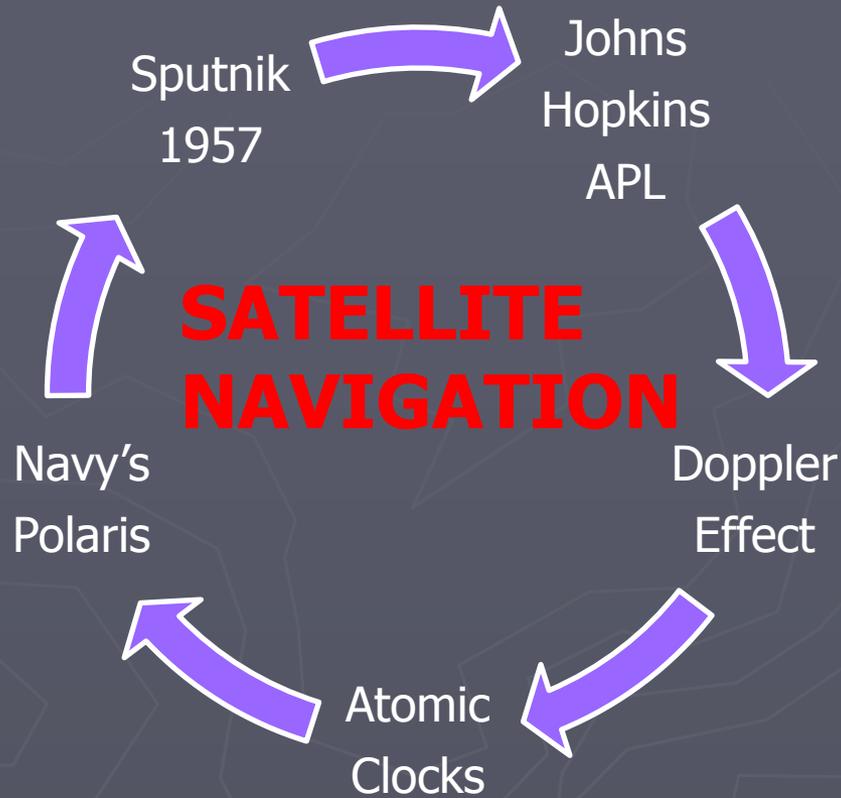


DECCA



OMEGA

General Relativity



1973

Sat Nav

1984

GPS

2000

GPS (SA)

2012

Remove SA

GPS (Gen III) WASS



GLONASS

GALILEO

CHINA/INDIA



Pseudorange



Time counts

Sundial

Hour glass

Harrison's clock

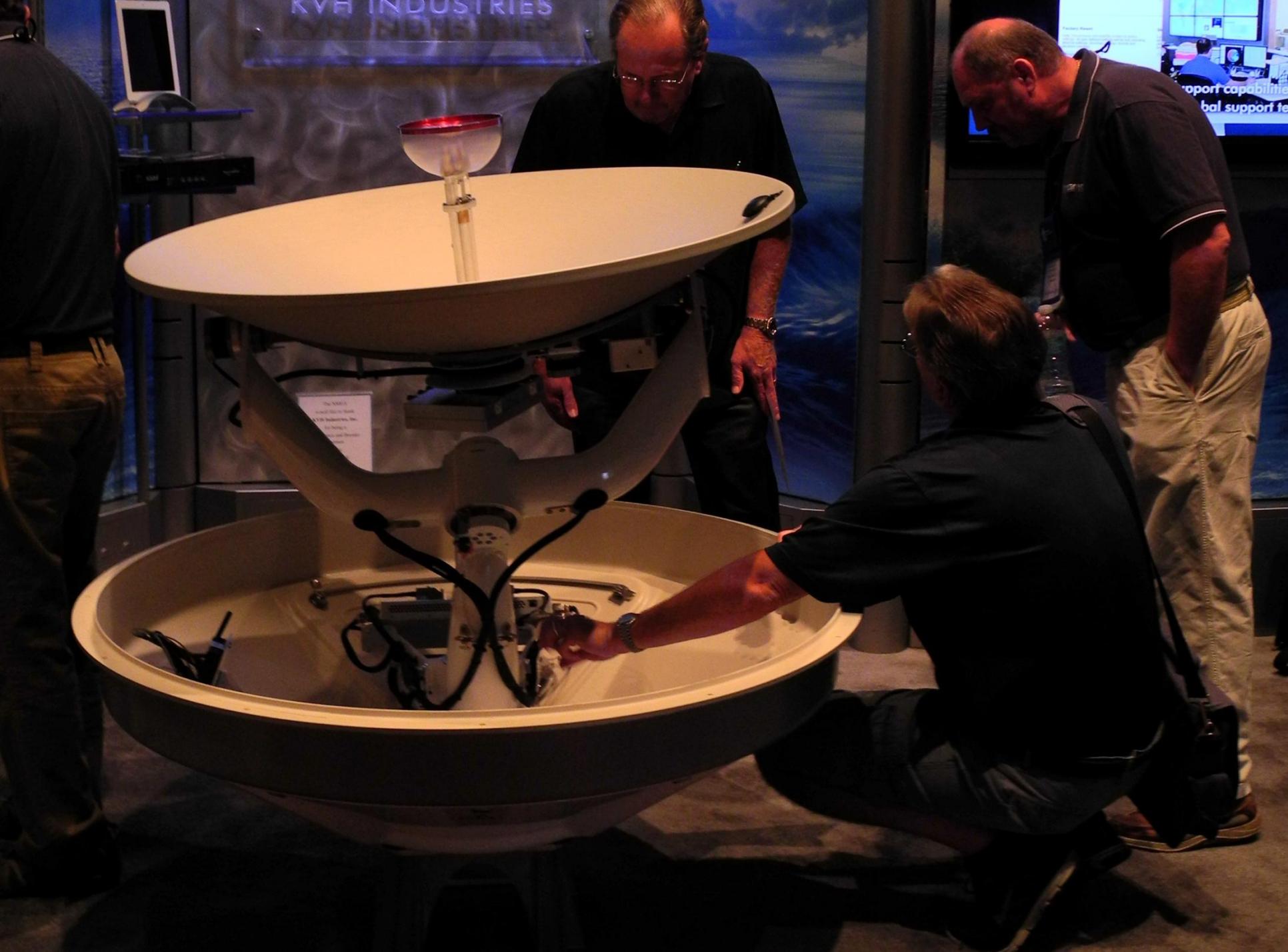
Quartz watch

Atomic clock

Quantum logic clock



KVA INDUSTRIES



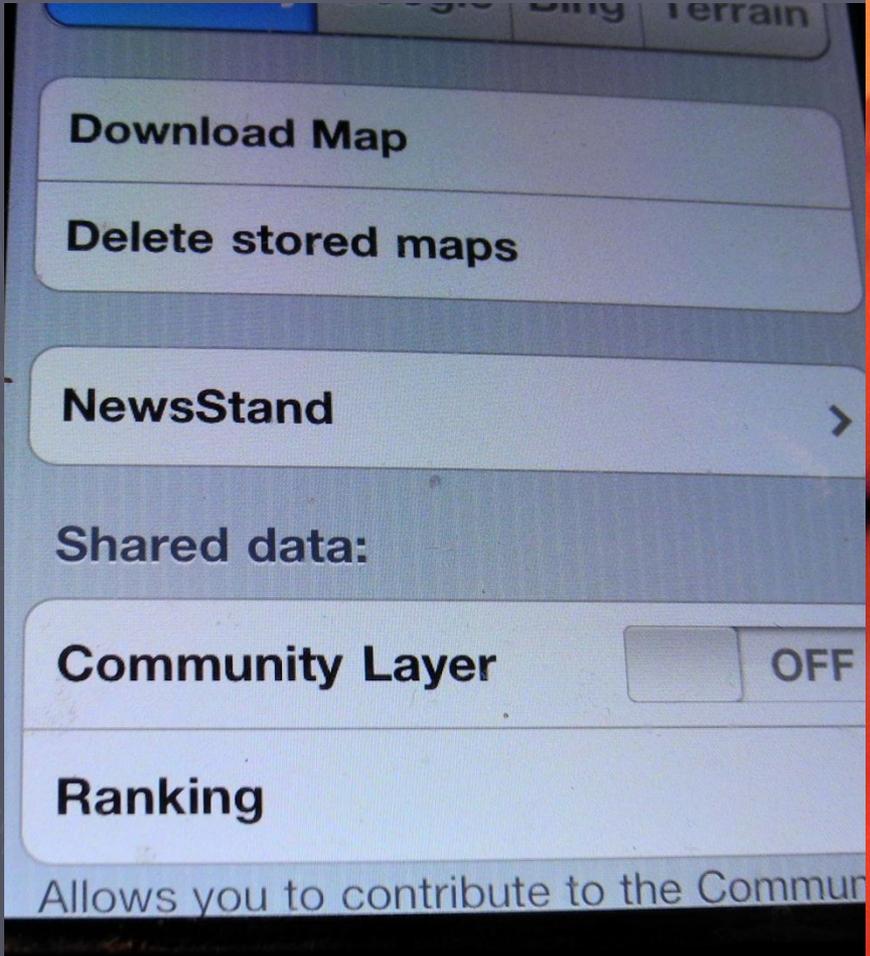
The KVA-100
is a high performance
satellite antenna, the
only one in the world
that can be used for
both ground and space
based applications.

Support capabilities
Global support te

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Smart phone interface





FURUNO

MAXSEA

emo:NN50_North Bay (with radar).nnd

Navigation Planning Radar Dual Nav Nav & Radar Update Polar



41° 38'

ZONE
Z)

North Bay

St Marys

Shem
Port

289.0 COG

4.9 SOG
kn

16.1 ft DPT

CTS

TTG

Little Island

Cable
Area

1:0 300

1.355 NM

start

MaxSea TimeZero

5:54 PM

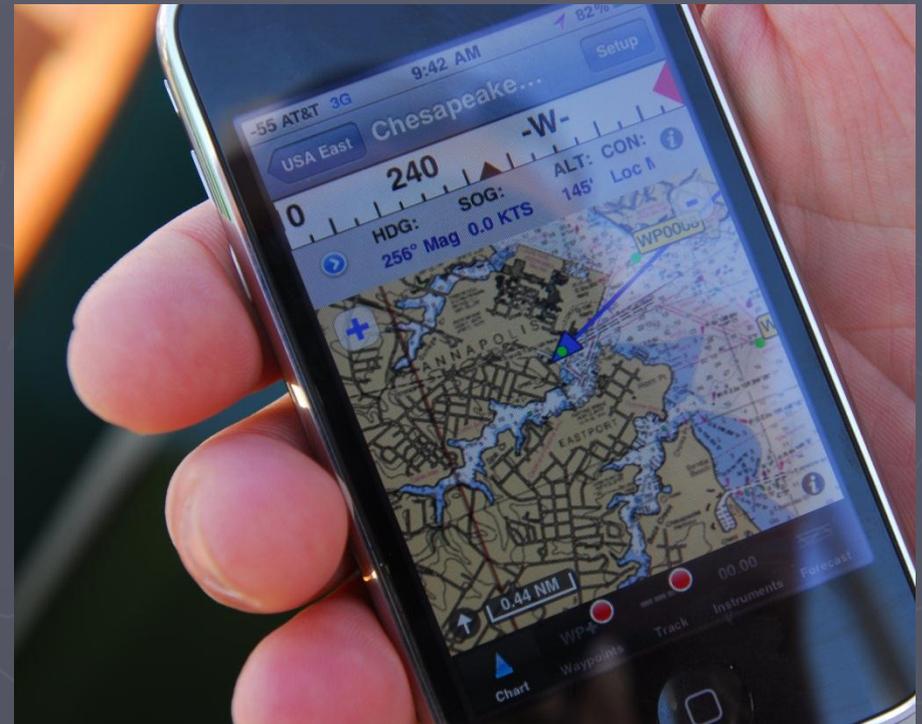
Furuno NavNet EZTouch



Tradition



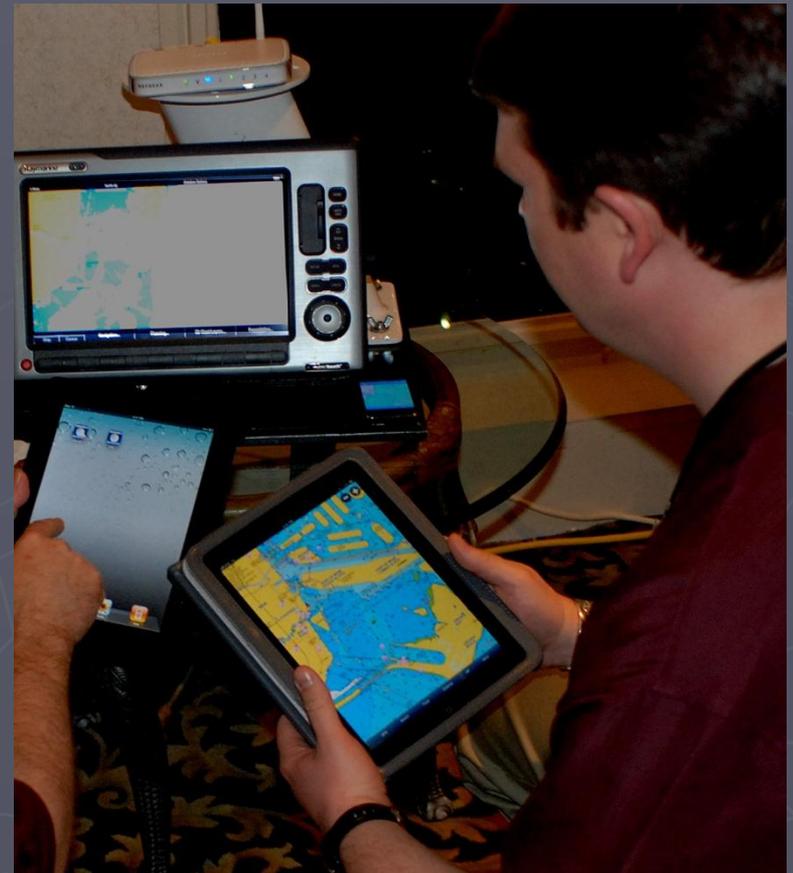
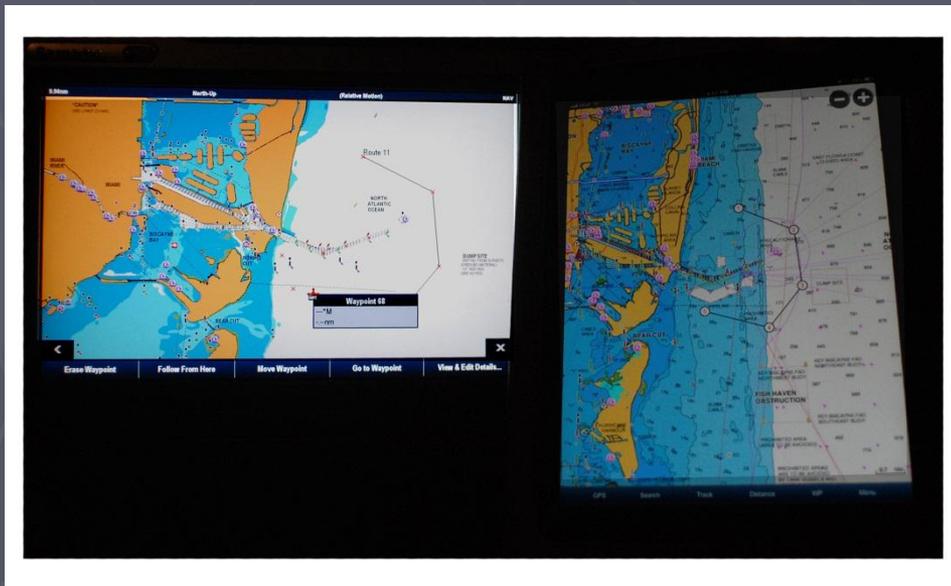
A well connected crew



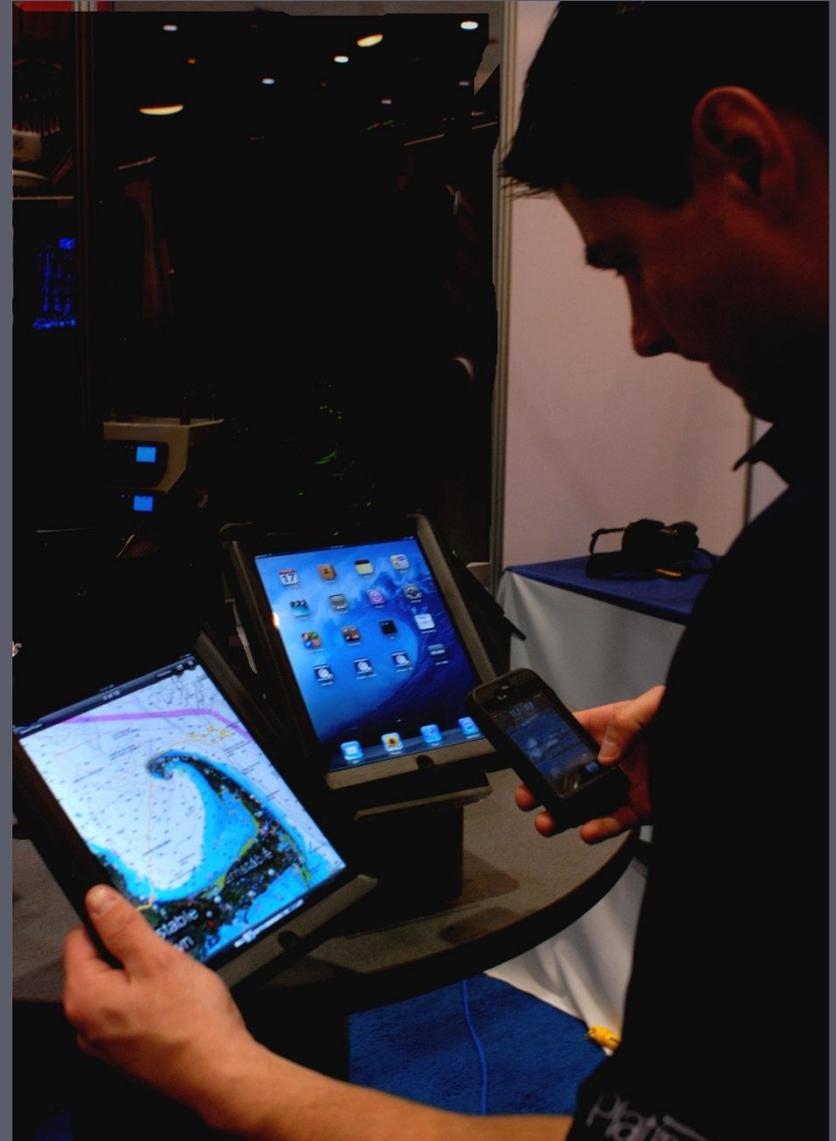
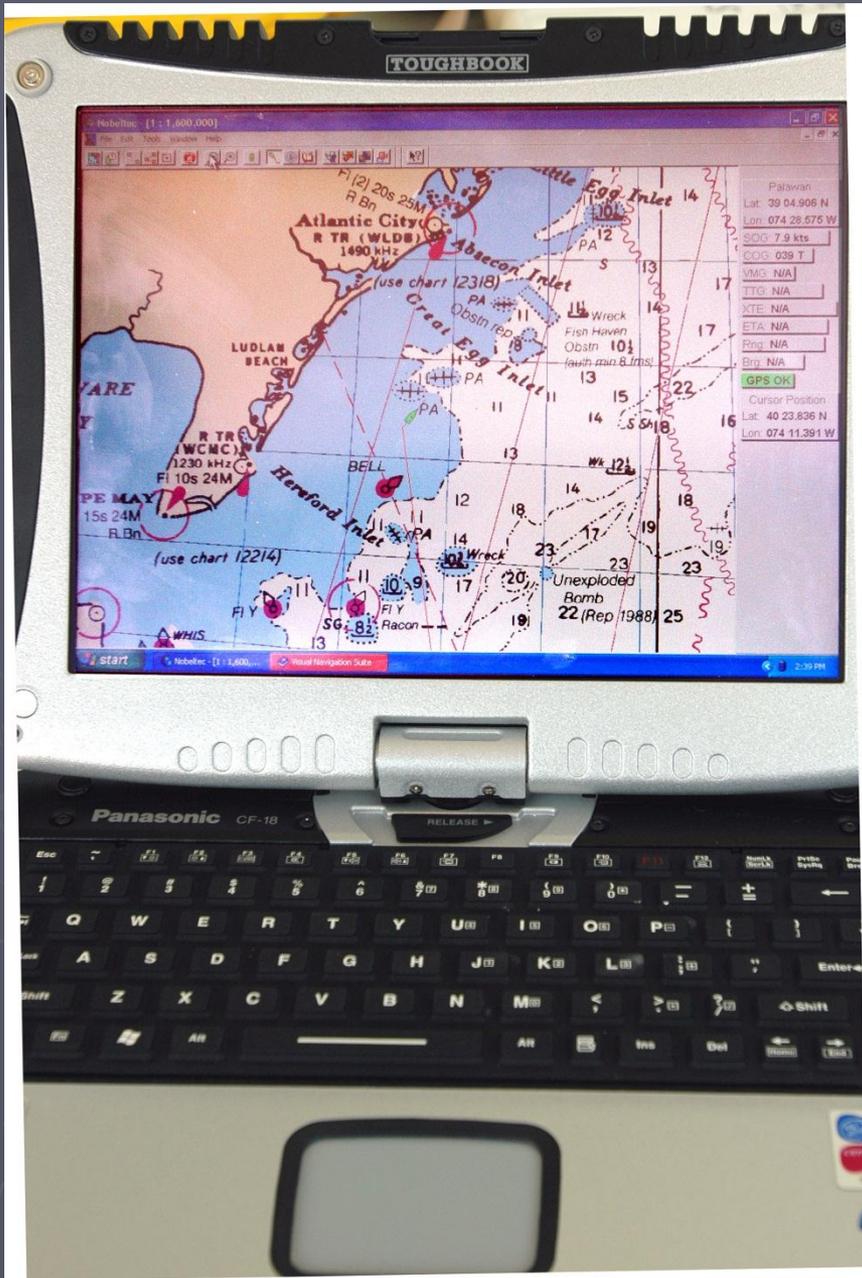
Smartphone seaworthiness



- ▶ Wifi sync to a Network
- ▶ Added portability
- ▶ Remote data access



Portable platforms



The navigator's amalgam

- ▶ Intuition
- ▶ Sense of direction
- ▶ Vector awareness
- ▶ Relative motion



The Goal

- ▶ Knowing where you are
- ▶ Defining where you want to go
- ▶ Monitoring progress



Human interface



- ▶ Doubt
- ▶ Double check
- ▶ Deliberate
- ▶ Decide

Virtual grounding



Flinders Islet Incident



CYC Photo



← Flinders

Outcome...

- ▶ Grounding
- ▶ Vessel a total loss
- ▶ Two crew members dead

FLINDERS ISLET YACHT RACE

INQUIRY

Cruising Yacht Club of Australia Internal Inquiry

The contributory factors identified are:

a. General navigation

i. Lookout and sea room

ii. Reliance on chart plotter and GPS

iii. GPS inaccuracies

b. Organization of the boat

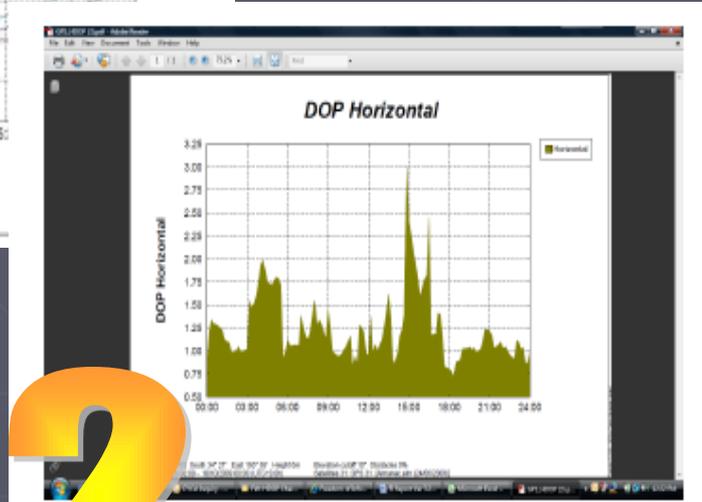
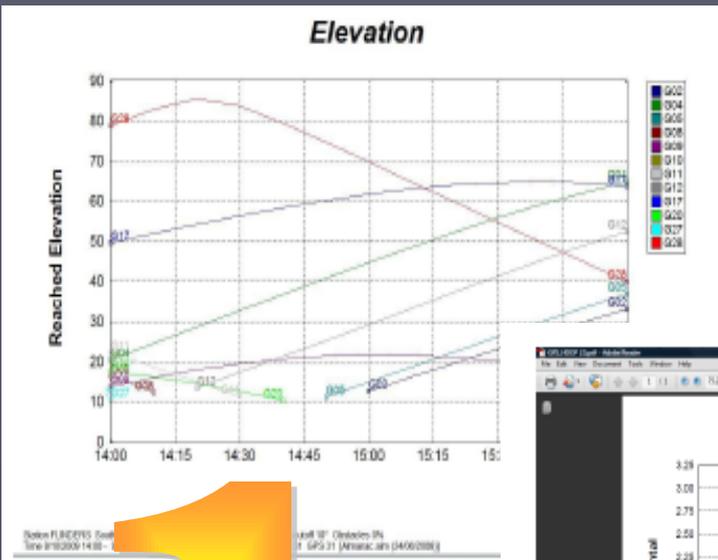
c. Fatigue and overload.



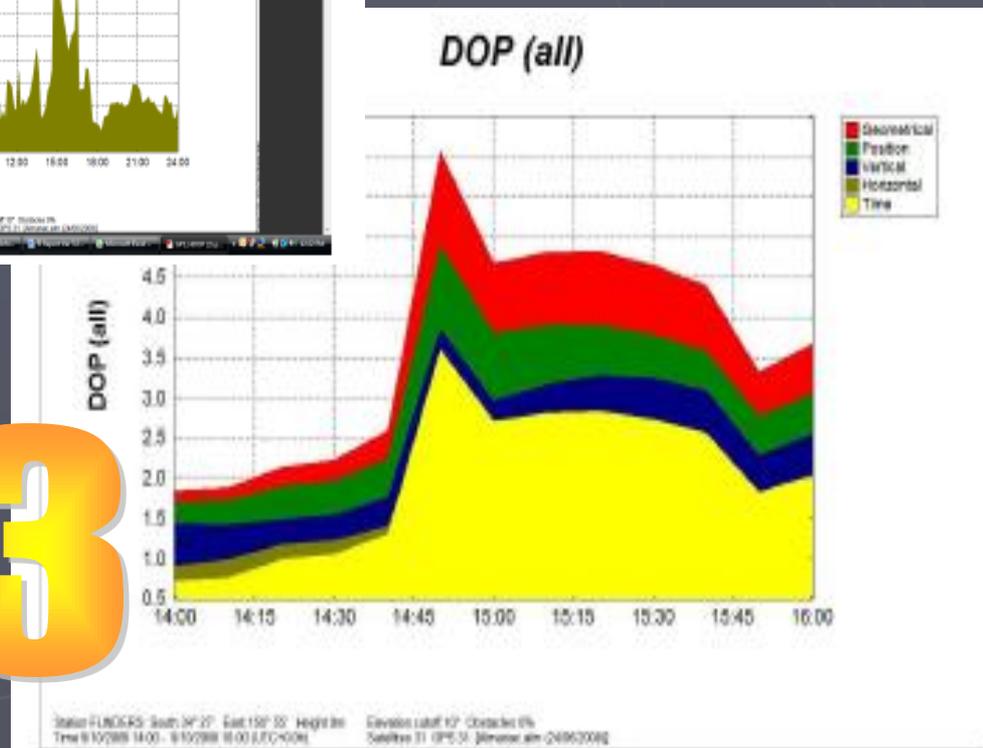
Networked Digital Charting System



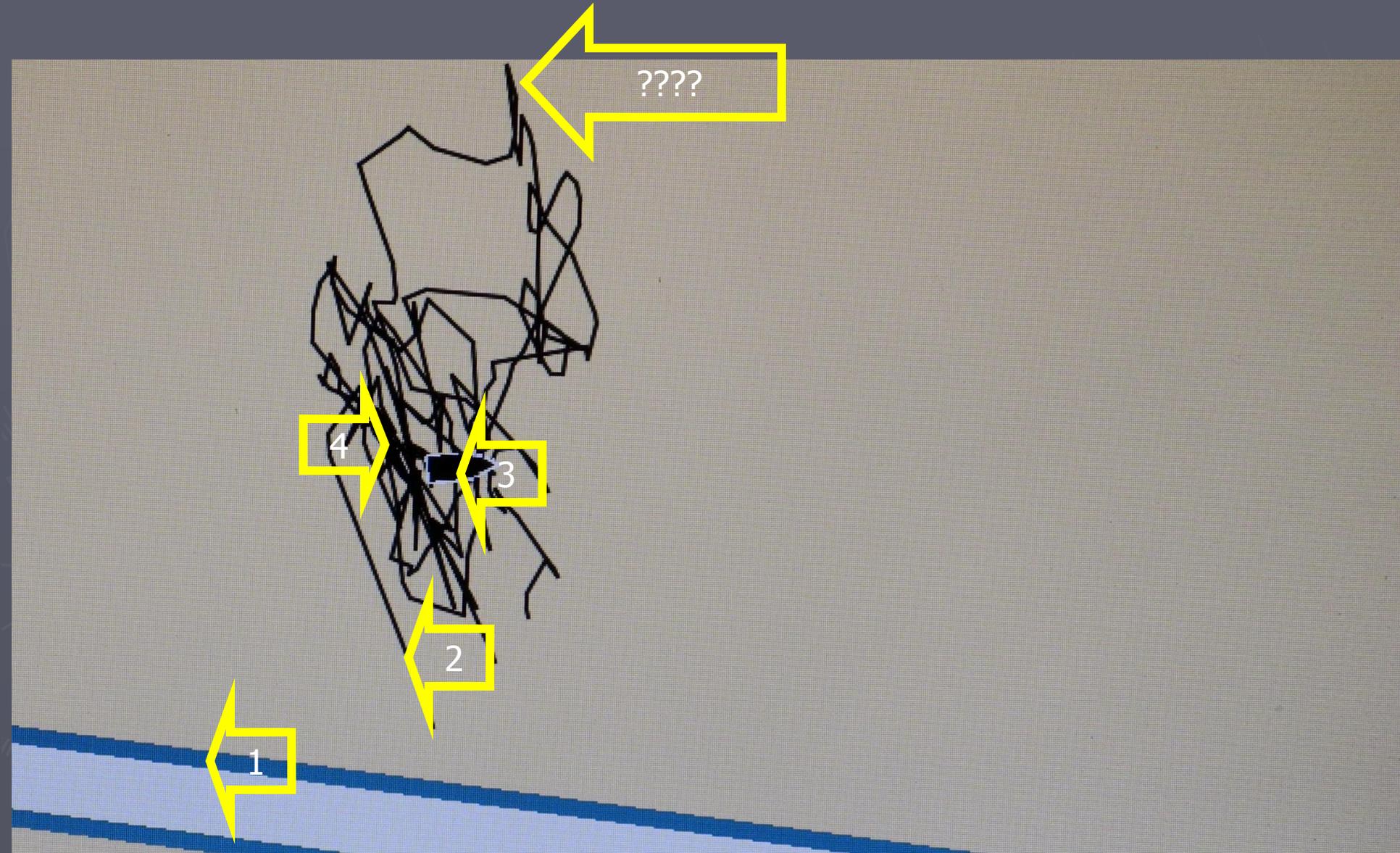
Dilution of Precision



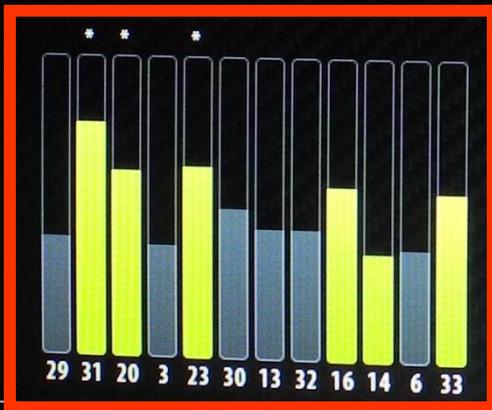
3



The navigator's Rorschach Test



Satellites



Status

Fix: 3D, WAAS
EPE: 6.6 m
HDOP: 1.0
SNR best 4: 32.8
SNR avg all: 25.4

Position

N 38°56.623'
W 76°29.413'

Time

11:06:34 am
07/29/2011

GPS Source

ZG50 [000DDF#]

Change

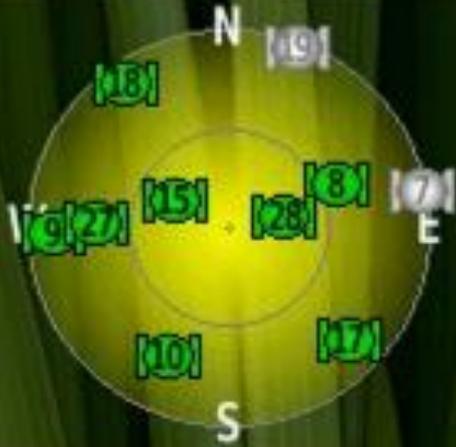
Configure

Location

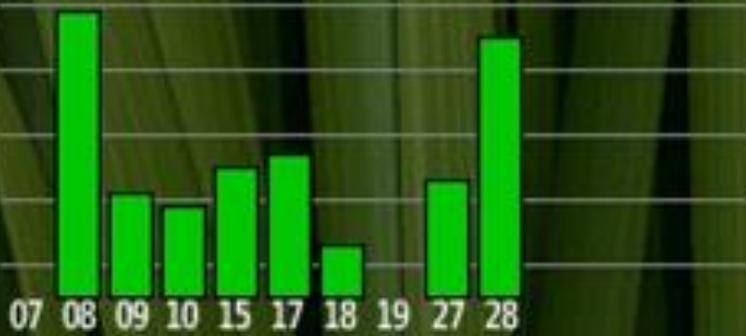
N 48°11.917'
E 016°20.037'

GPS Accuracy

21 m



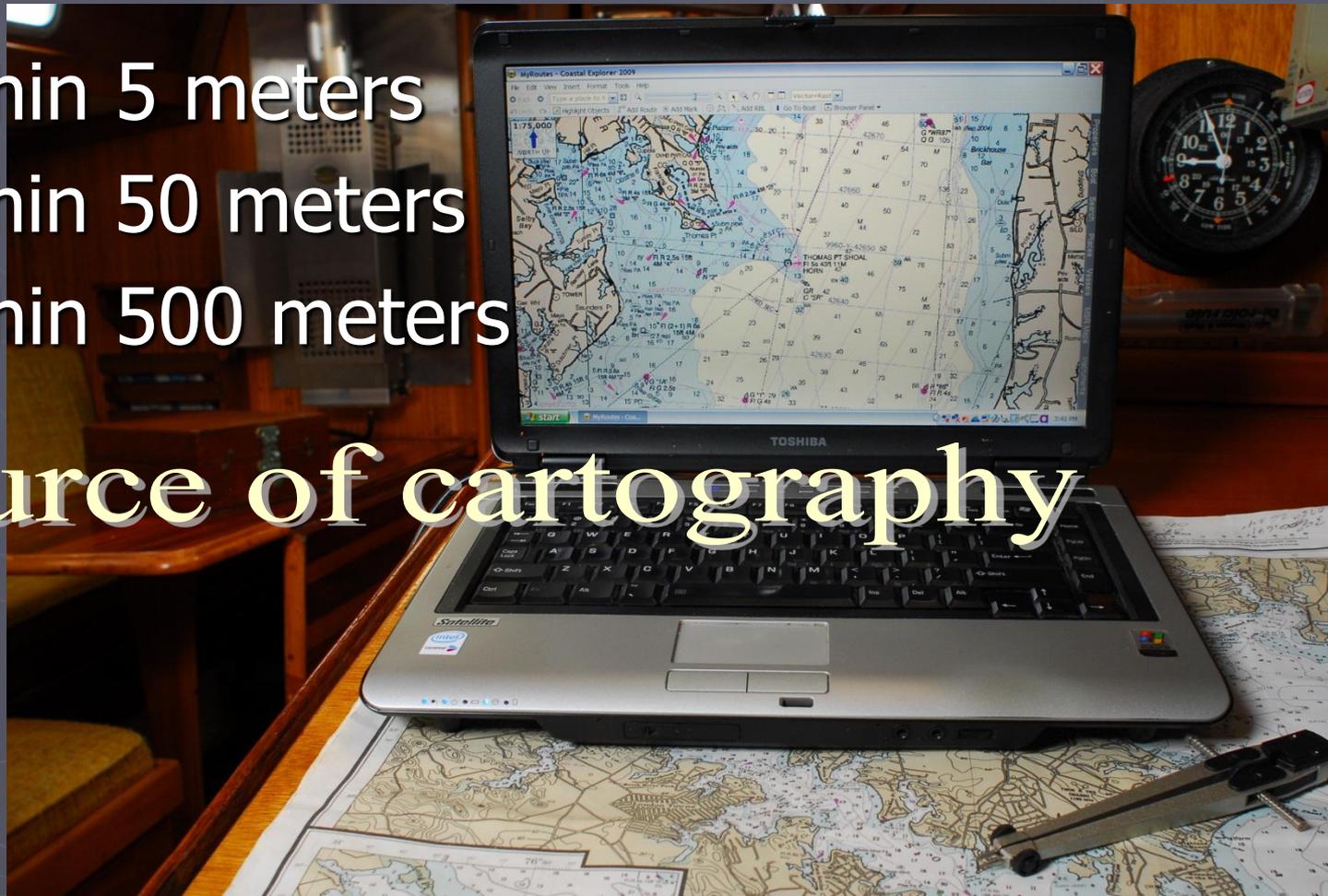
229 m



Implications of ZOC

- ▶ A= within 5 meters
- ▶ B= within 50 meters
- ▶ C= within 500 meters

source of cartography



I agree button

- ▶ “electronic charts are inadequate as a primary means of navigation”



Nobeltec software

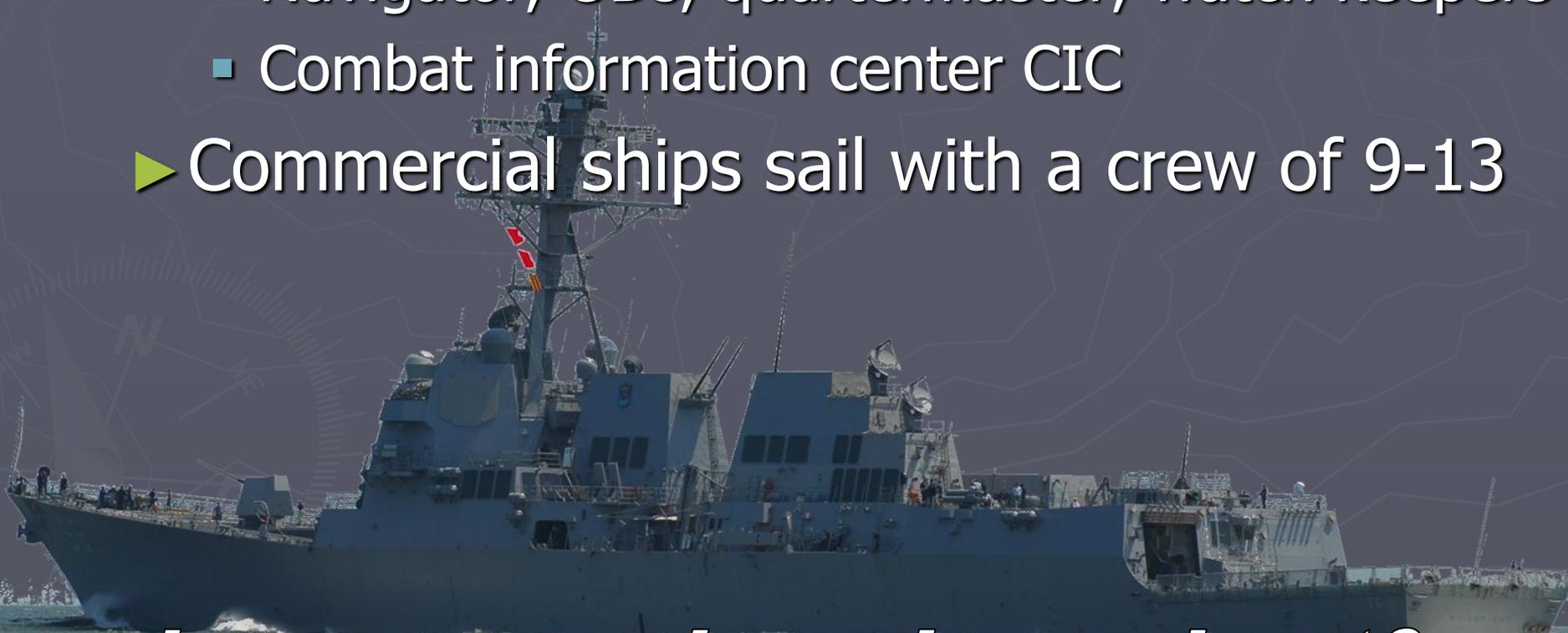
Your slant on sailing

- ▶ Day sail local waters
- ▶ Club racing
- ▶ Coastal/Offshore racing
- ▶ Coastal cruising
- ▶ Ocean passage making



The Navy way

- ▶ Full bridge compliment
 - Navigator, ODs, quartermaster, watch keepers
 - Combat information center CIC
- ▶ Commercial ships sail with a crew of 9-13

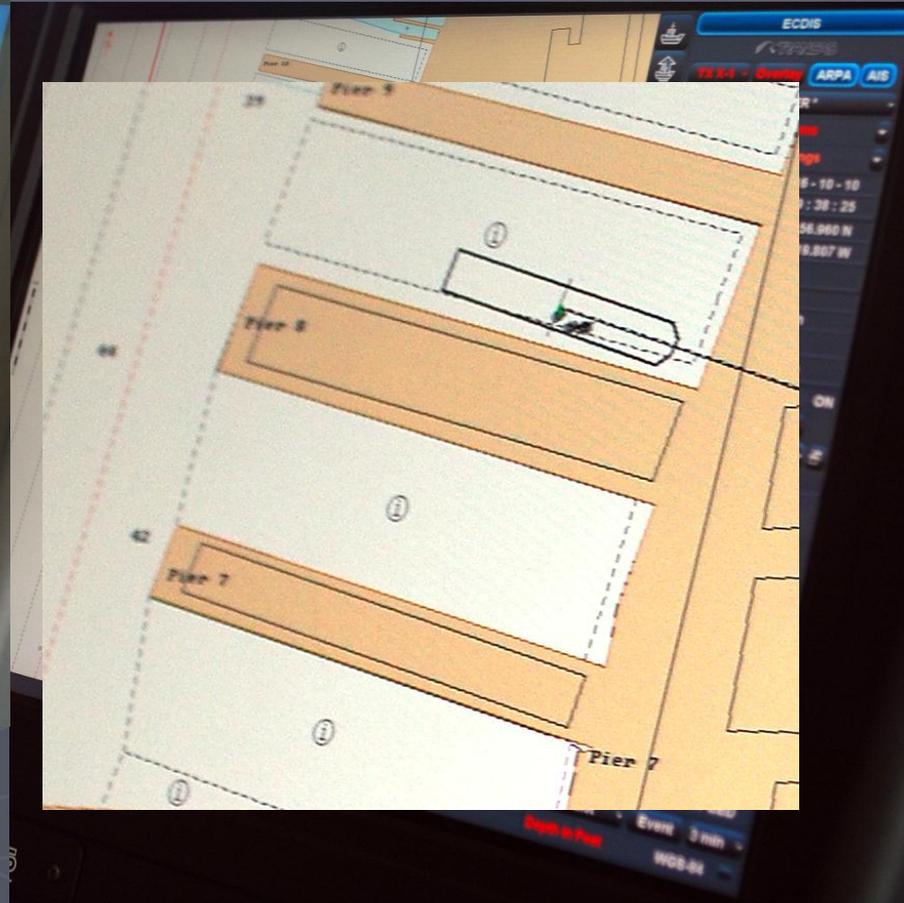


how many aboard your boat?



ECDIS

ELECTRONIC CHARTING AND DIGITAL INFORMATION SYSTEM





The shorthanded mandate



- ▶ Streamline navigation process
- ▶ Add accuracy to position fixing
- ▶ Concerned about shortcuts



Data input

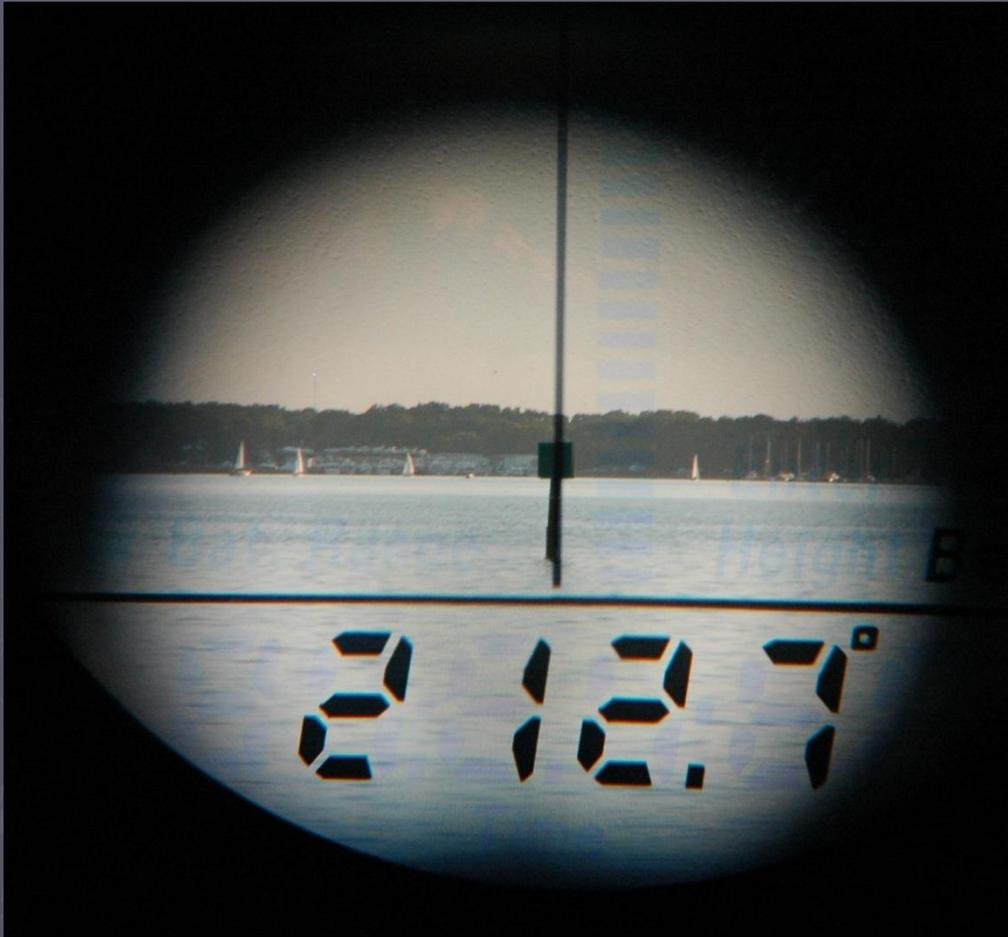
- ▶ Compass
- ▶ Knot meter/log
- ▶ Fathometer
- ▶ Radar
- ▶ GPS
- ▶ AIS
- ▶ FLIR



Plotting becomes a reflex

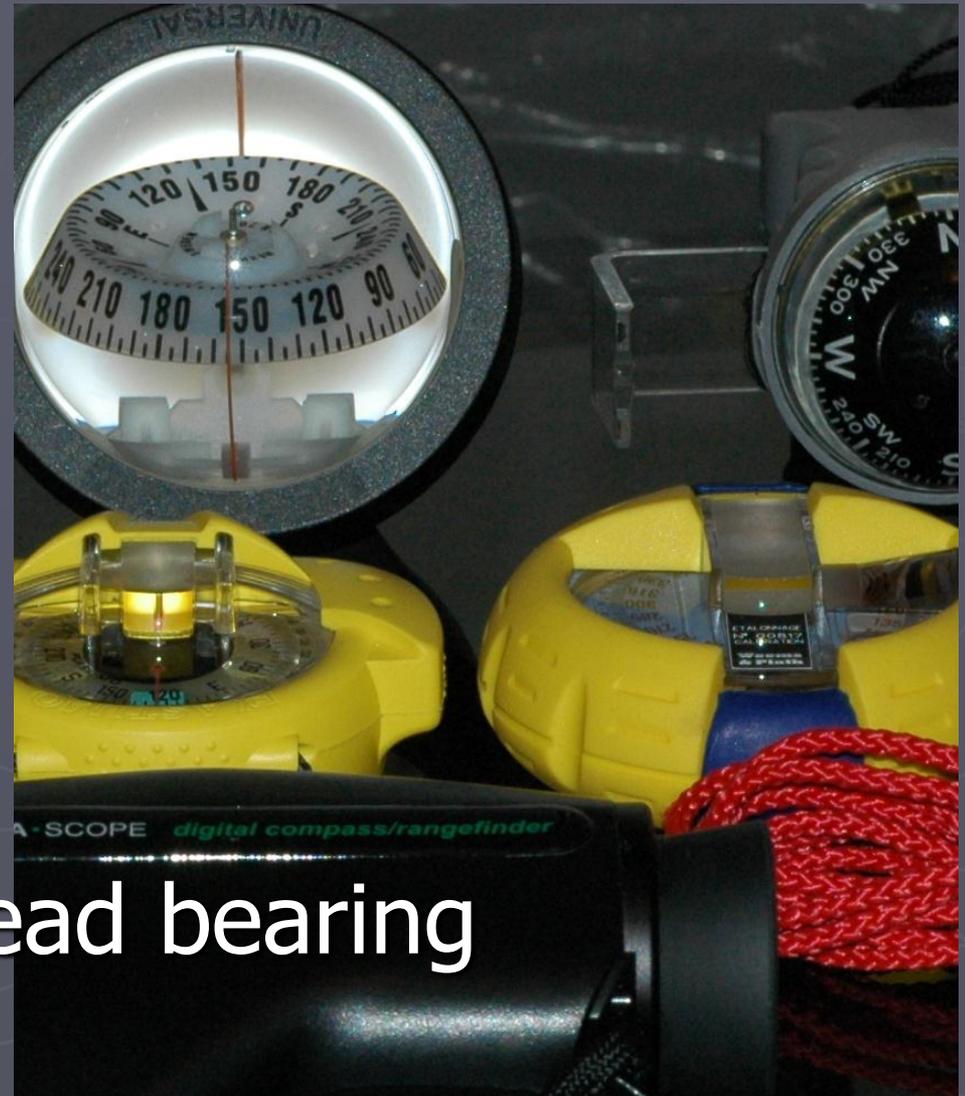


Taking bearings



Using a hand bearing compass

- ▶ Identify object
- ▶ Engage in sight
- ▶ Simultaneously read bearing

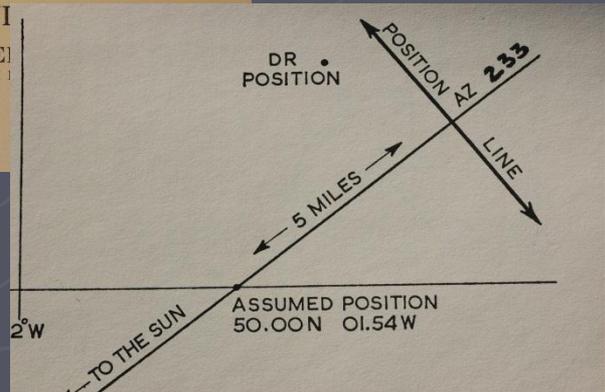
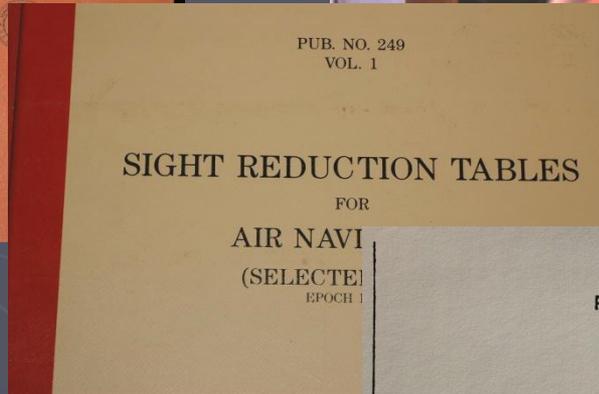
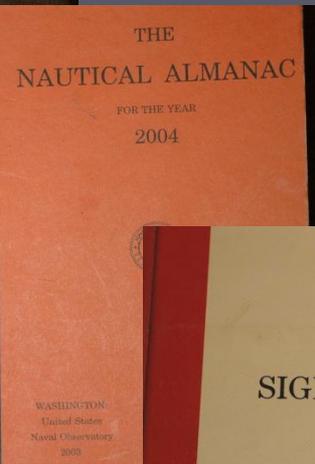


Checking a range



- ▶ Align two fixed objects show on a chart
- ▶ Measure the bearing with a HB compass
- ▶ Plot bearing line on chart
- ▶ Compare ranges (measured and observed)





Celestial Navigation

The navigator's routine



DR and Piloting





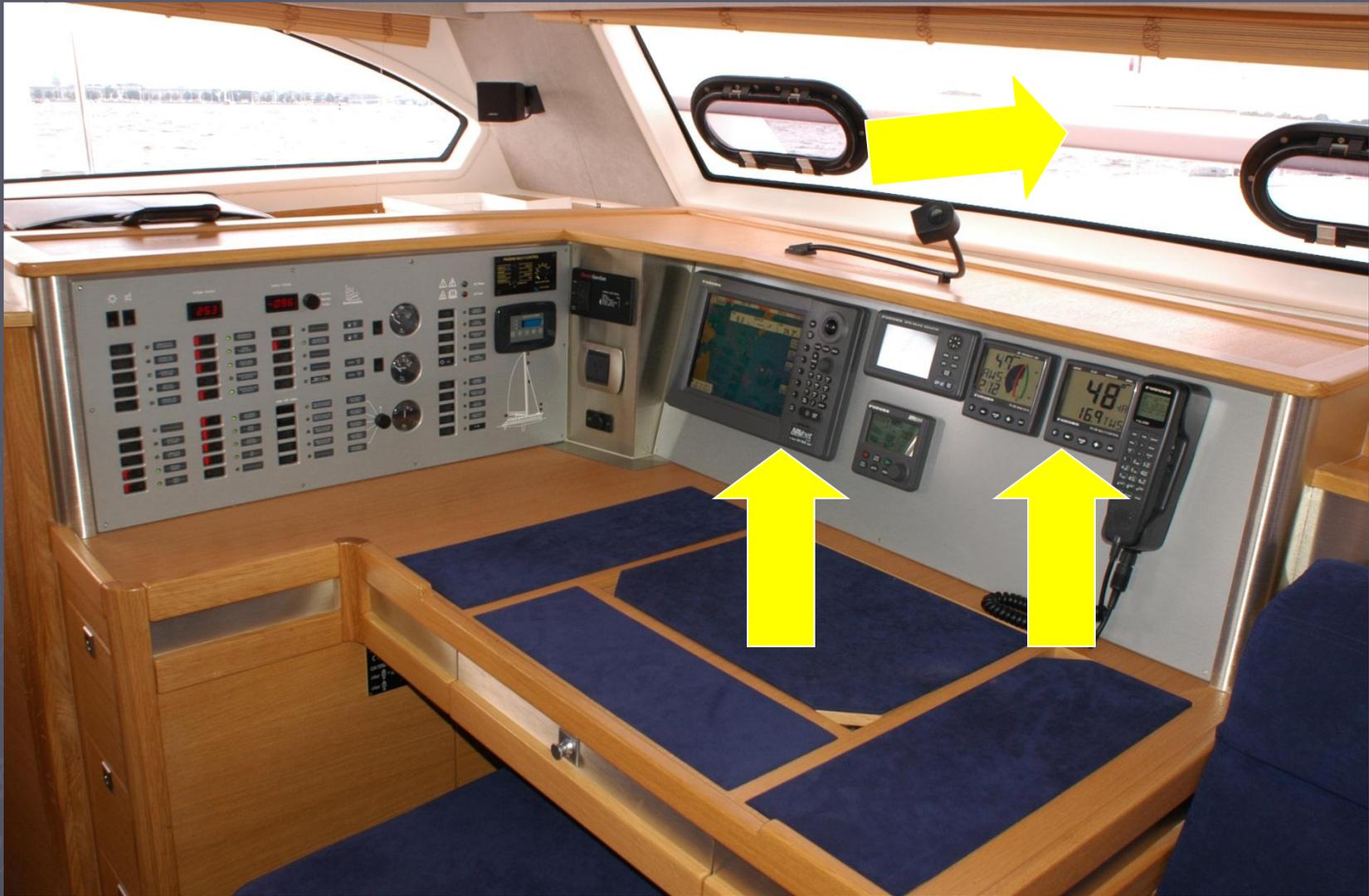
Compare visual bearing with cursor bearing line to same object



More data

- ▶ Set and drift
- ▶ Leeway
- ▶ Steering proficiency



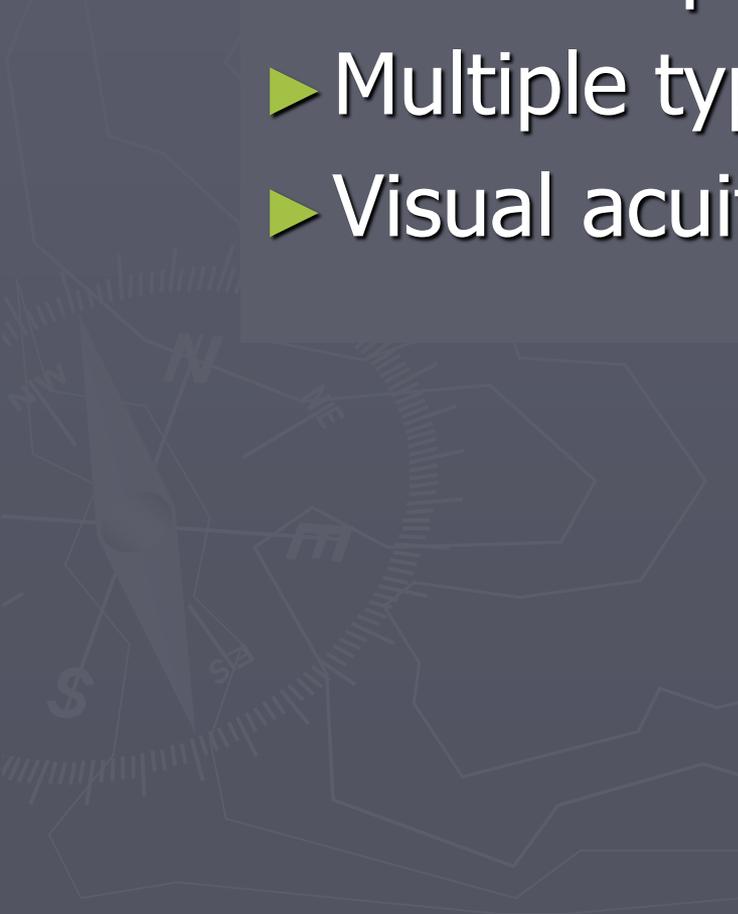




MPT	DRG	COG	SOG	DEARING
360.0°	H	344.6°	8.0	350.0°
200	nm			

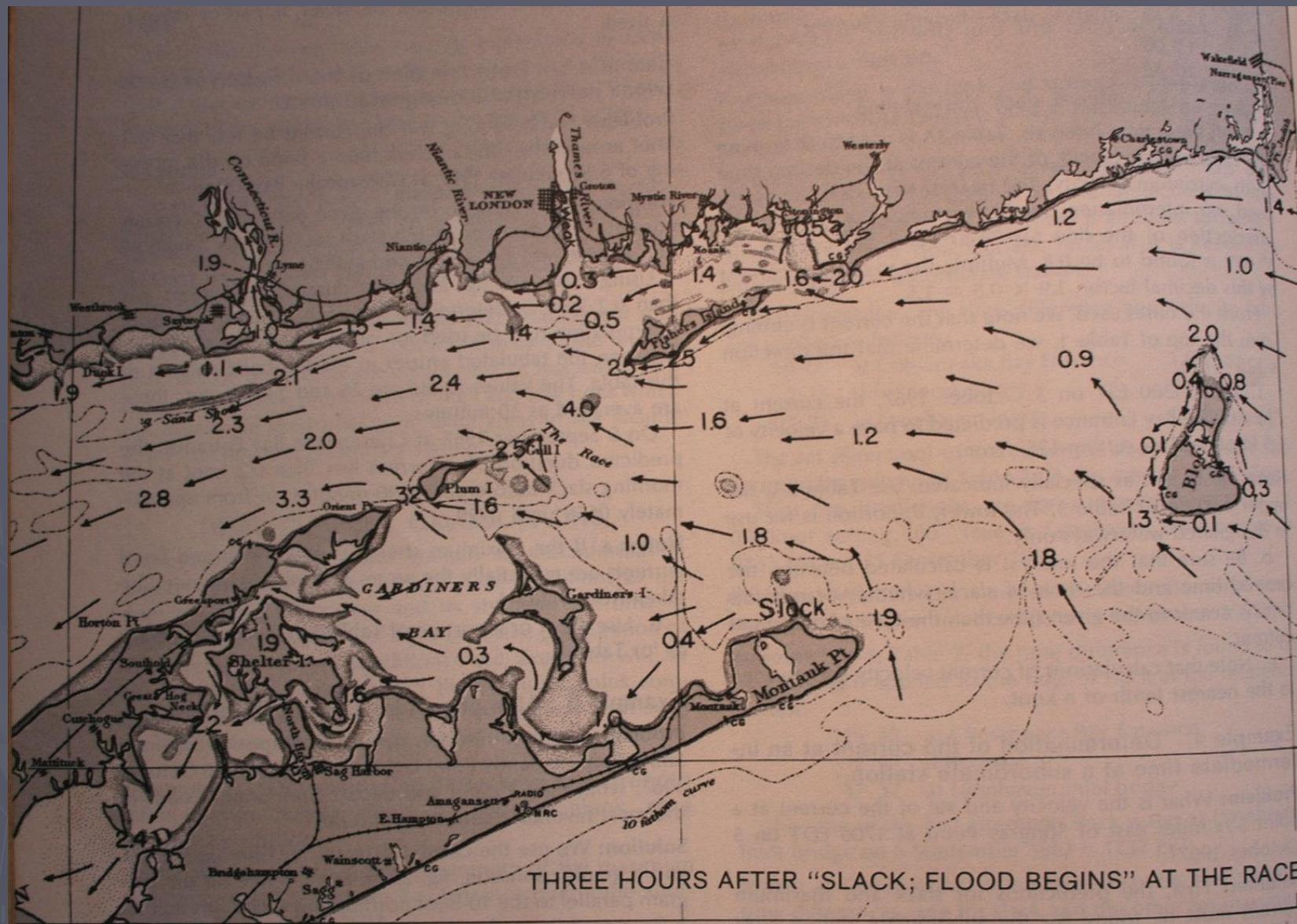
The nighttime routine

- ▶ More frequent plots
- ▶ Multiple types of fixes
- ▶ Visual acuity enhancers



Light levels



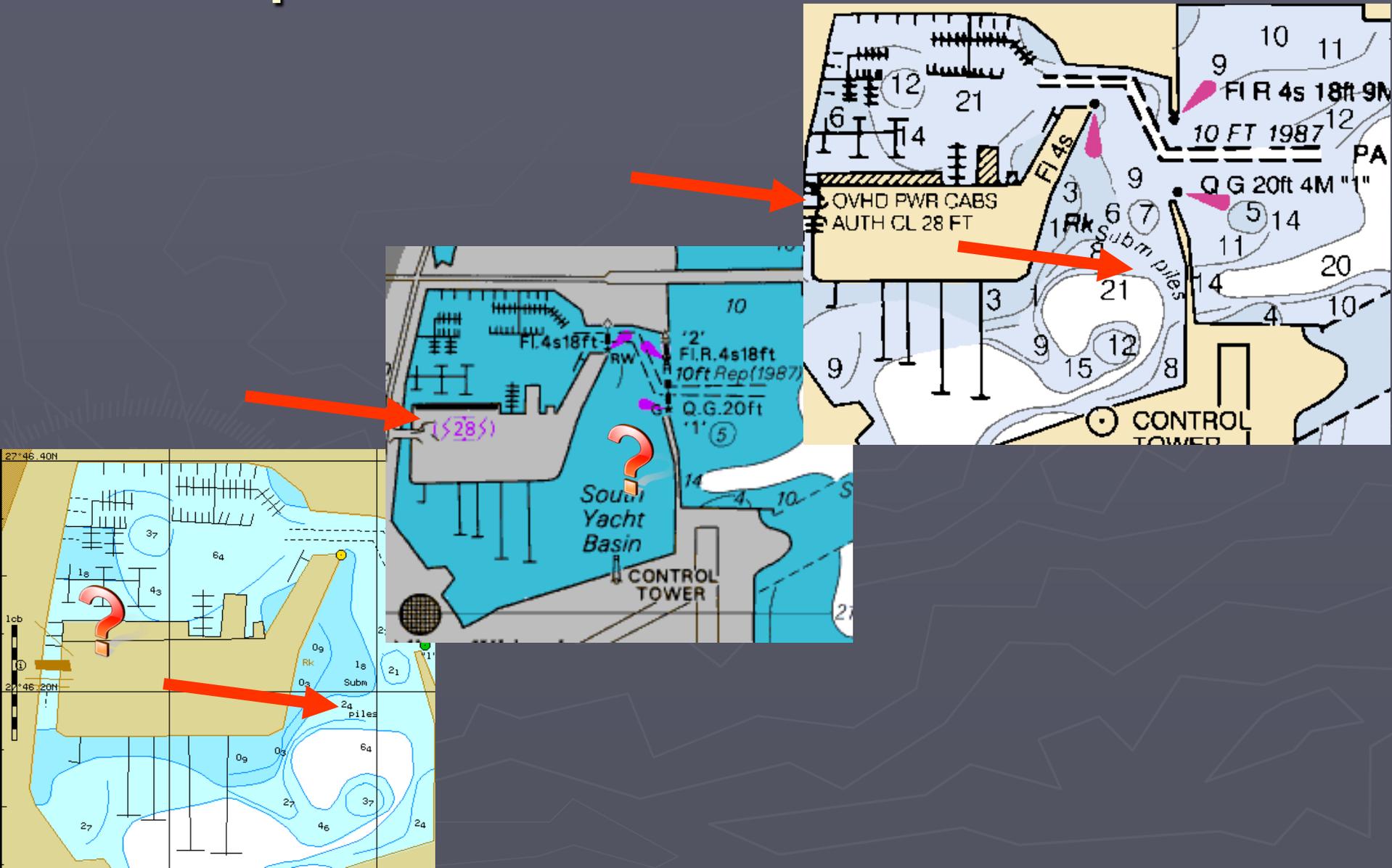


DOUBTFUL DATA: Reported but unconfirmed depths or dangers are indicated by an encircling dotted line.

NOTE
The representation of international boundaries is not necessarily authoritative.



Graphics and detail



GPS Speed

0.0 ^kt

Distance

4.69 ⁿ

Arrival

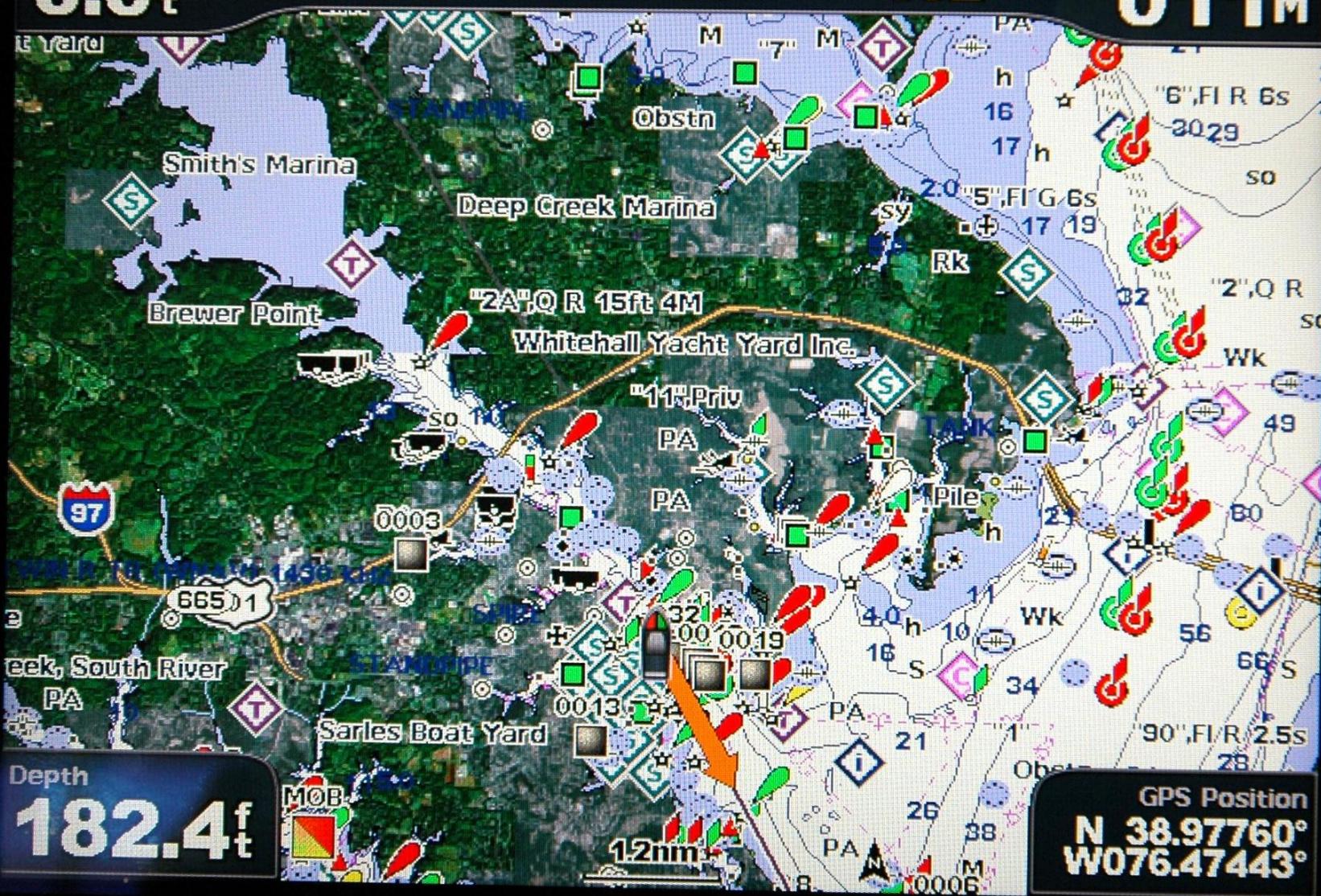
---:-- ^am

Bearing

162 ⁿ

GPS Heading

011 ^M



Depth

182.4 ^ft

GPS Position
 N 38.97760°
 W 076.47443°

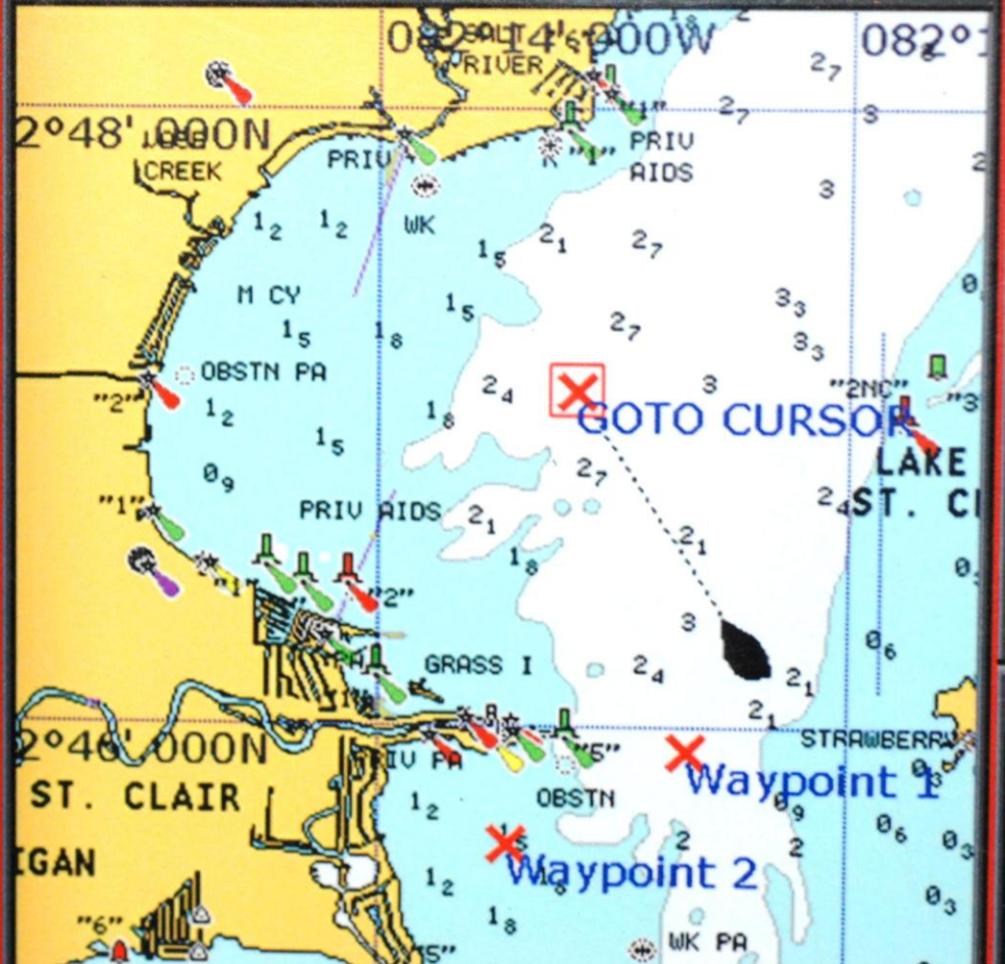
Raymarine

C80

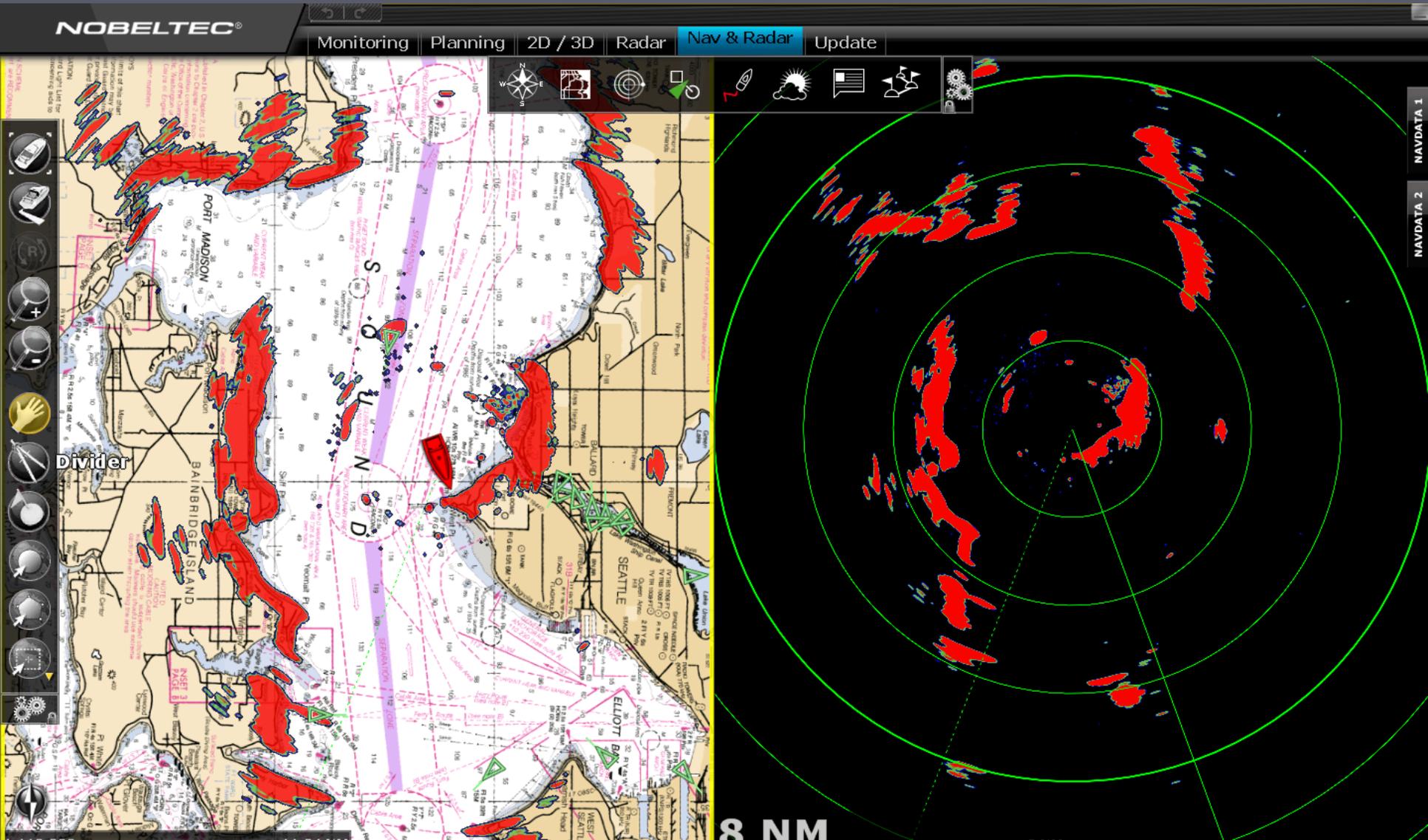
16nm

N-UP (RM)

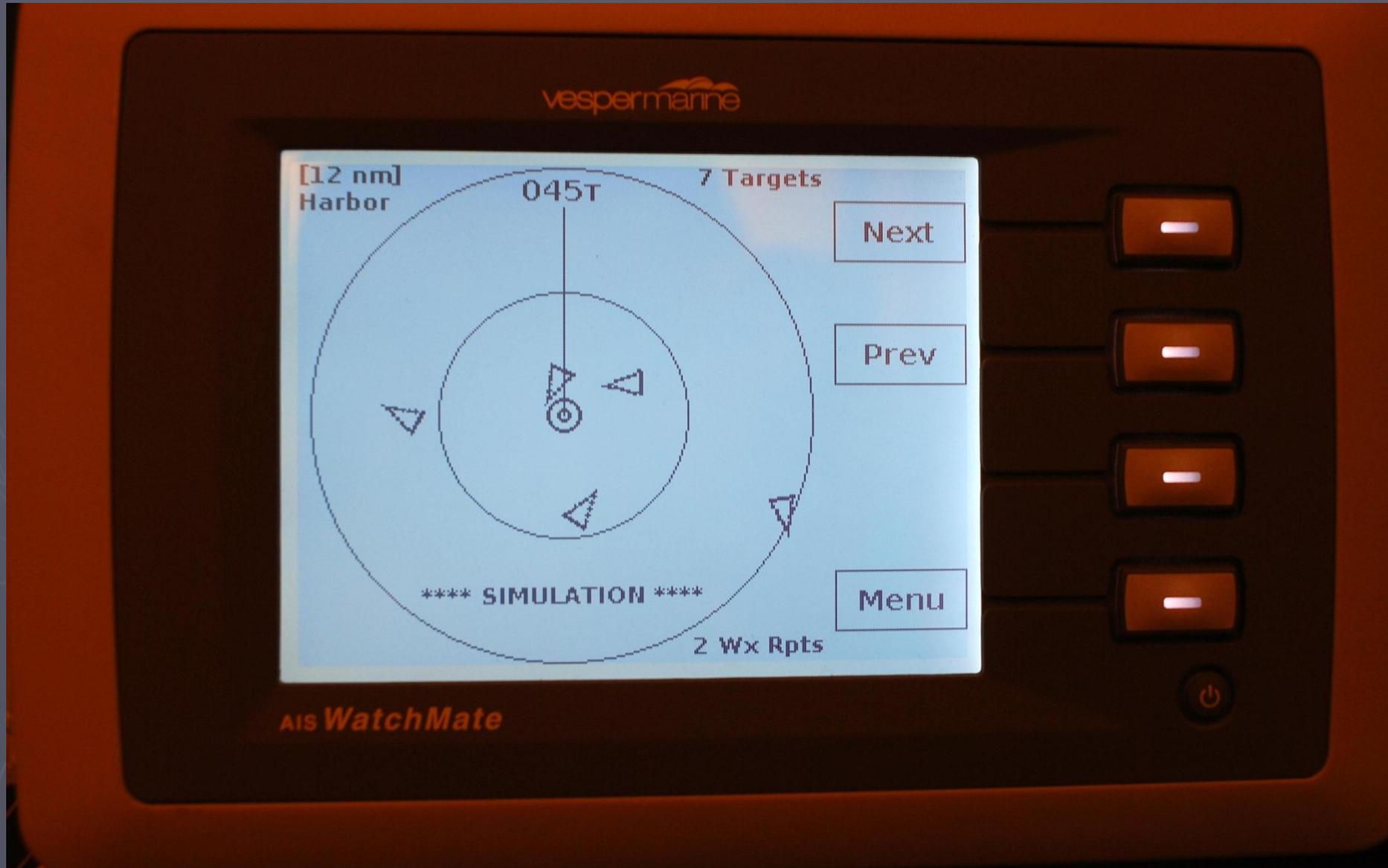
Local



Overlay capability



AIS standalone



Vesper Marine

For customers in the US...
be programmed with data corresponding to the vessel on which it will be installed. Programming must be carried out by a Vesper Marine dealer. The included instructions contain information on how to verify the correct programming.

WARNING: It is a violation of the rules of the Federal Communications Commission to input an MMSI that has not been properly assigned to the end user, or to otherwise input any inaccurate data in this device.

marine
4VDC 1A max, 3W nom
safe distance: 0.6m (2ft)
162/4321414/10
ID: YJDVESPWMX900
model: **WNC200**

USCG: 165.156/1210
IC: 9118A-WMX900 B
S/N: **KZ74126**

CE 0168 Ⓢ FC Z1039



Vesper Marine

AIS networked





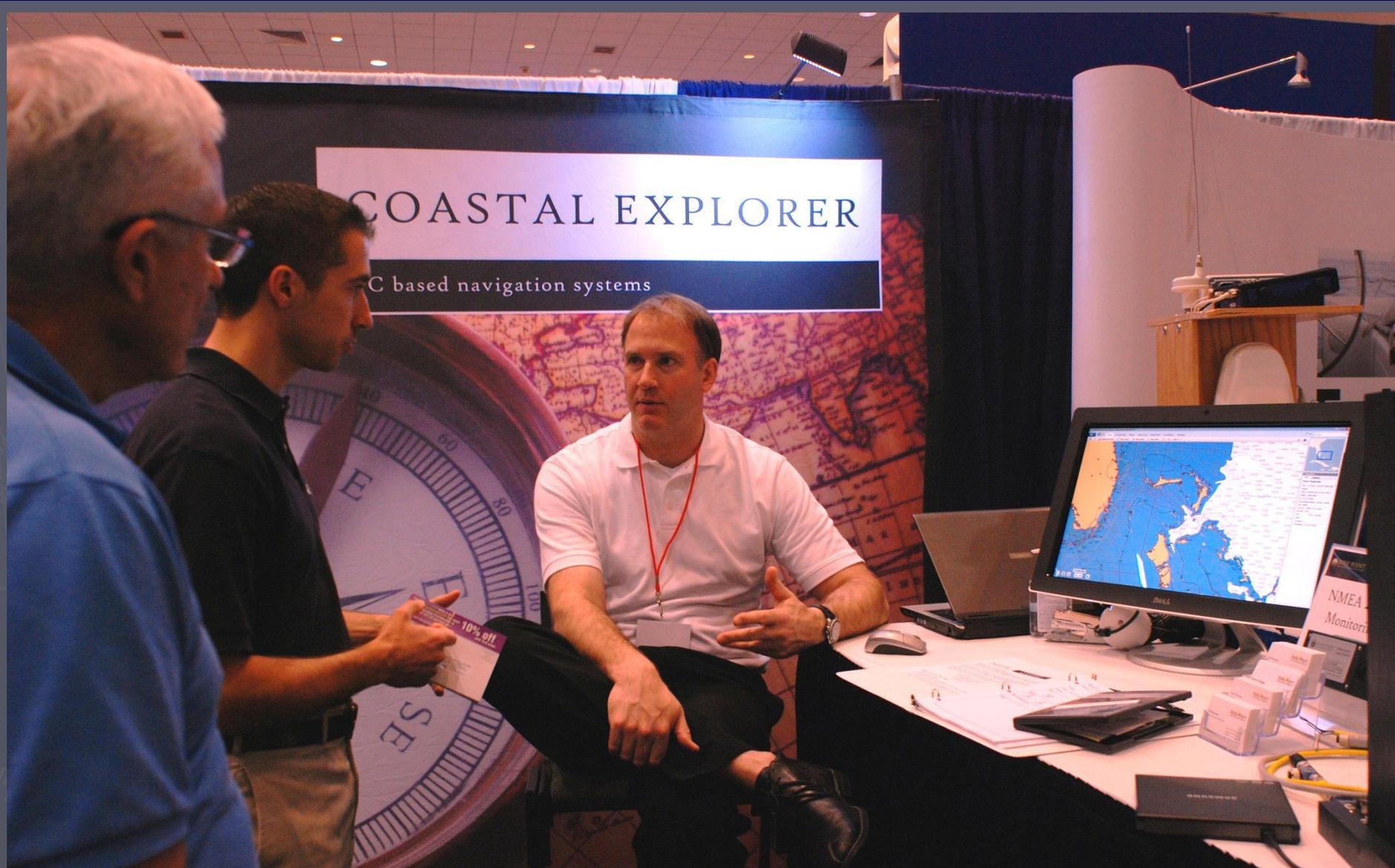
***Digital Charts
and
Electronic Navigation***



Cartography 2011



Boat show opportunities



SPC

COG

M POS

DEPTH

m TIME

Settings

System

Chart

Echo

Radar

Navigation

Fuel

Tracks

Alarms

Units

Network

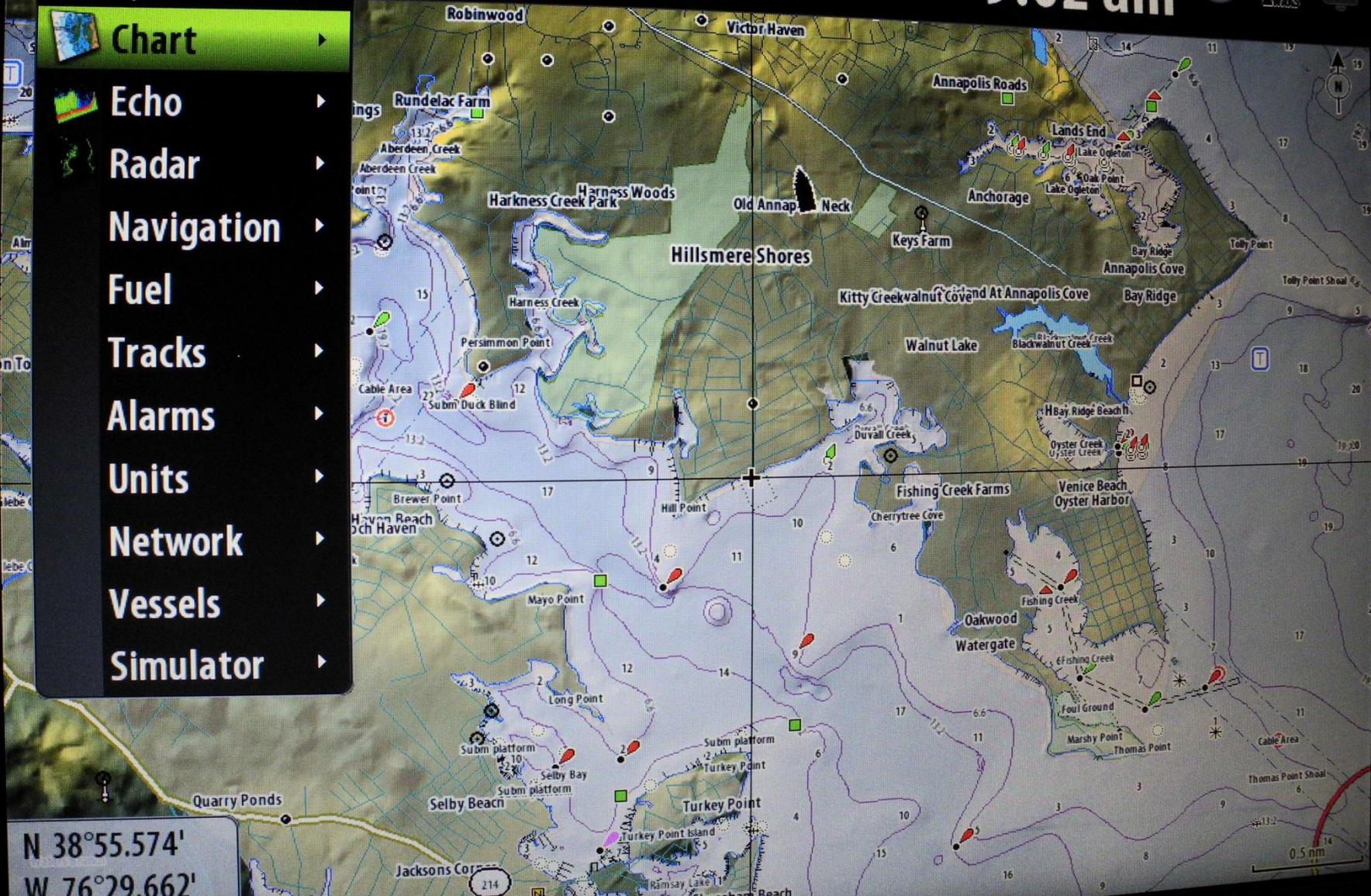
Vessels

Simulator

001

N 38°56.624'
W 76°29.416'

9:02 am



N 38°55.574'
W 76°29.662'

0.5 nm

GARMIN
GMS 10

LNK DUP
ACT COL 100

POWER







Raymarine

24nm CSR N38°04' 928 BRG 146°M
POS W063°49' 815 RNG 381.4nm

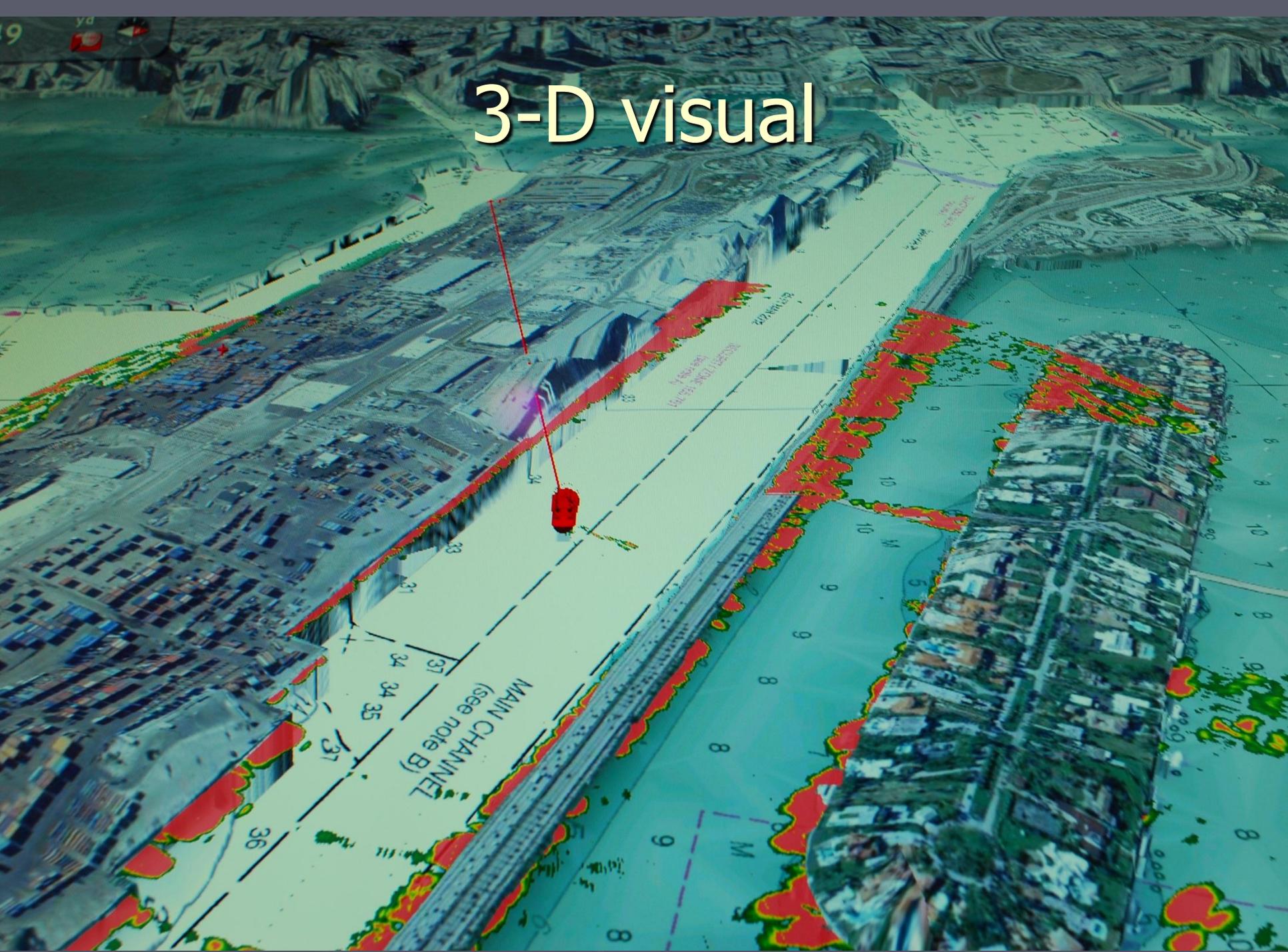
TIME	HEADING	SOG	SPEED
9:53:00 AM	225°M	6.6kts	7.0kts
ROUTE	GOTO	SCREEN	FIND SHIP

Raytheon

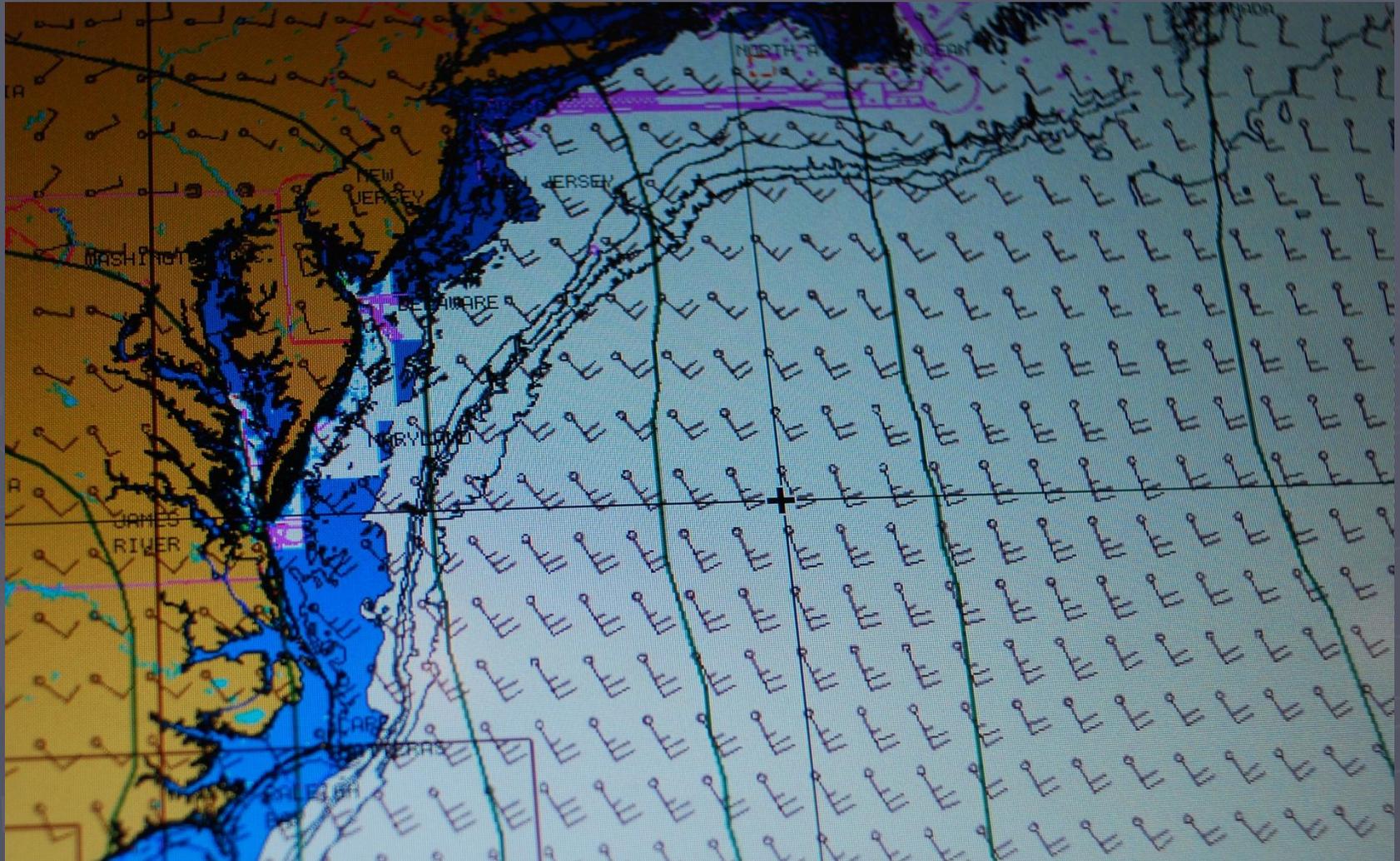
1 1/2 nm RINGS 1/4 225°M RY3 AUTO ST
H-UP

CURSOR	DEPTH	TIDE	TEMPERATURE
BRG 259°M RNG 1.911nm	186.6ft	105°M 0.9kts	62.6°F
HOG MODE	TARGETS	SCREEN	MARPA

3-D visual



GRIB Files



Infrared imaging





What suits your needs

Faced the same challenges

- ▶ Where you are
- ▶ Location of the destination
- ▶ Tracking progress

