DUKC® Chart Overlay

Presentation to IHO TWL and DQ Working Groups
Wollongong, March 2014

Seawork2009 Winner!
Innovations Showcase Award
MARINE CIVIL ENGINEERING & CONSTRUCTION

Outline

- Who is OMC?
- DUKC® description & methodology.
- DUKC® Chart Overlay concept.
- Chart Overlay application example.
- Where to from here...?
- OMC Wish List

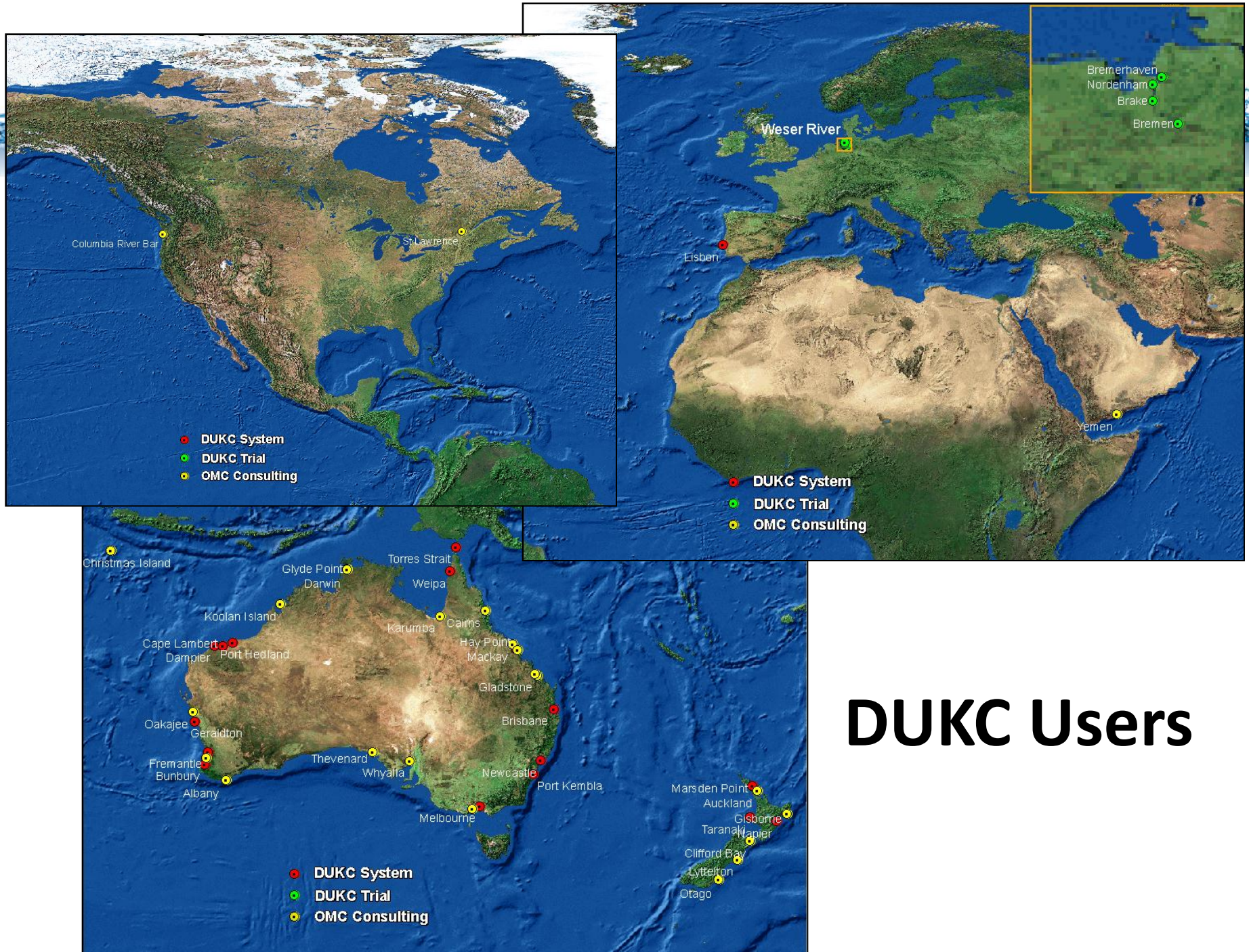
Who is OMC International?

- Provide under-keel clearance advice
- Inventor and sole supplier of DUKC®
- Installed at 21 Australian, NZ and EU ports

JAS-ANZ

LLOYD'S REGISTER QUALITY ASSURANCE · ISO9001

UKAS QUALITY MANAGEMENT 001


Columbia River Bar
St Lawrence
DUKC System
DUKC Trial
OMC Consulting
Weser River
Bremerhaven
Nordenham
Brake
Bremen
Lisbon
Yemen
DUKC System
DUKC Trial
OMC Consulting
Christmas Island
Glyde Point
Darwin
Torres Strait
Weipa
Karumba
Cairns
Koolan Island
Cape Lambert
Dampier
Port Hedland
Hay Point
Mackay
Gladstone
Brisbane
Oakajee
Geraldton
Fremantle
Bunbury
Albany
Thevenard
Whyalla
Newcastle
Port Kembla
Melbourne
Marsden Point
Auckland
Gisborne
Taranaki
Napier
Clifford Bay
Lyttelton
Otago
DUKC System
DUKC Trial
OMC Consulting

DUKC Users

What is DUKC®?

- "Decision support system for the planning and monitoring of deep draft vessel movements in shallow waters".
- Provides under keel clearance and sailing advice:
  - On-shore, and
  - On-board
- Used by:
  - Schedulers / planners
  - VTS officers
  - Mariners (pilots & masters)
  - Regulators

What is DUKC®? An example

Voyage Planning Service

Current | Search | Edit | New | Delete

Deep Draught Message

Voyage Plan for OMC DEMO TANKER (-1000588)

(Other plans for OMC DEMO TANKER)

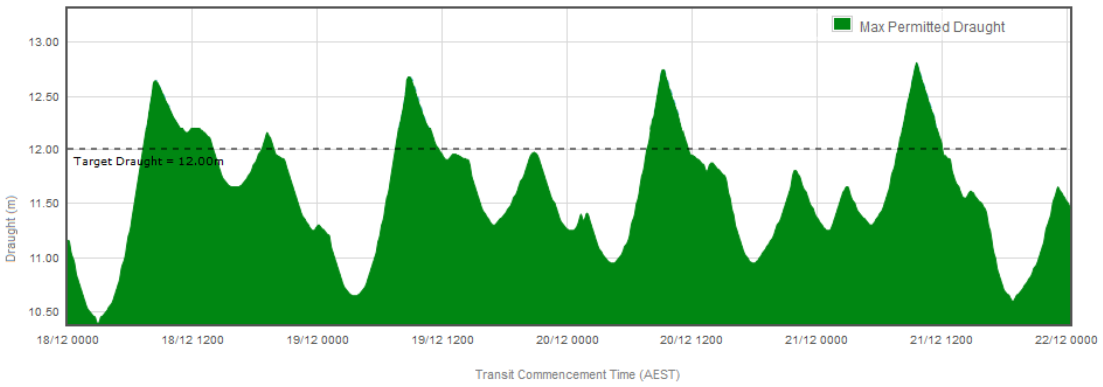
ID	156377.1 View History	Direction	Eastbound (Deep)
Created by	[redacted]	Earliest commencement date	18Dec2011 0000
		Latest commencement date	22Dec2011 0000
		Target Draught	12.00 m

Maximum Predicted Draught

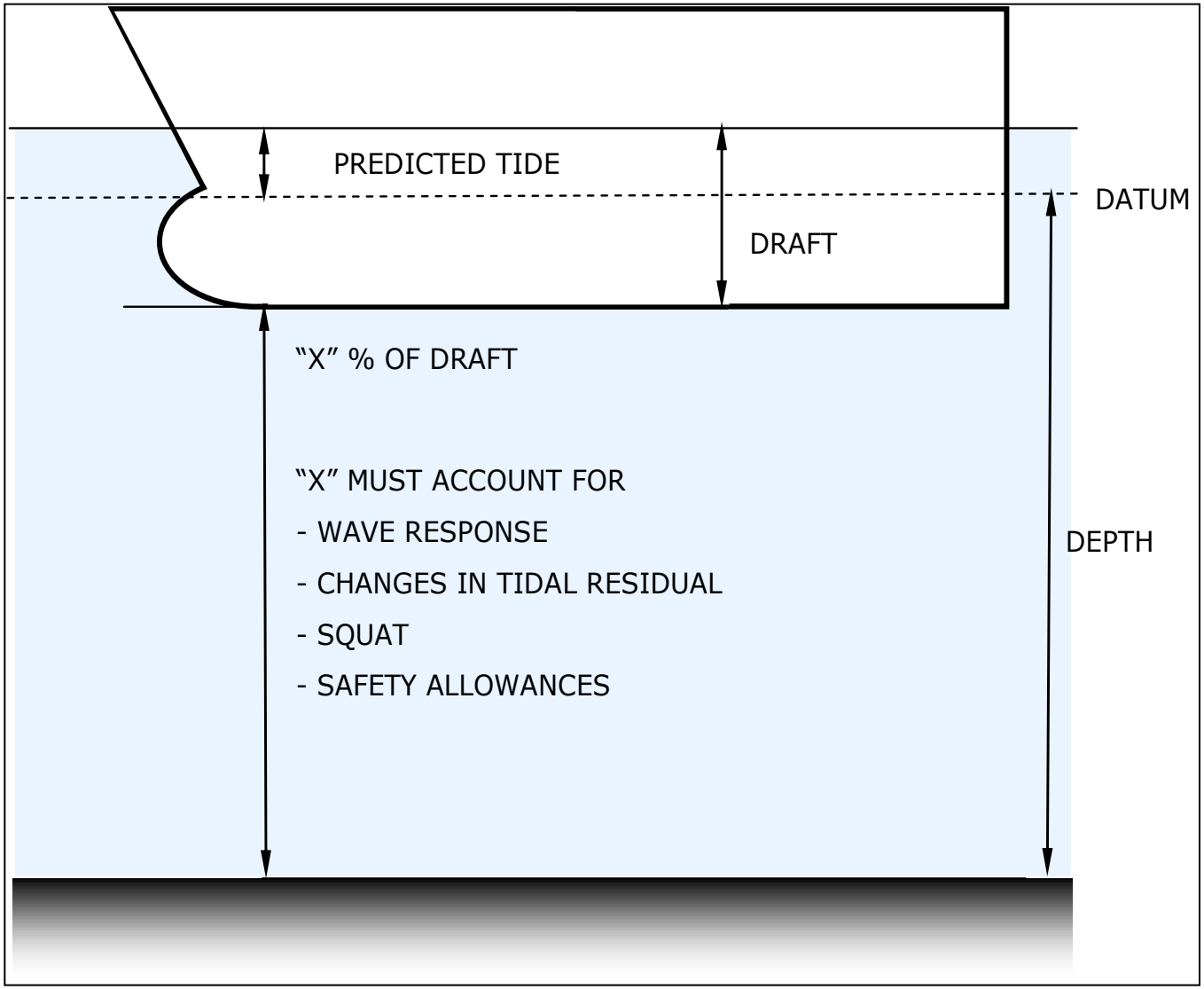
18Dec2011 0003 : 11.16 m	18Dec2011 0829 : 12.65 m	18Dec2011 1208 : 12.21 m	18Dec2011 1909 : 12.15 m	19Dec2011 0004 : 11.30 m
19Dec2011 0849 : 12.70 m	19Dec2011 1259 : 11.95 m	19Dec2011 2046 : 11.97 m	20Dec2011 0118 : 11.40 m	20Dec2011 0154 : 11.41 m
20Dec2011 0910 : 12.75 m	20Dec2011 1346 : 11.87 m	20Dec2011 2149 : 11.80 m	21Dec2011 0249 : 11.65 m	21Dec2011 0932 : 12.81 m
21Dec2011 1220 : 11.94 m	21Dec2011 1445 : 11.61 m	21Dec2011 2309 : 11.65 m		

Commencement windows for target draught: 5

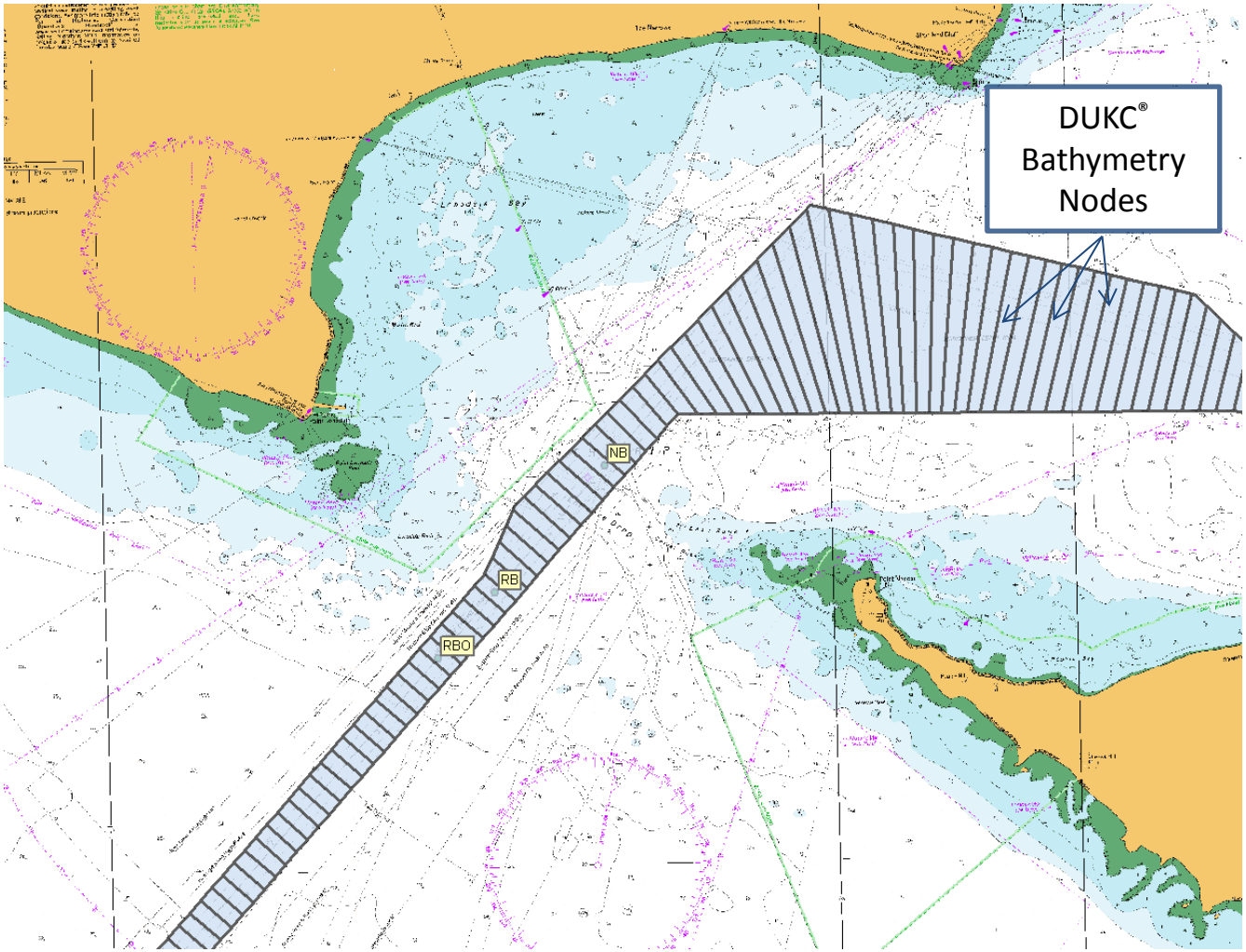
Window open	Window close	Duration	Window open	Window close	Duration
18Dec2011 0715	18Dec2011 1400	6 hrs 45 mins	20Dec2011 0740	20Dec2011 1140	4 hrs 0 mins
18Dec2011 1840	18Dec2011 1950	1 hrs 10 mins	21Dec2011 0750	21Dec2011 1204	4 hrs 14 mins
19Dec2011 0730	19Dec2011 1140	4 hrs 10 mins			



Dynamic vs. Static



DUKC® Methodology



DUKC® Methodology

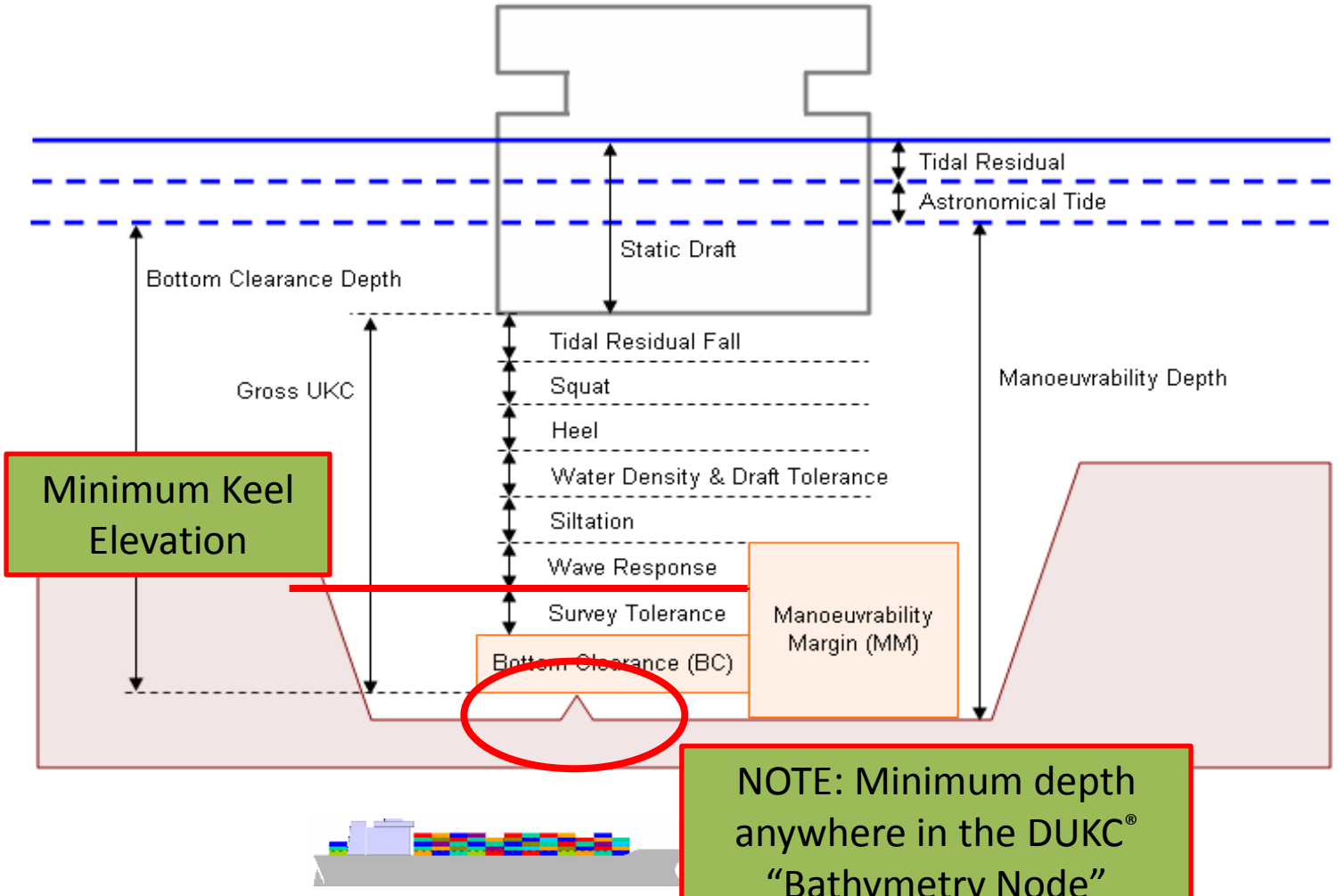
predicted waves

predicted tide & currents

predicted wind & pressure

latest sounded depths

astronomical tides



ship in given load state

ship speed envelopes

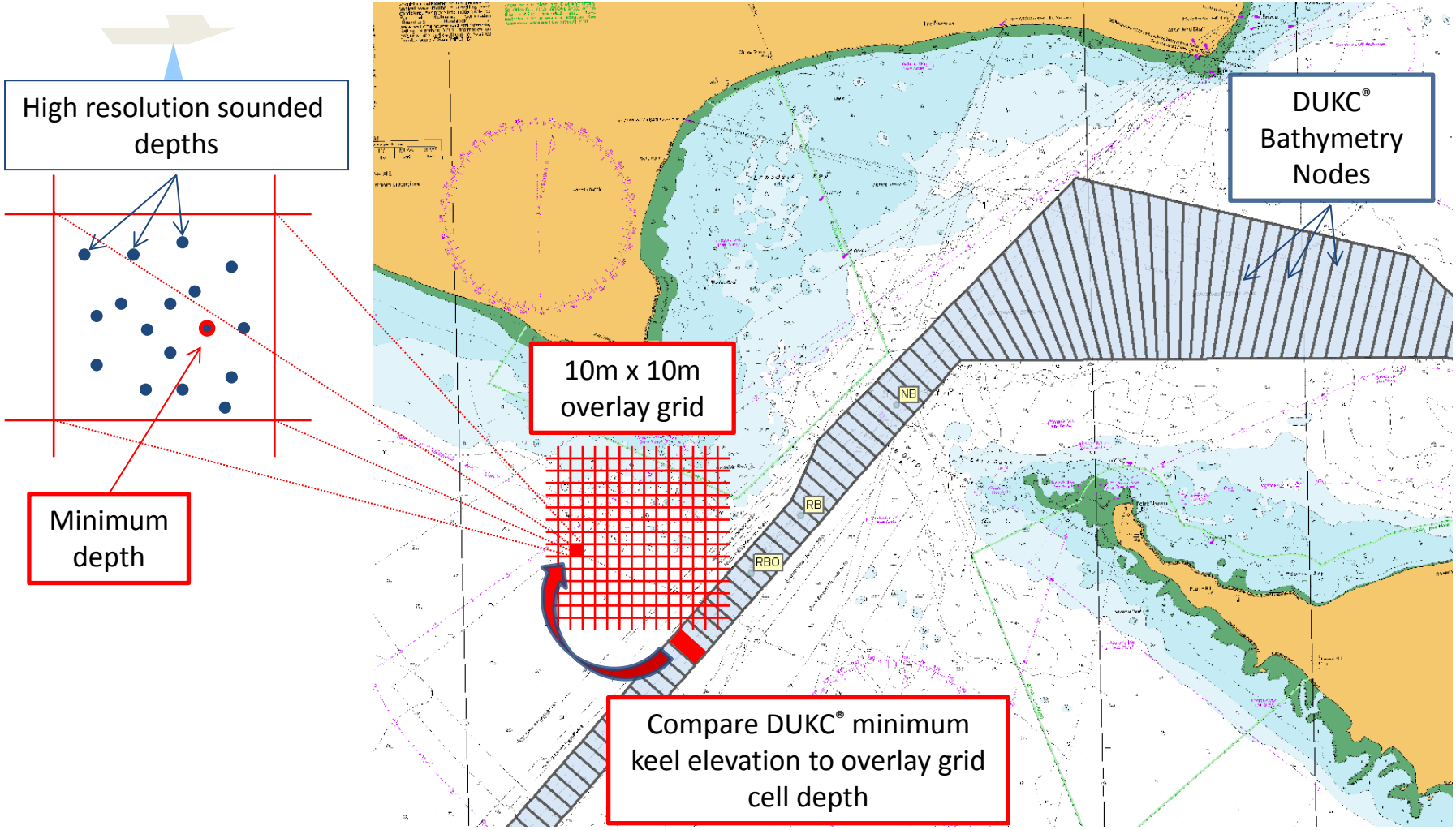
CHART OVERLAY

DUKC® Chart Overlay

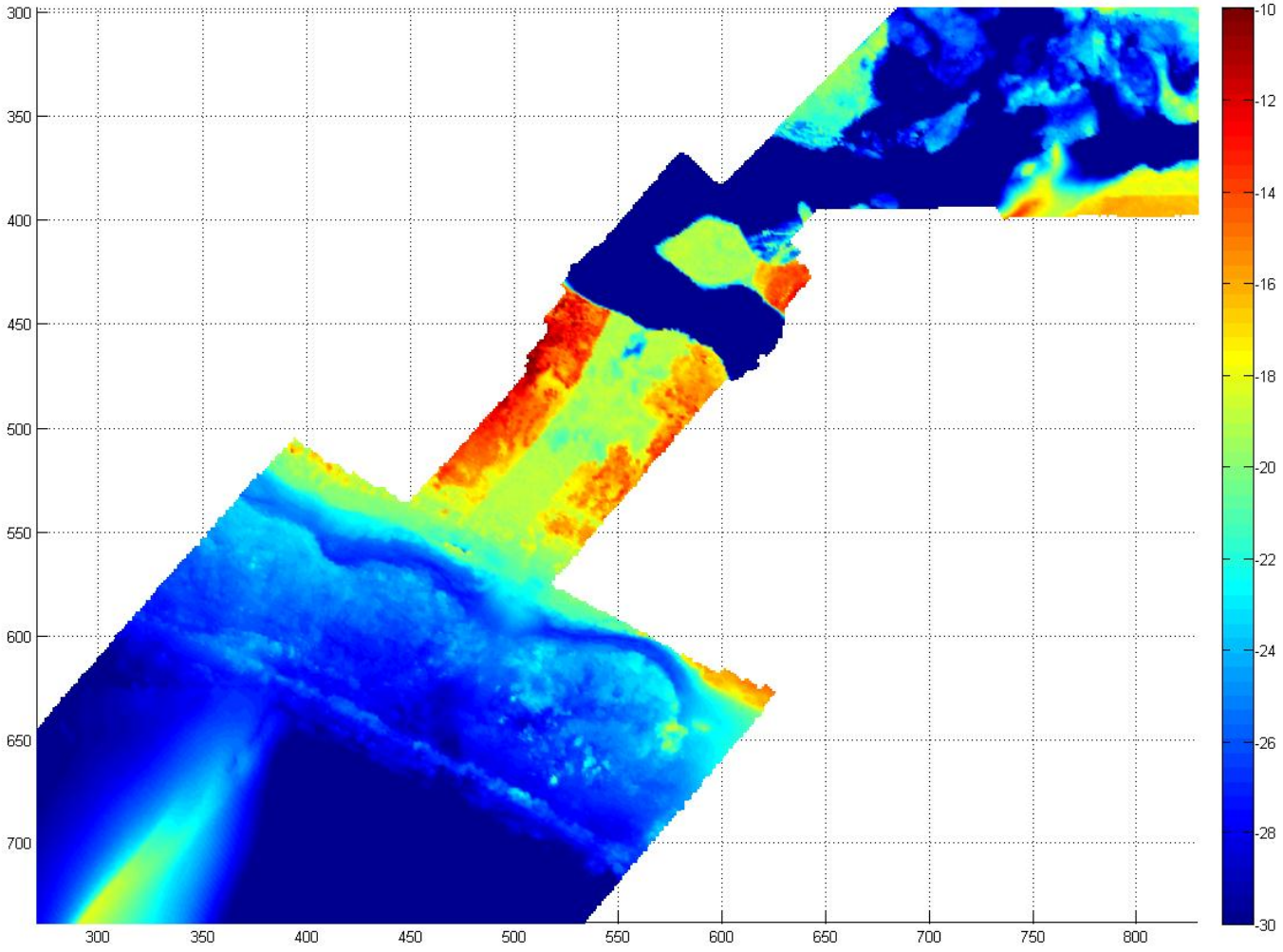
- Marine Information Overlay for UKC
- Shows ‘go’ and ‘no-go’ areas

ECS dynamic depth contours	DUKC® Chart Overlay
Based on static UKC allowance	Based on dynamic UKC calculation
Shows live go / no-go	Shows predicted go / no-go for ETAs, speeds and conditions along route
Dependant on resolution of ENC bathy	Uses latest locally-sourced high resolution bathy
Computed on-board	Computed on-shore and transmitted to vessel

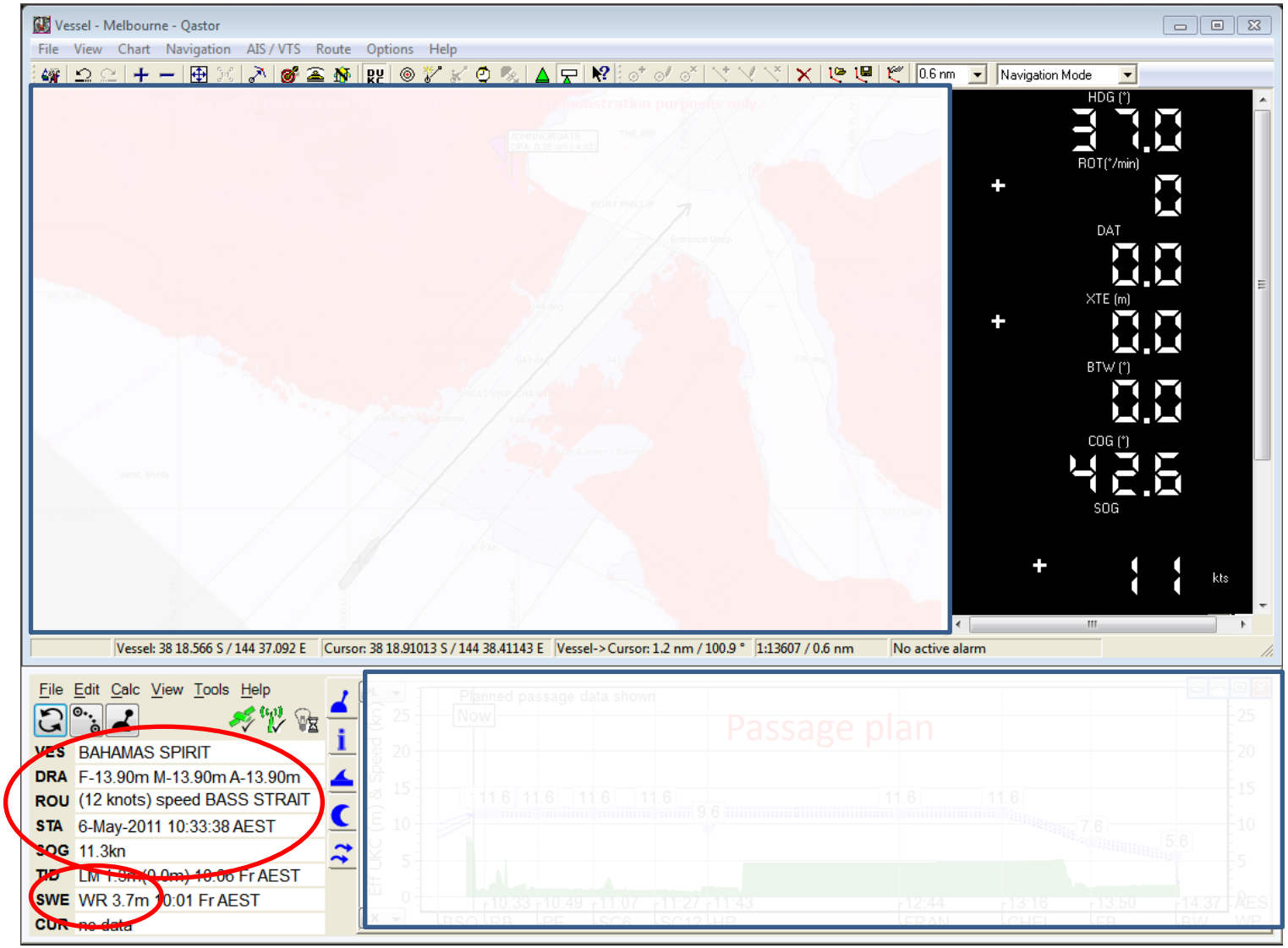
Computing the 2D overlay



High-resolution bathymetry grid



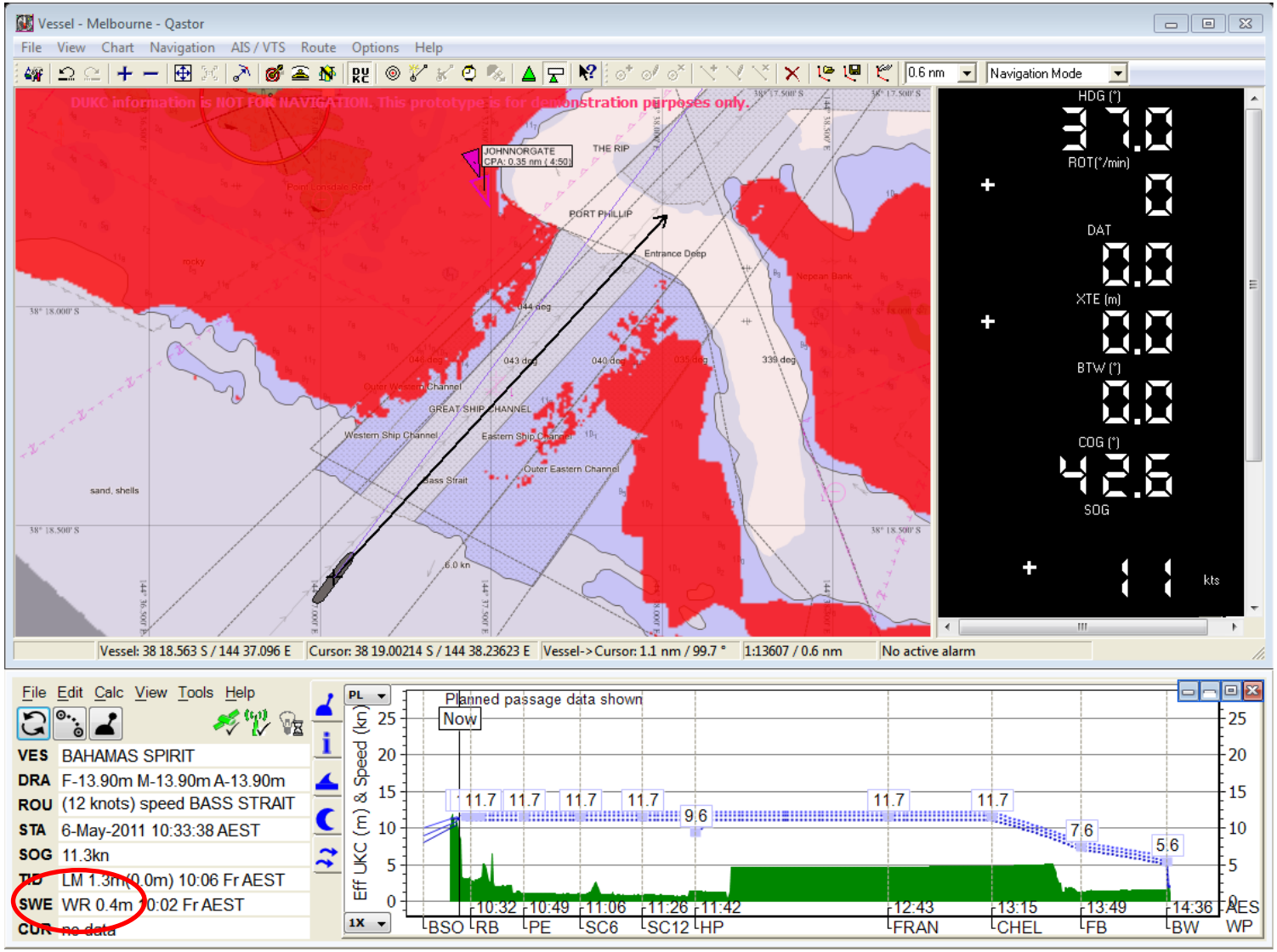
Prototype Chart Overlay on ECS



Transit Details

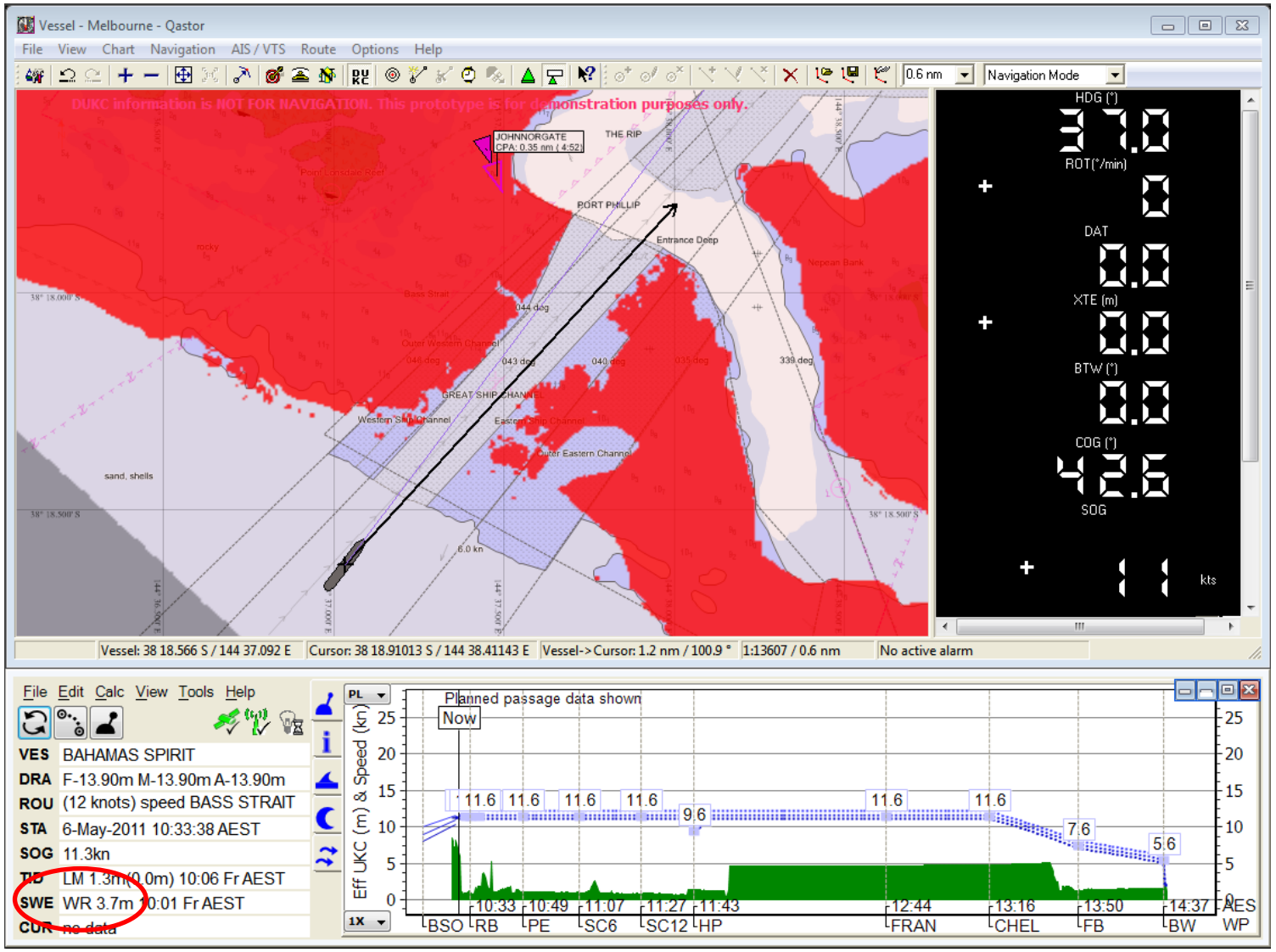
High swell

What If – Low Waves…?



Low swell

Prototype Chart Overlay on ECS



High swell

Deep-draught transit

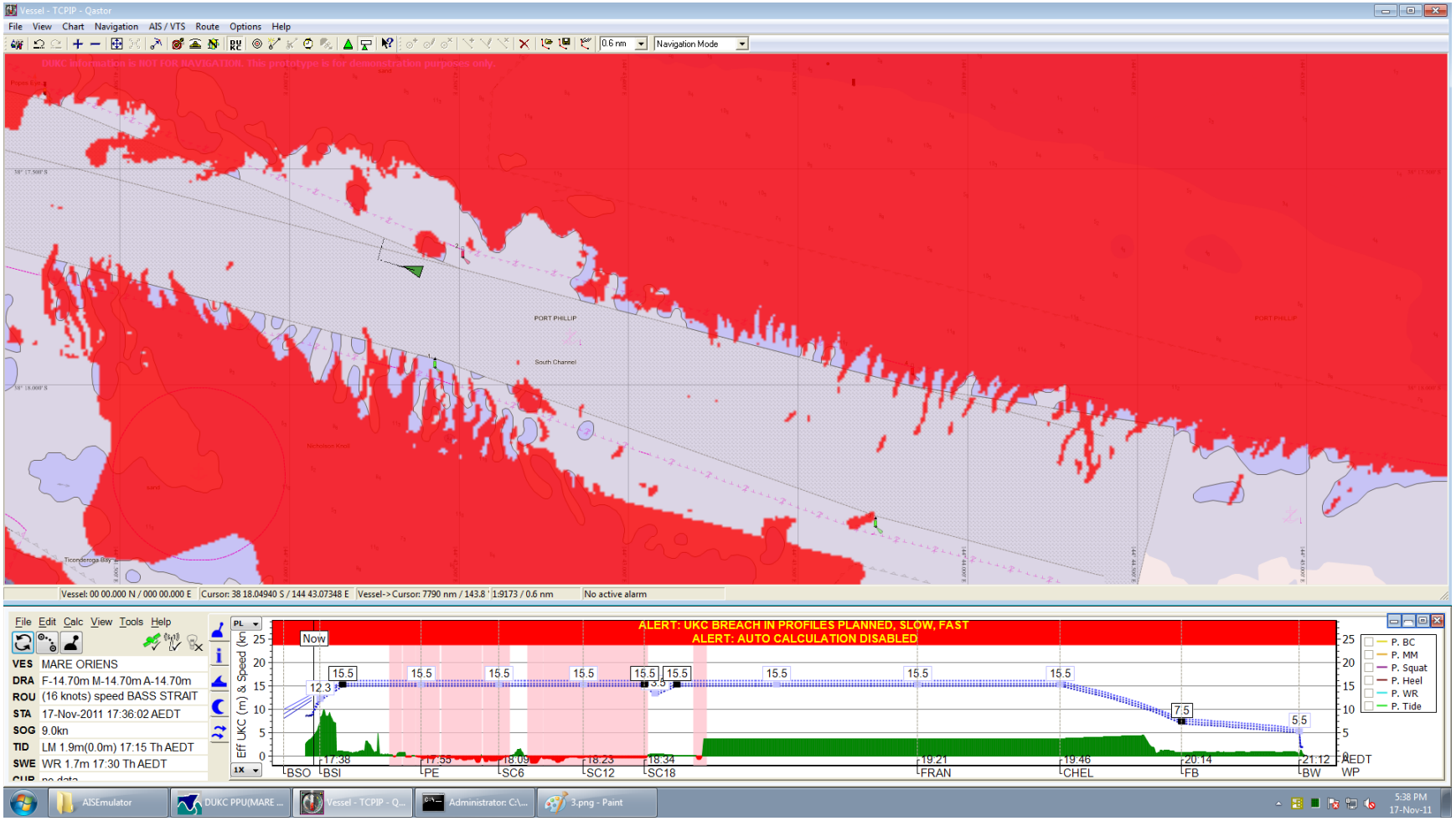
- Bahamas Spirit (Tanker)
  - LBP 247m, Beam 42m
  - Draught 13.9m

Place: Port Phillip Bay
Date Taken: 2011-05-06 11:04

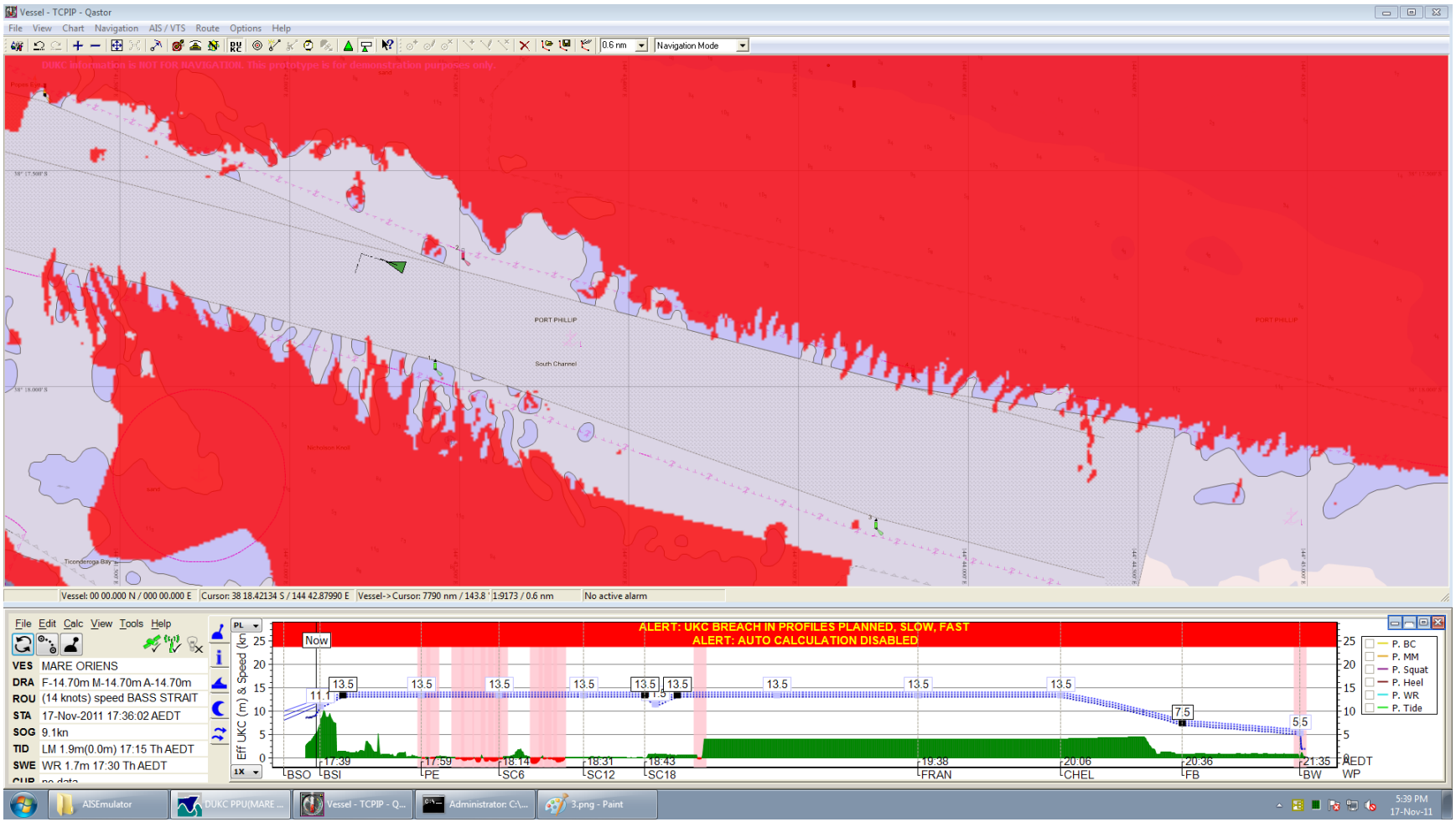
Use in Passage Planning

- Forecast effect of departure time and transit speed.
- Hypothetical example in Port of Melbourne.
- Planning a deep draft tanker movement.

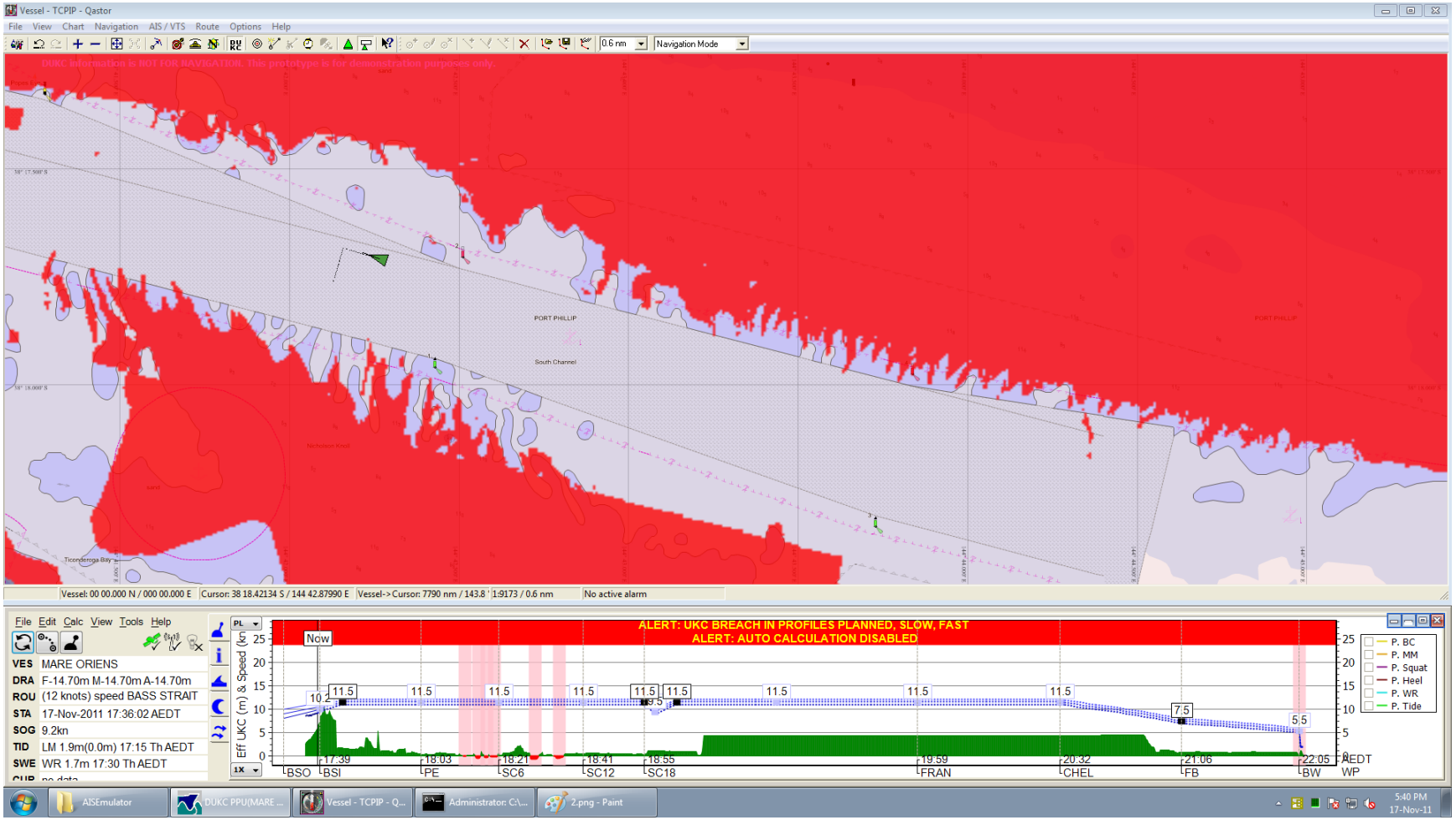
What If – 14.7m at 16 knts?



What If – 14.7m at 14 knts?



What If – 14.7m at 12 knts?

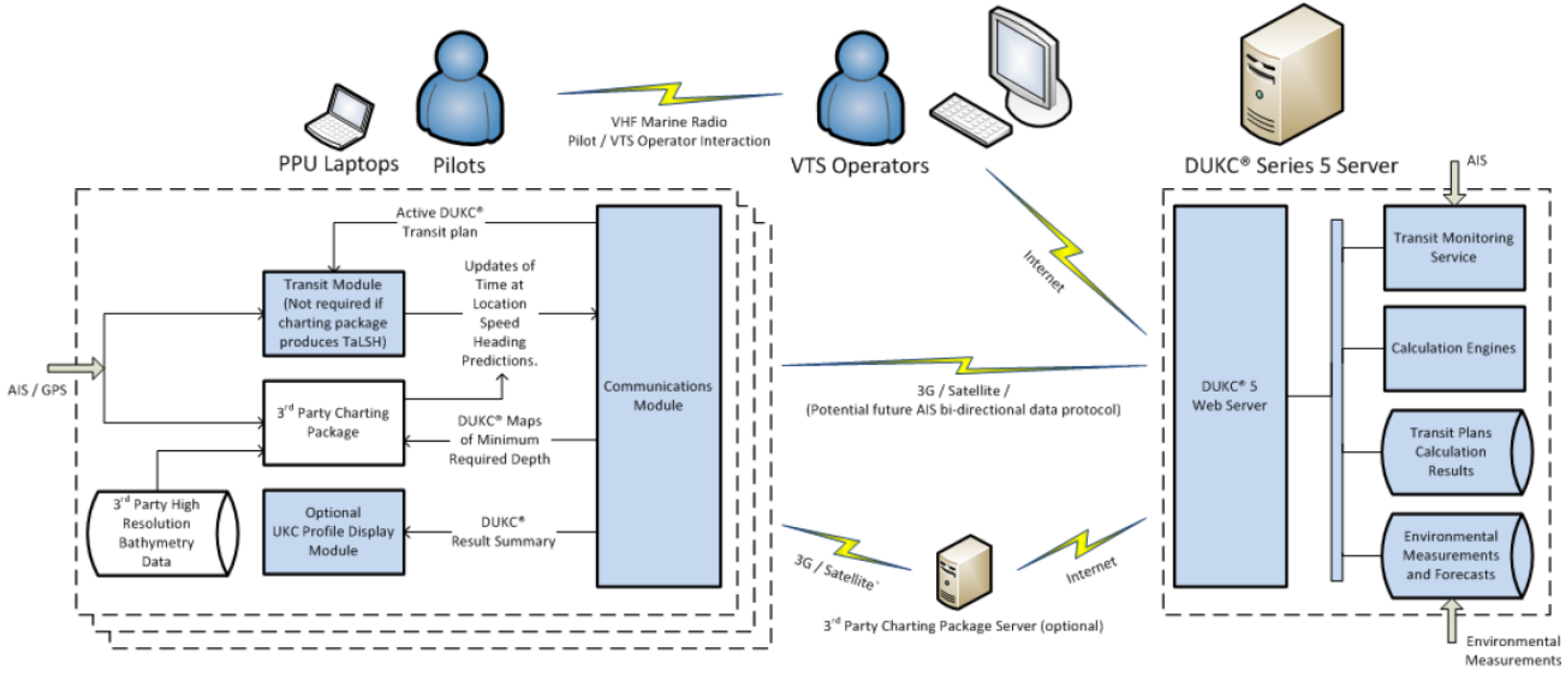


Early implementation

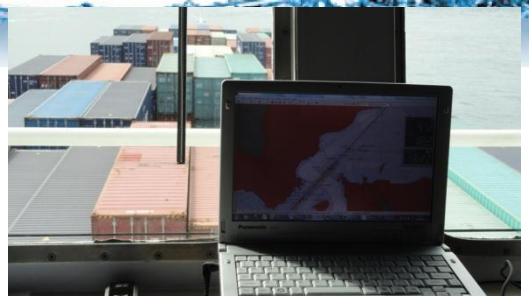
- Initial integration with QPS' Qastor ECS.
- Qastor used by pilots at Melbourne and Port Hedland.
- Integration not exclusive to Qastor.
- Deployed to Port Hedland December 2013.
- Web map version under delivery to AMSA for Torres Strait by June 2014. On-board trial proposed.

System Architecture

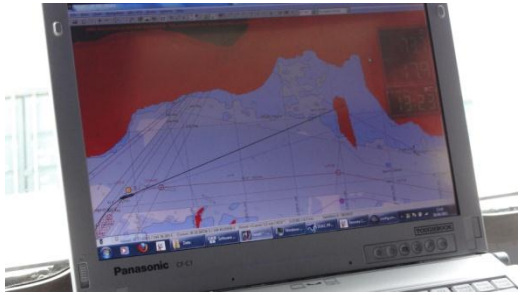
2 Architecture



User feedback



- Overwhelmingly positive
- Pilots
  - Assists time-critical decisions in conjunction with shore based support.
  - Invaluable information for emergency situations.
  - Reduces unknowns and allows better-informed decision making.
- Ports
  - Valuable tool to maximise channel usage
  - Some concern about misuse of the information.
  - Must go hand in hand with operating procedures



WHERE TO FROM HERE?

Where to from here?

- Predictive UKC overlay concept has been proved
- Merge with ongoing e-navigation developments
- Improve integration and robustness
- “Live” UKC?

Relevant standards

- Exchange of:
  - Wave and tide (spatial) forecasts.
  - Vessel passage plan (and updates).
- High resolution bathymetry data.
- Datum definitions and separation models

E-navigation elements

- Vessel static and loading details.
- Vessel dynamic motion models.
- Ship – shore – ship data communications.
- Integration with ECS or ECDIS display software.

Design decisions

- Which calculations on-board?
- Which calculations on-shore?
- Low bandwidth communications.
- Reliability of results (ensuring accurate, up to date input data).
- Robustness of system to communications or hardware failure.
- Speed / simplicity / useability of the system.
- Degree of coordination required with 3rd party developers.

Outstanding issues

- Custom hardware must be taken on-board (by pilot).
- Display of time dimension on ECS.
- Better integration of passage planning with ECS desirable.
- Transmission and display of space and time varying forecasts.
- Standard approaches to using high resolution bathymetry data.
- Relies on 3G phone coverage for updates.
- Lack of international standard for transmitting UKC data.
- Possible discrepancy between navigational systems.
- Lack of fall-back systems.

What does OMC need? Specifics

- Details on data uncertainty:
  - total water depth (depth + tide)
  - Spatial variability (like ZOC)
- Details on vertical datum and datum relations
  - E.g. CD to WGS84
  - Example: Real-time UKC measurement through GPS
  - Spatial variations
- Details on bathymetry:
  - Shoal biased? Rounded?
  - Bed material
  - Tide reduction method applied (to ensure OMC applies same method)
  - Ideally can be queried in CD and WGS84
  - Ideally an indication of seabed mobility
- Tide data:
  - Measurement location
  - Vertical datum of measurement
  - Relation to WGS84 ellipsoid
  - At least 2 decimal places…
  - Has filtering been applied to provided data?
  - Spatial variation
  - Astronomical predictions
  - Tidal streams (observations and predictions)

Safer Shipping | Smarter Ports

Smarter Ports don't come about **by accident.**

Questions Please.

OMC International