

# Weather Monitoring Buoys

## Operational Wave Monitoring and Sea State Forecasting

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Canadian Marine Pilots' Association



chc2010

21-23 juin | June 21-23  
Québec, QC, CANADA  
[www.chc2010.ca](http://www.chc2010.ca)

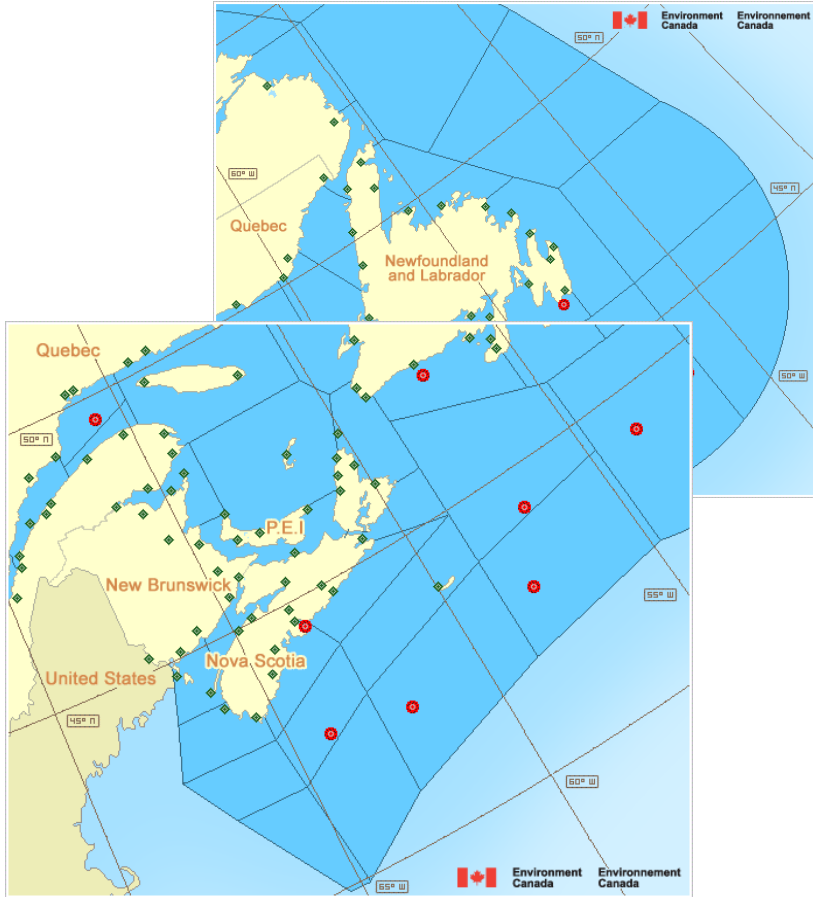
# Canada's Weather Buoys

## Public Access



- British Columbia 17
- Ontario 13
- St. Lawrence 1 +  
4 St. Lawrence  
Observatory
- Atlantic Canada 9 +  
3 SmartBay

# Weather Buoys Atlantic Canada



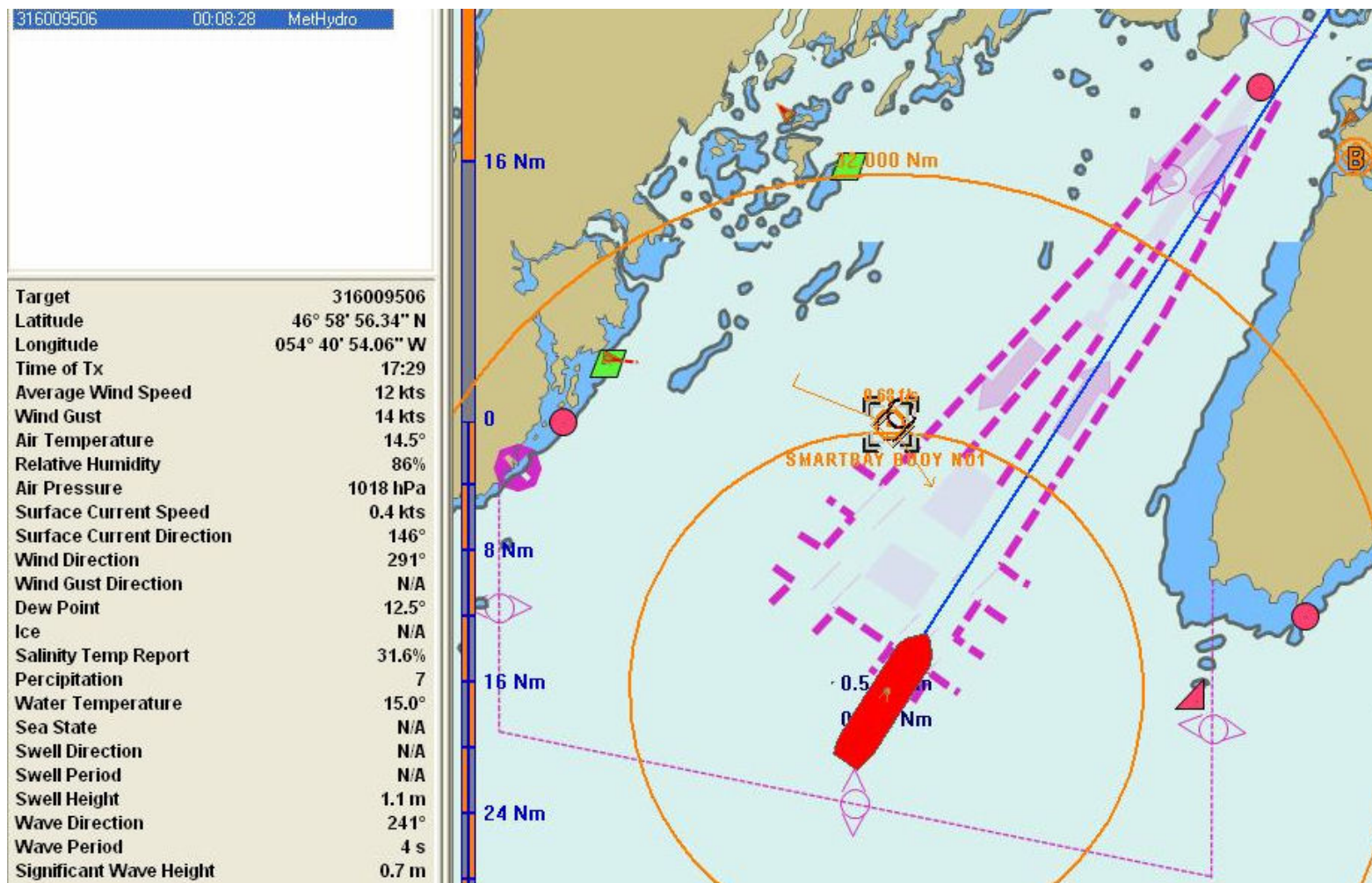
- 8 Environment Canada buoys (in red)
- 3 SmartBay buoys (NF Government & original seed money from DFO – Canada's Ocean Action Plan).
- NEW in February 2010 – One new buoy (Atlantic Salmon Growers Association & DFO)

# Placentia Bay



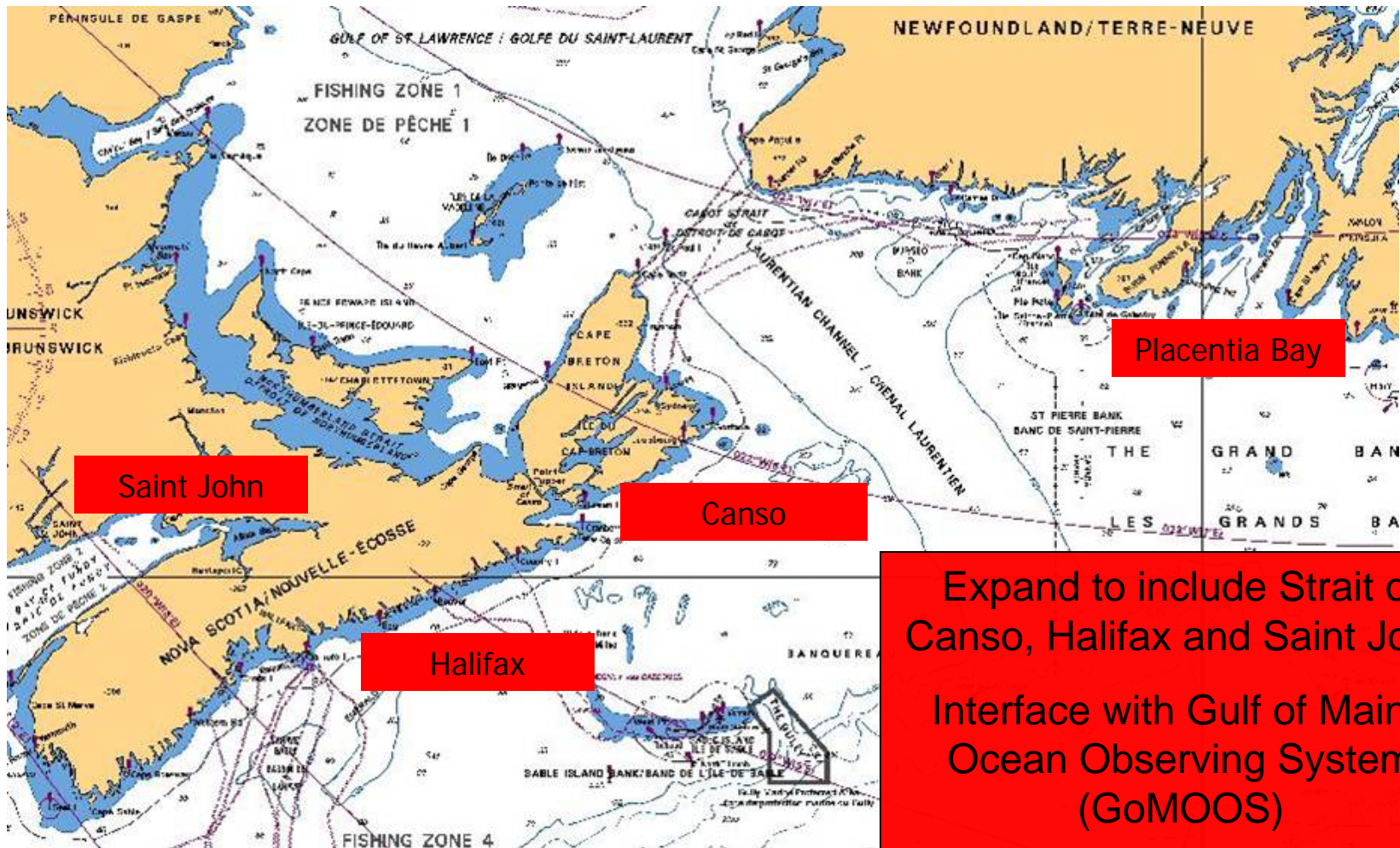
- In 2009, Government of Newfoundland invested \$330,000 in SmartBay.
- New replacement buoy for Placentia Bay pilot boarding station & at Come by Chance Point (near oil refinery).
- SmartBay buoys get 7,000 hits per month for weather information but is still seeking a permanent funding solution.

# SmartBay is working example of E-Navigation





# Completing the System



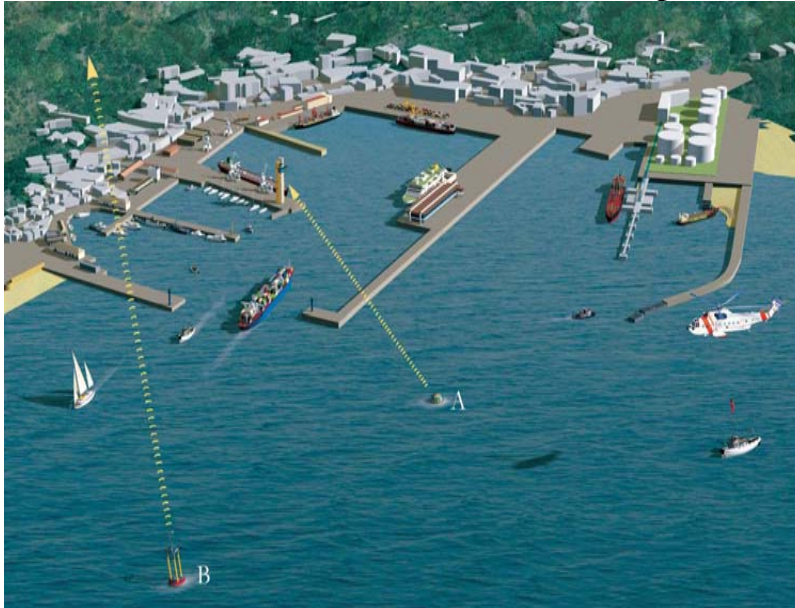
# Spain and Italy

- State owned and operated
- Coastal and deepwater weather buoy networks.
- 30 Canadian-made buoys deployed to support port operations
- All buoys are Public Access



**Wave, wind and other data from the buoys are used by local mariners and port authorities to make vessel traffic management decisions**

# Spain's Coastal & Deep Water Buoy Networks



**A.** Coastal Buoy Network - Communication by radio to Harbour Authority office and then to the central computer and to the web.

**B.** Deep Water Buoy Network. Communication by satellite to the central computer and to the web.

## Applications:

- Port operation and safety.
- Marine engineering/ harbour infrastructures design.
- Search and rescue
- Forecasting oil spill trajectories.
- Fish farming/aquiculture
- Ship routing and navigational aids.
- Recreation and tourism.

Source: Puertos del Estado



# Italy's Public Access Weather Buoy Network (all in ports)

## WMO Code

[61214](#)

[Pending](#)

[61208](#)

[61209](#)

[61210](#)

[61211](#)

[61212](#)

[61216](#)

[61217](#)

[61218](#)

[61219](#)

[61213](#)

[61215](#)

[61207](#)

## Location

Ponza

Cagliari

Mazara

Palermo

Crotone

Cetraro

Siniscola

Civitavecchia

Ortona

Ancona

Spezia

Alghero

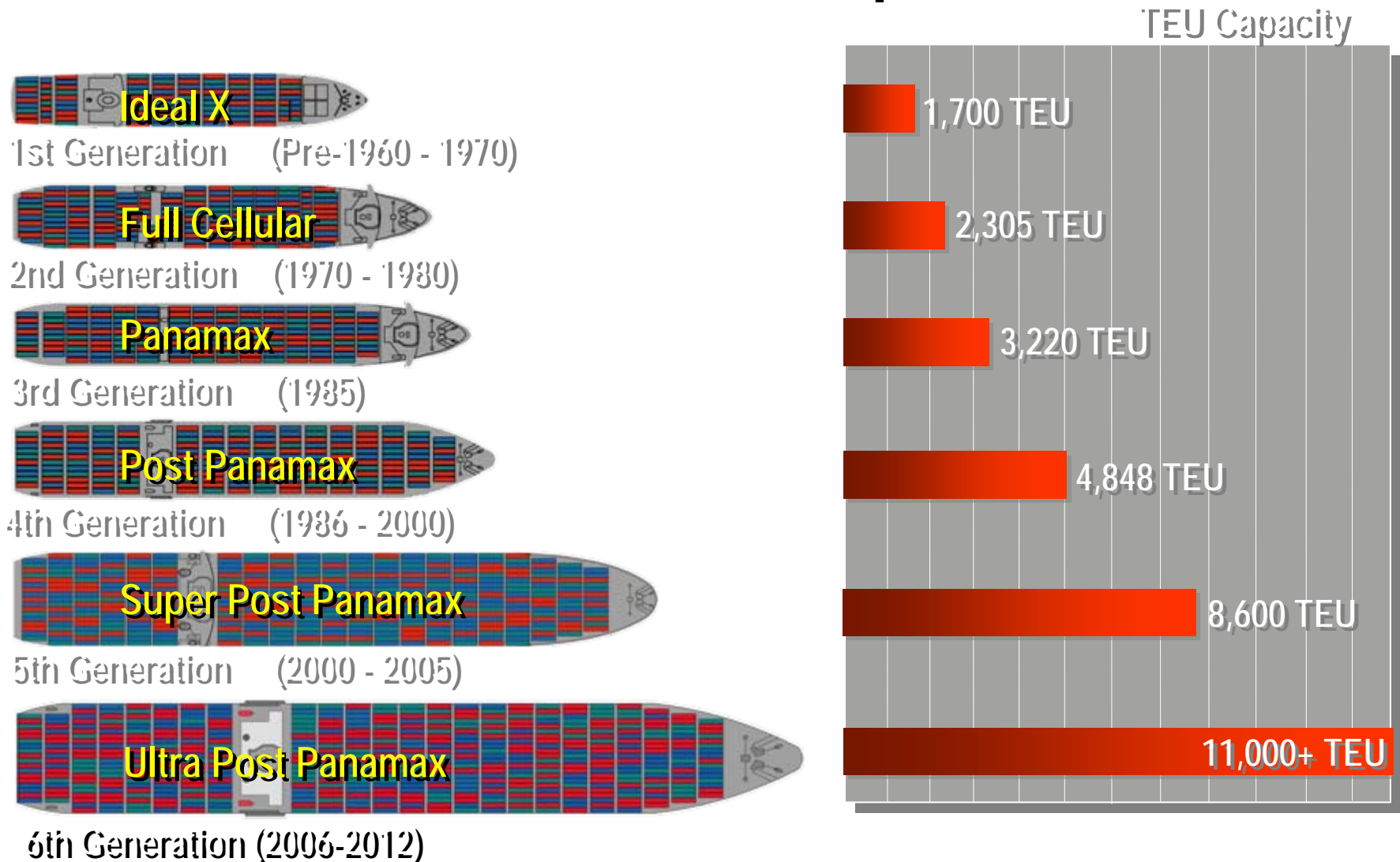
Monopoli

Catania



At present on line database contains  
**millions** records starting January 1999.

# World Container Ship Evolution



Regina Maersk

6,000 TEU

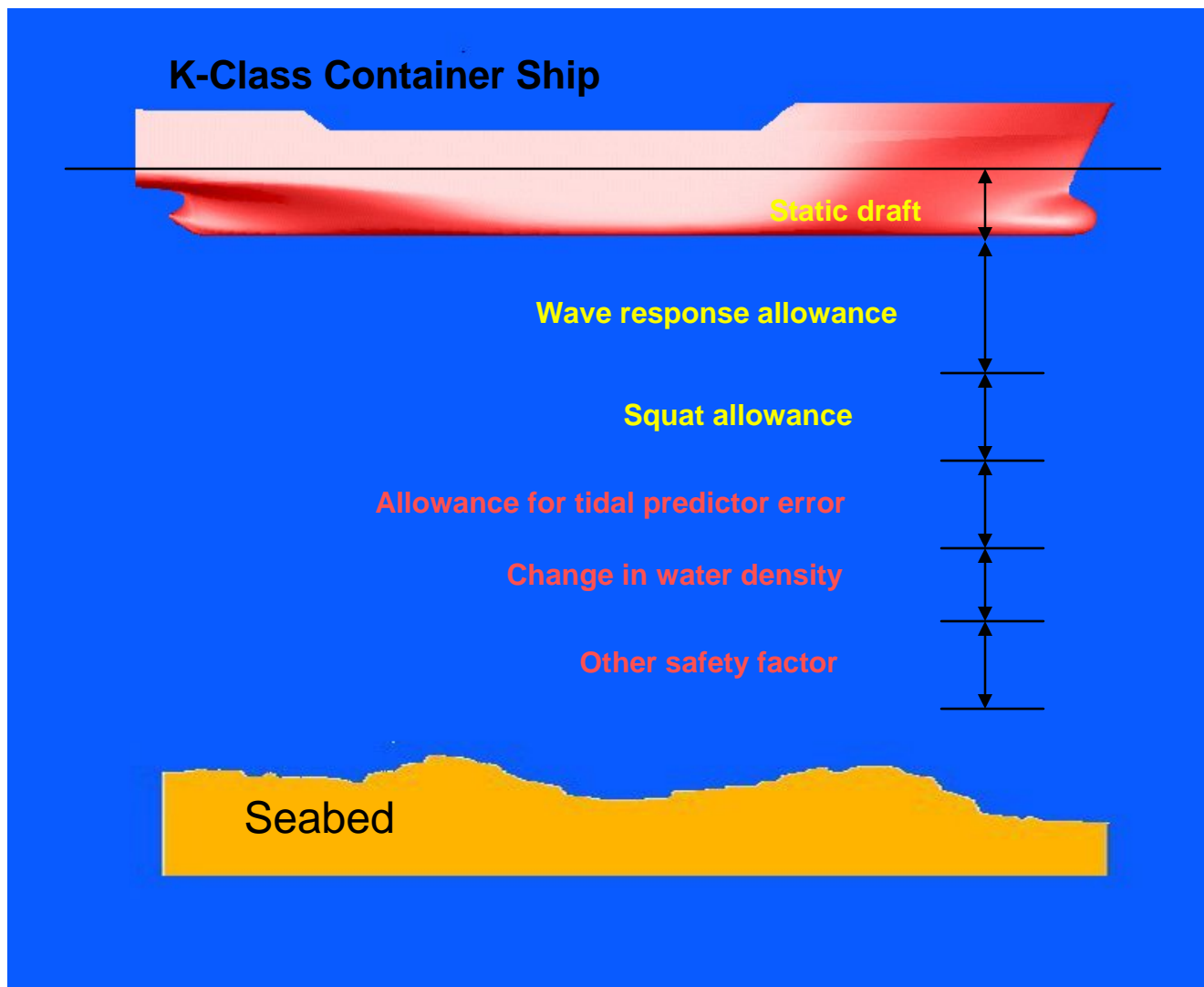
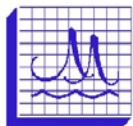
125,000 DWT

318m LOA (1,043 ft)

42m Beam (137 ft)

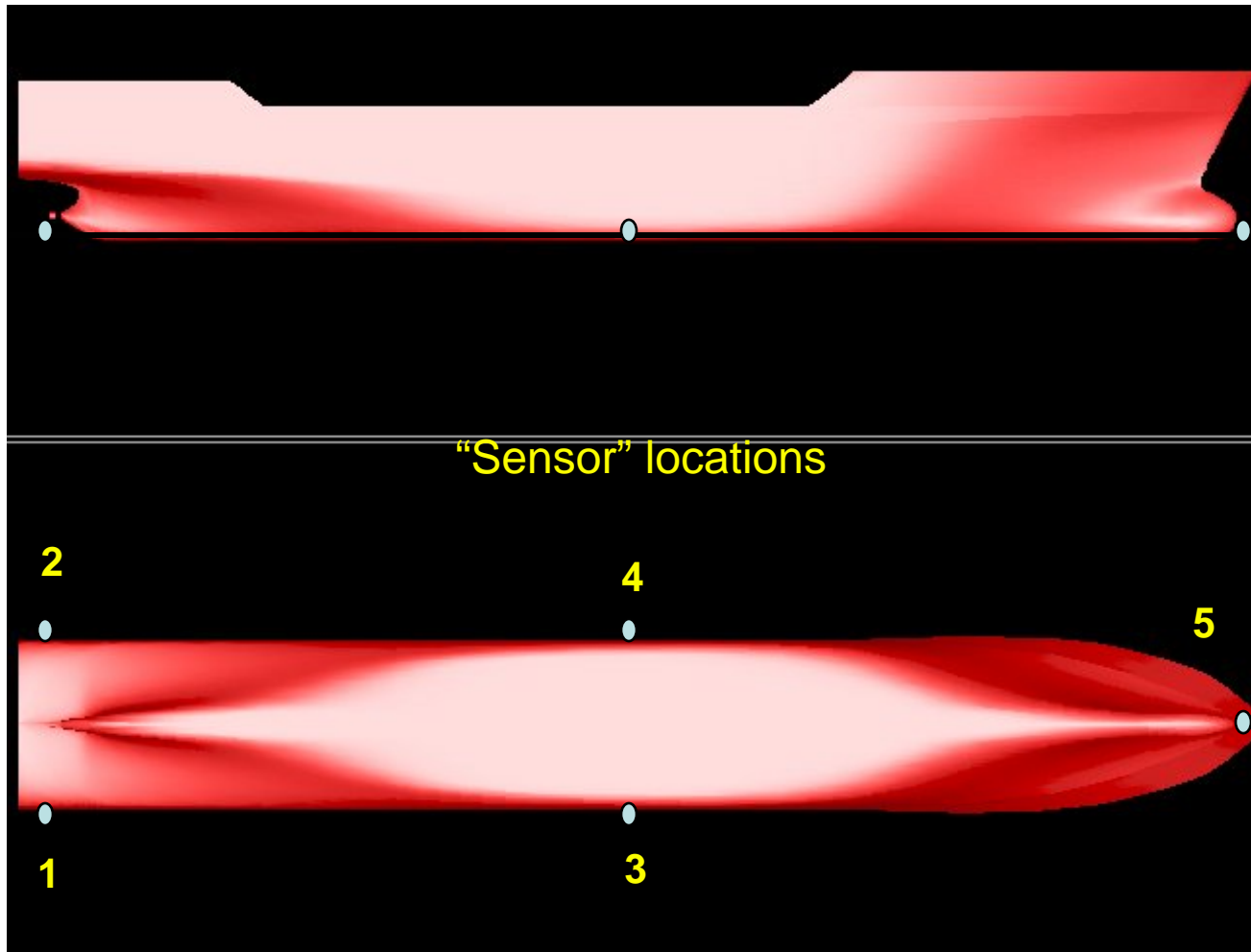
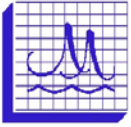
14.5m Maximum Draft (47.5 ft)

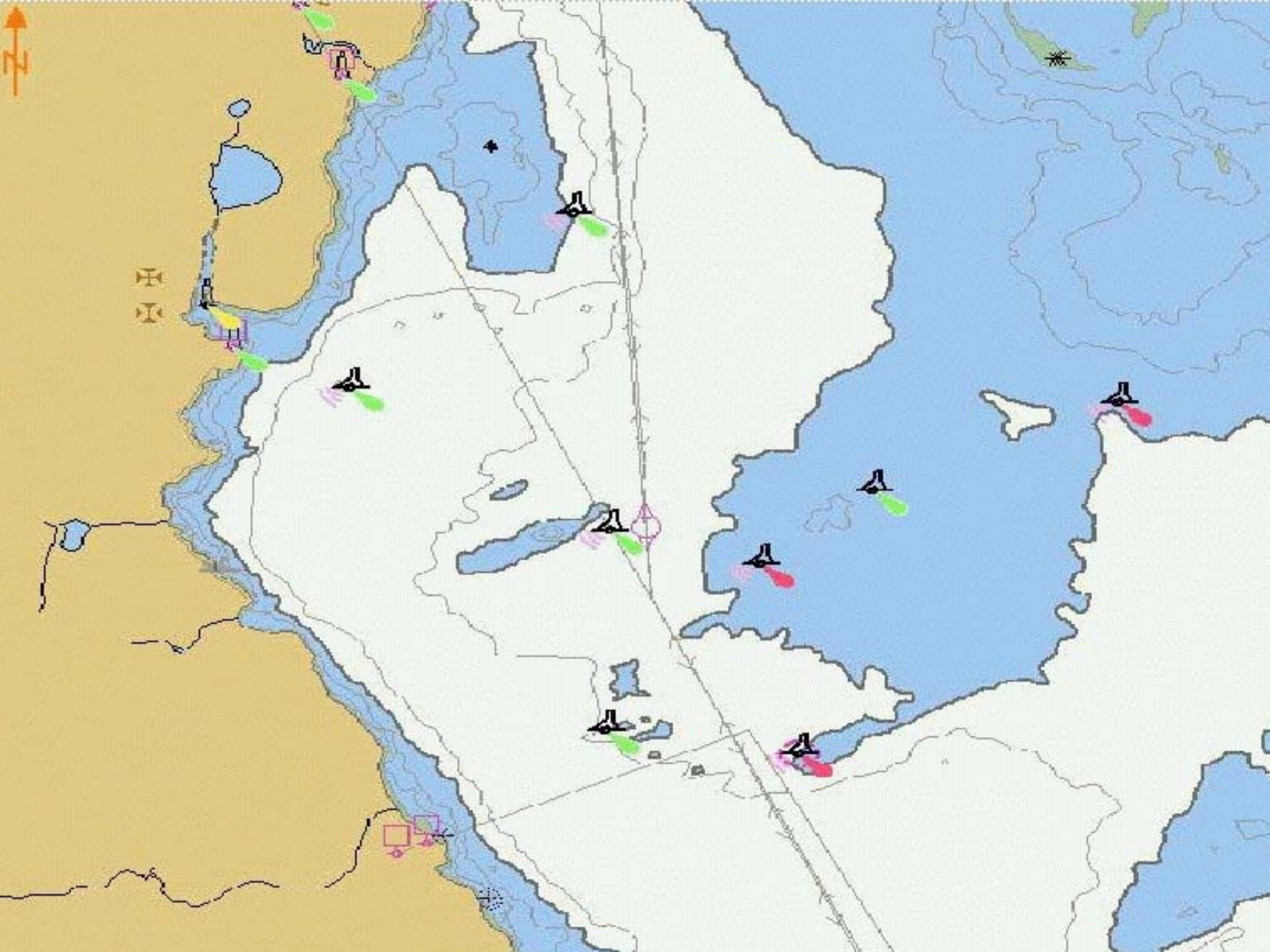




## Components of Underkeel Clearance (UC)

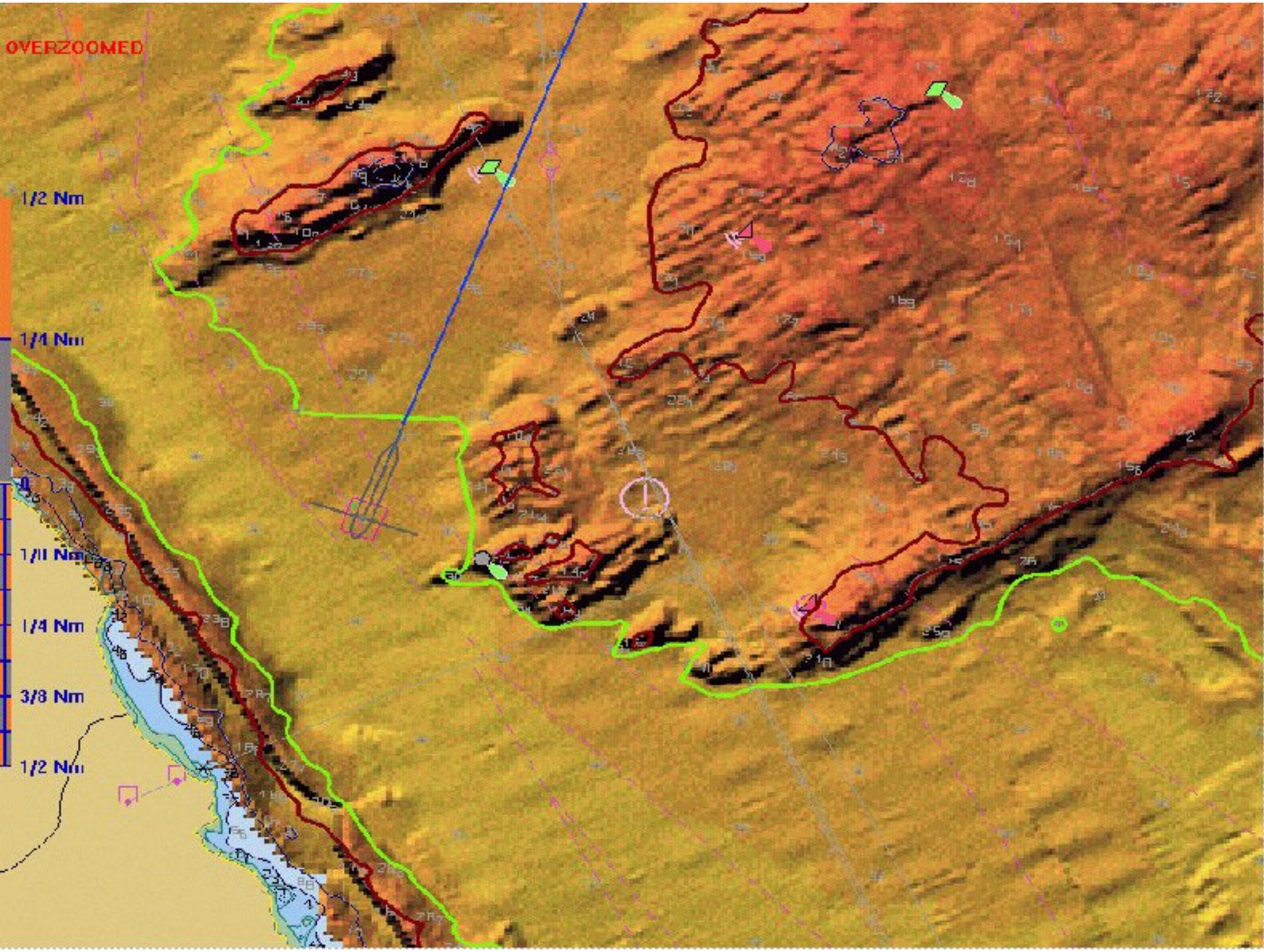




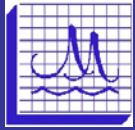




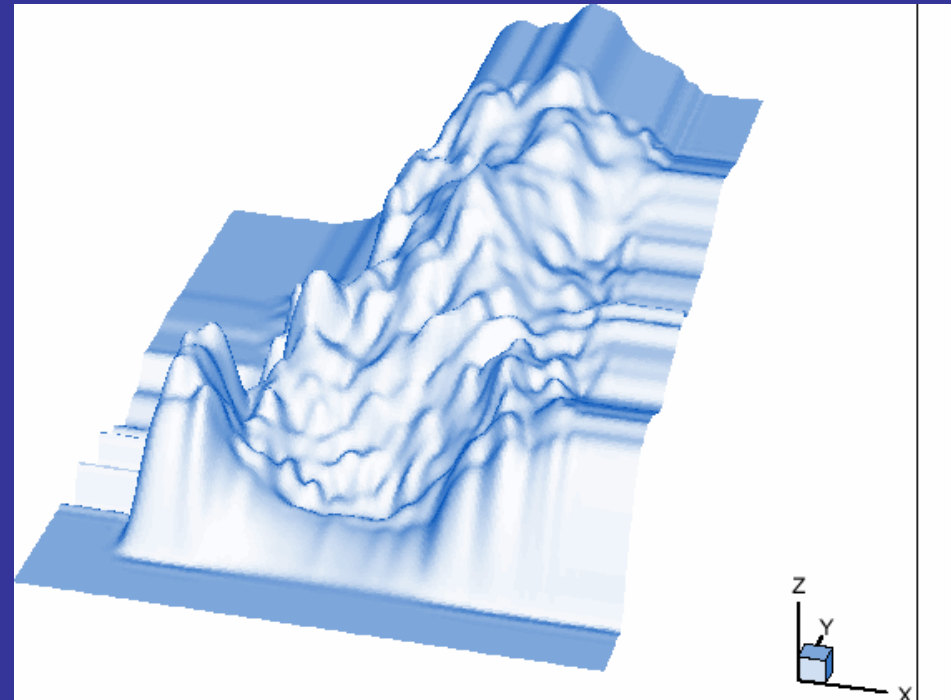
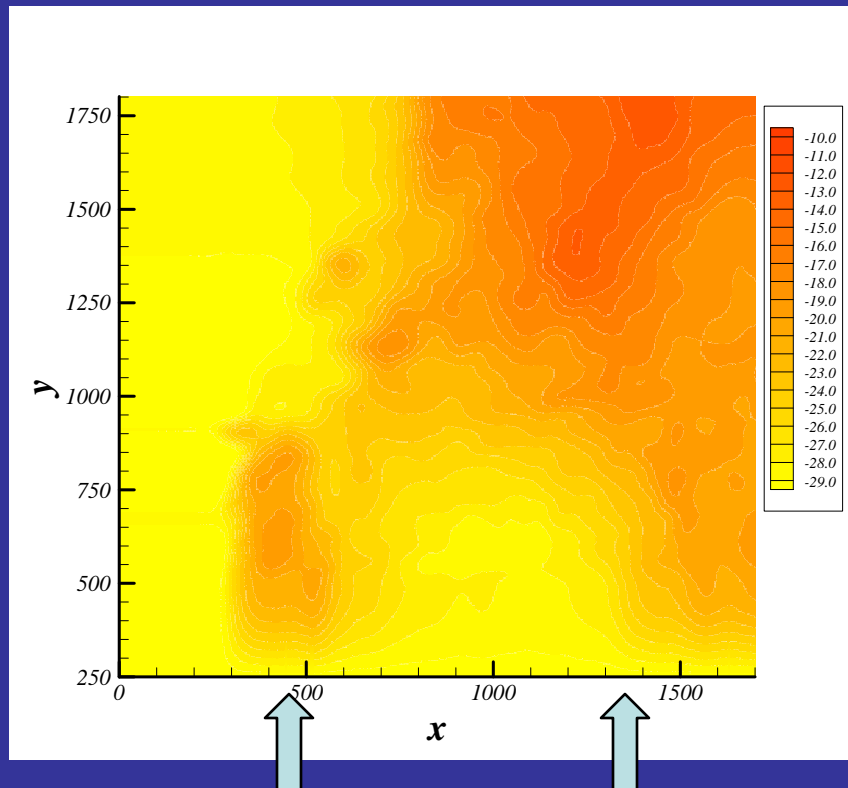
OVERZOOMED







# Numerical Prediction of Wave Refraction & Reflection



Incident wave: 10.2m, 15.5s

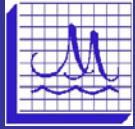
Wave 3D

Wave 2D

Velocity-x

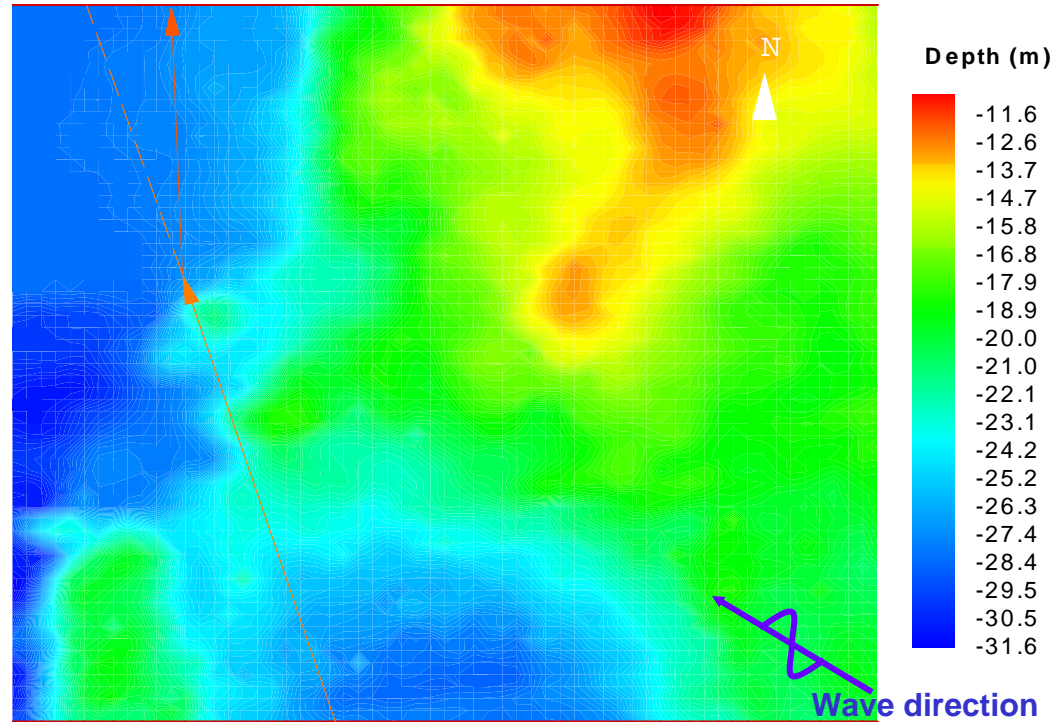
Velocity-y





(63:32:5.64, 44:33:20.27)

(63:30:57.22, 44:33:20.27)



(63:32:5.64, 44:32:47.8)

(63:30:57.22, 44:32:47.8)

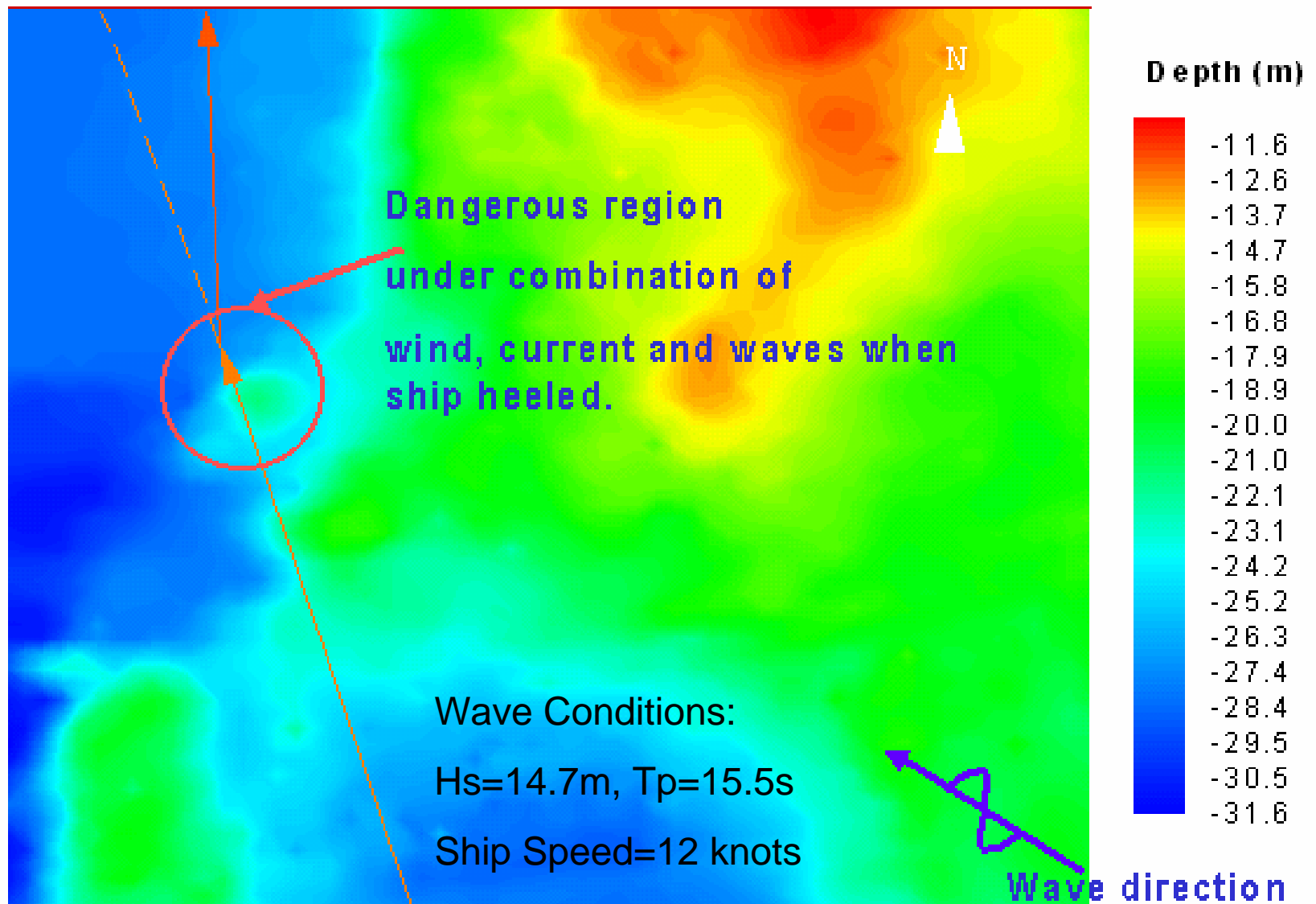
2D Side View

Ship speed=12 knots

Wave conditions:  
Hs=14.7m, Tp=15.5s, JONSWAP

(63:32:5.64, 44:33:20.27)

(63:30:57.22, 44:33:20.27)

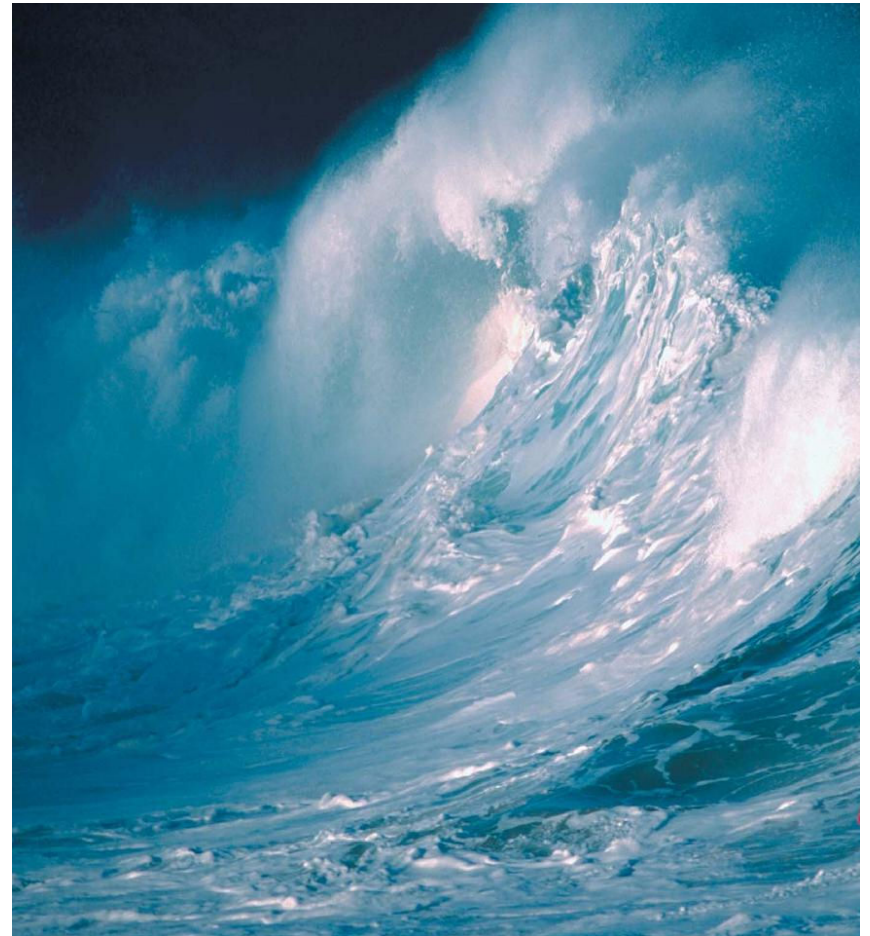


(63:32:5.64, 44:32:47.8)

(63:30:57.22, 44:32:47.8)

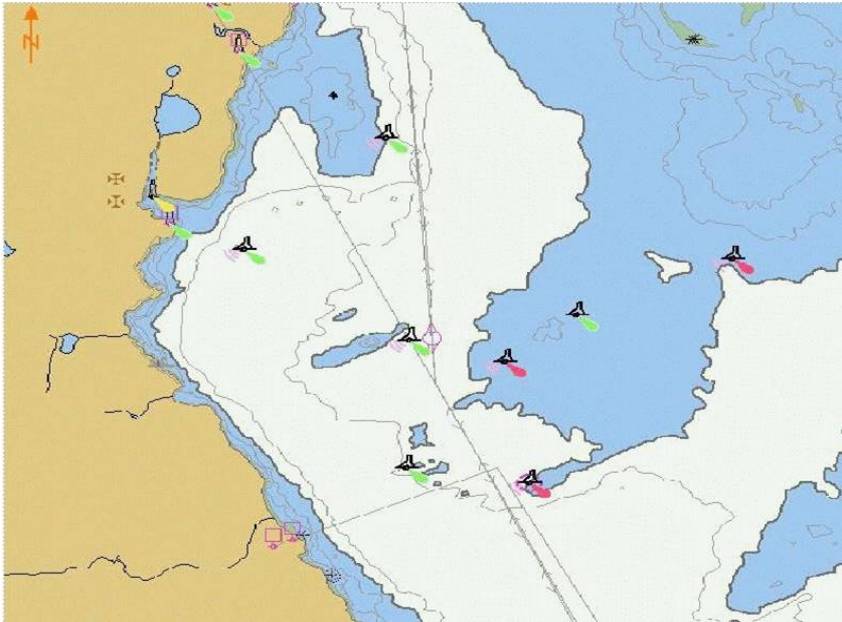
# Valuable Planning Tool

- Wave heights referenced to chart datum displayed as a safety contour on electronic charts.
- Buoy data validates wave transformation models.

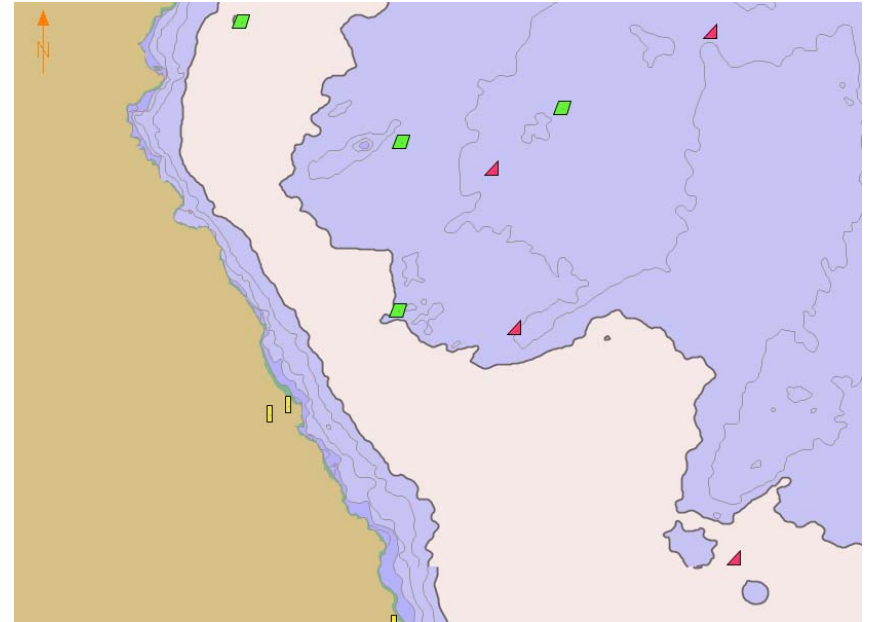


# Safety Contour Varies With Sea State

Good Sea Conditions

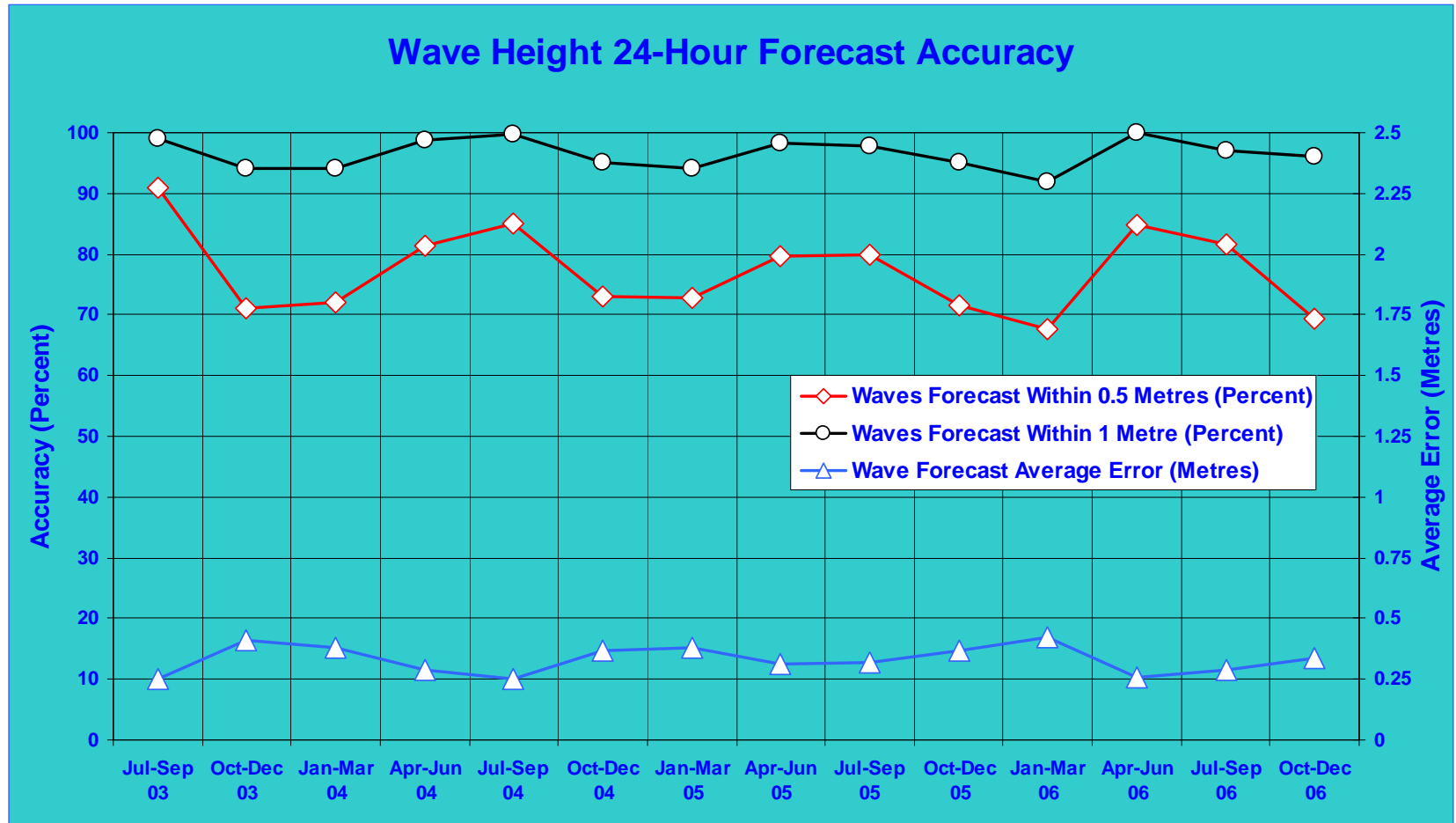


Adverse Sea Conditions



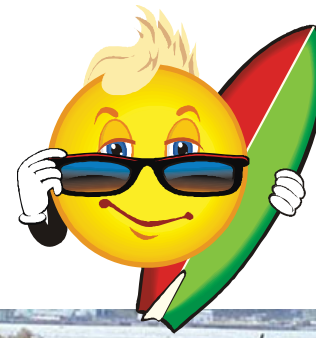


# Standard Sea State Forecast Accuracy –24 Hour





# Halifax



- Wave buoy in Halifax was slated to be cut. It was saved by the surfing community.
- Environment Canada uses data from the Halifax buoy for its marine forecasts.
- Buoy was source of critical wave data during Hurricane Juan reporting 20m wave height. Crucial information for pilots.



Storm surge from Hurricane Juan eroded the CN track dumping tanker cars into Halifax Harbour, 2003.

# Summary

- Canada is recognized as a leading manufacturer of weather buoy technology.
- Canada needs one single agency to oversee developing and maintaining a National Buoy Network.
- Single agency would provide mechanism to coordinate the data streams coming off the buoys so it can be shared among broad group of users.
- Single agency approach is essential for proper implementation of e-Navigation (i.e.) Fraser Arm buoy is ATON equipped for collision avoidance only.
- Single point of contact for information & funding.



We have gone beyond “Red Sky in the morning, sailors take warning.”

