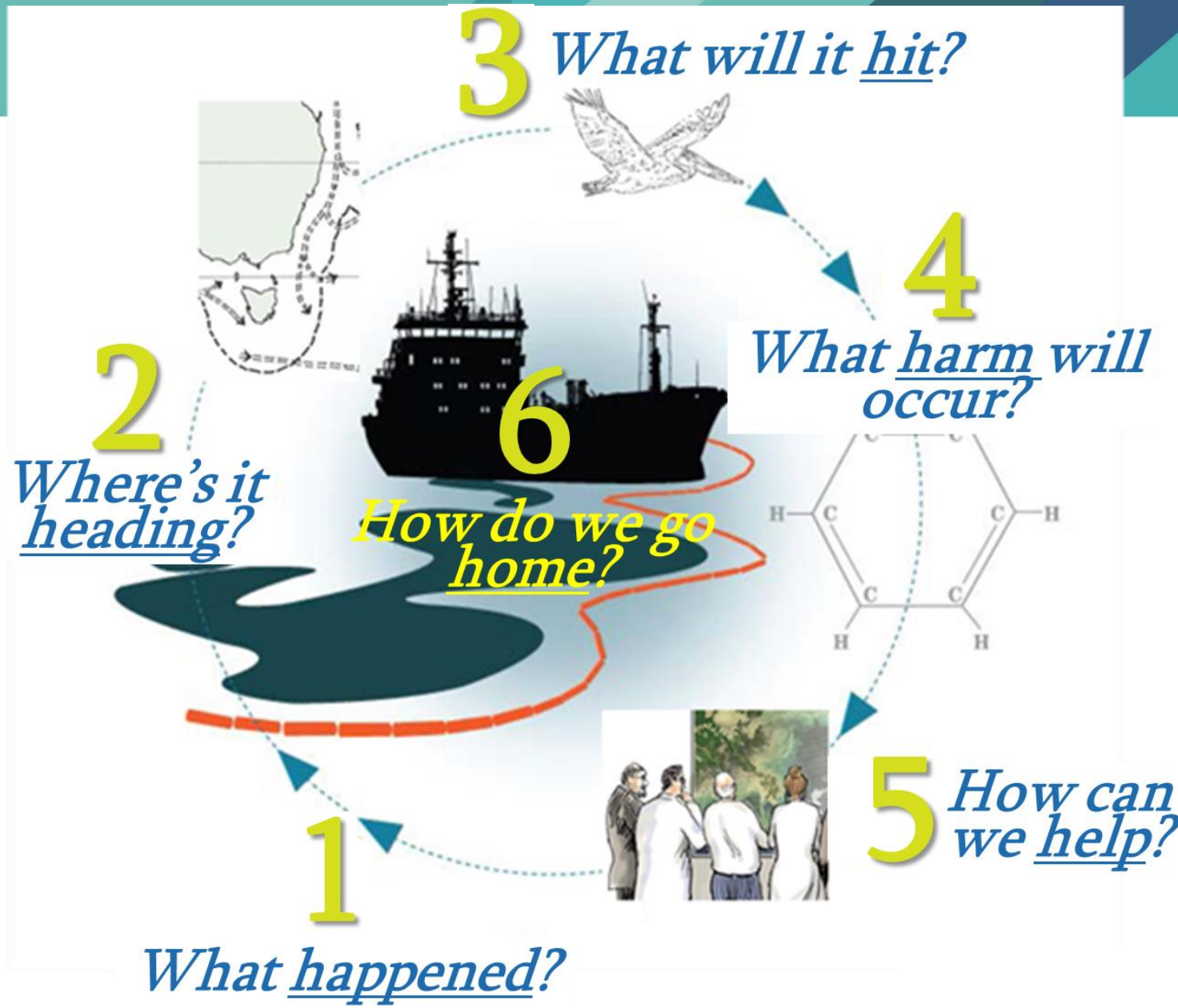
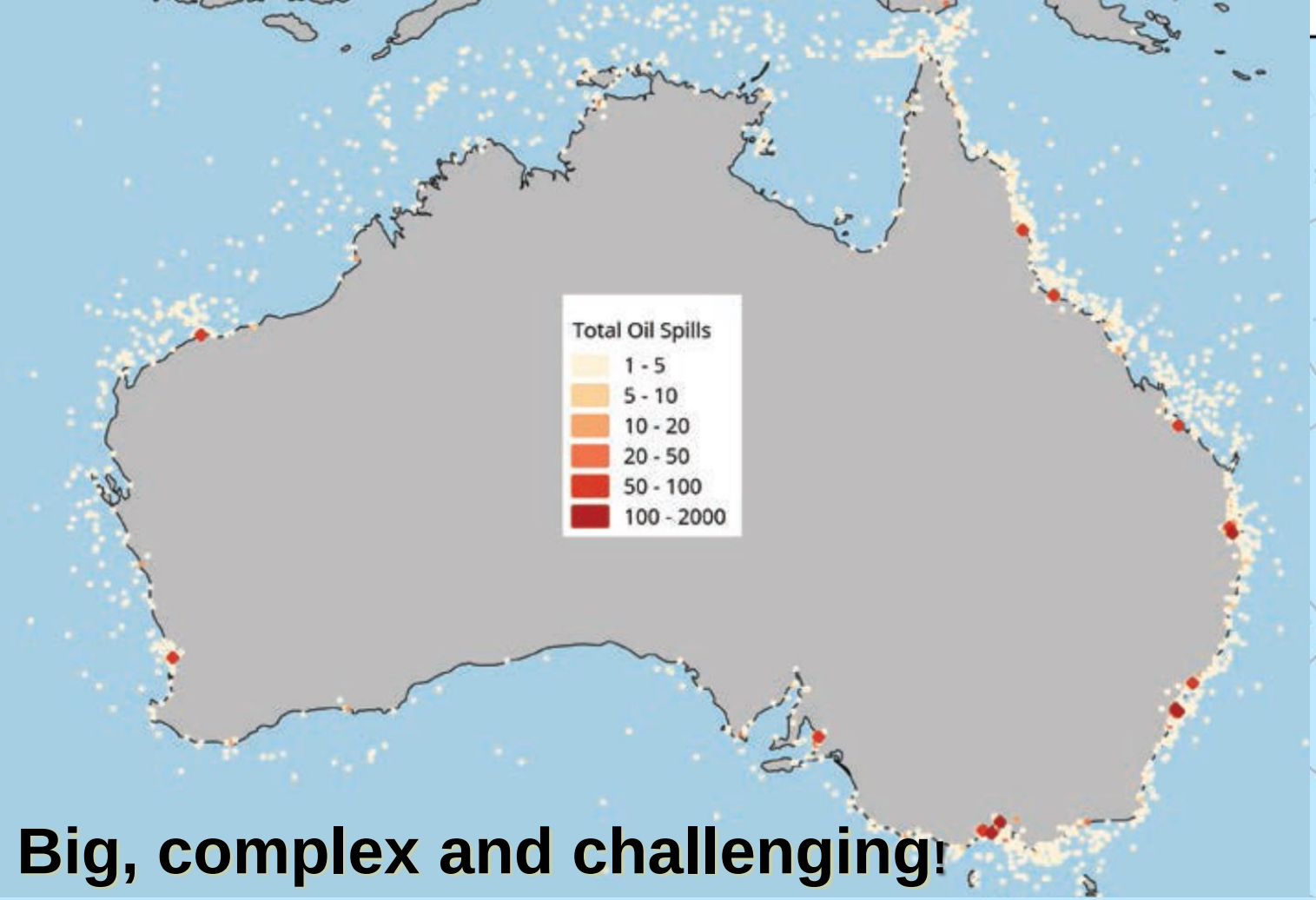
Saving lives and keeping seas clean, by applying oceanography! We know where you drift!

Paul Irving, AMSA, 22 November 2021

Session Intent

- Figuring out where things will go and then preparing or responding there!
  - search and rescue
  - maritime casualties
  - oil spills
  - containers overboard
- Starts
- Movements
- Searches
- Responses



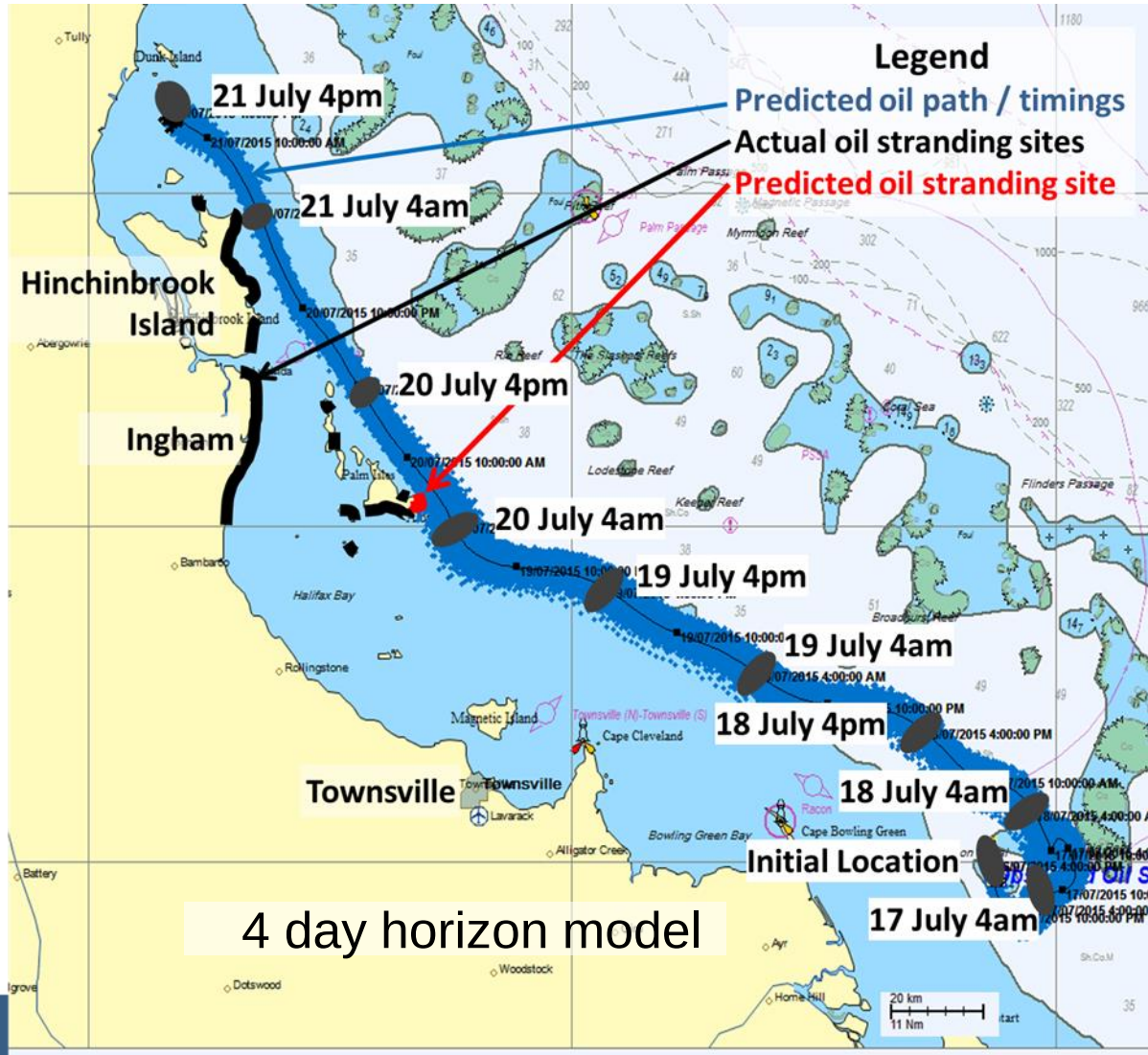


Big, complex and challenging!

- Covers 5 ocean climate zones & 6 maritime boundaries
- 60,000 km coast & 12,000 islands
- 8.232m $km^{2,}$ EEZ (3rd largest)
- Search and Rescue area = c.f. 10% earth
- 10% world sea trade via 35,000 int'l visits thru 73 ports

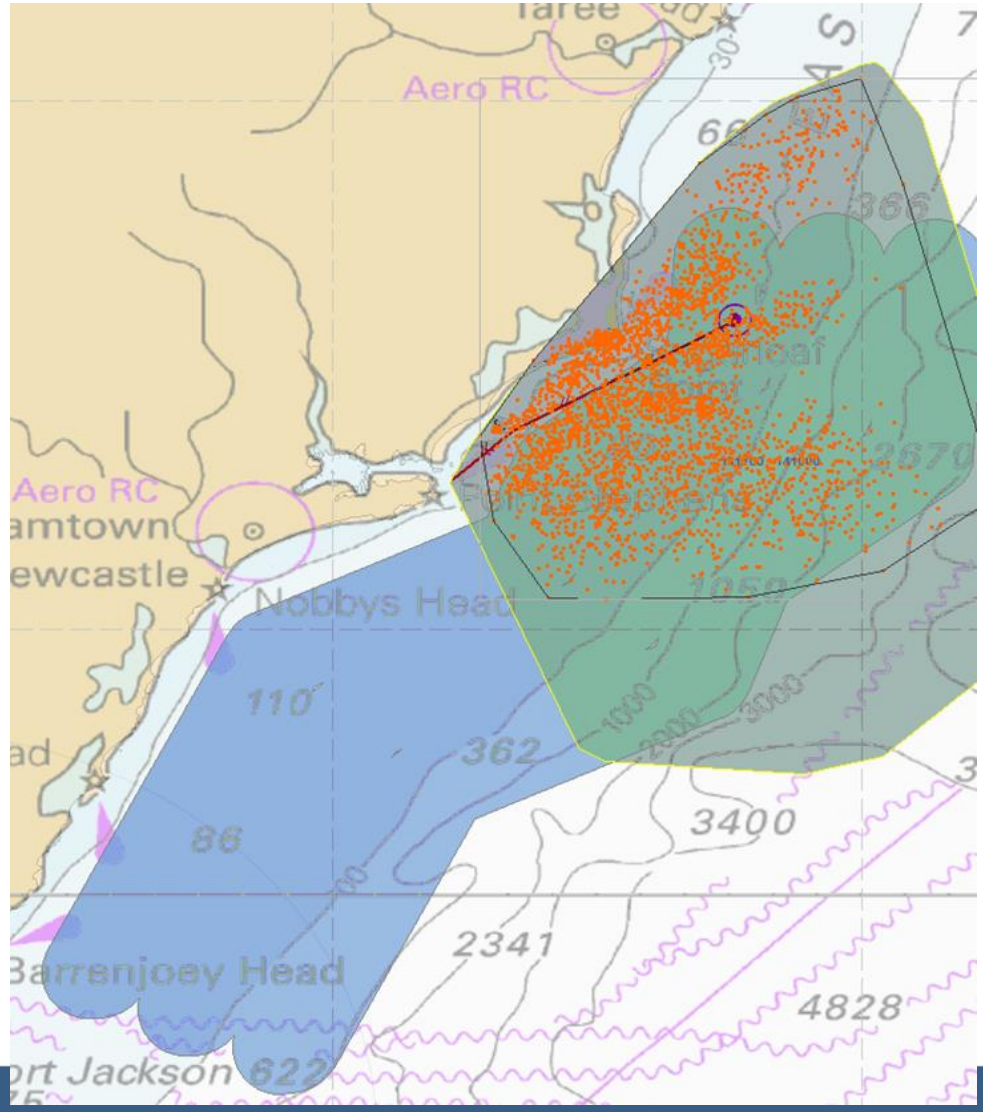
"All models are wrong, some models are useful"

- All underpinned by BOM and CSIRO
- Optimisation for different purposes & functions
- Understanding of their strengths & challenges
- Operator interpretation & application
- Operators focus on successes
- Constant need for improvement, but in which bit, for what reason.
- Metadata, inputs, assumptions, uncertainty, technical support/reference



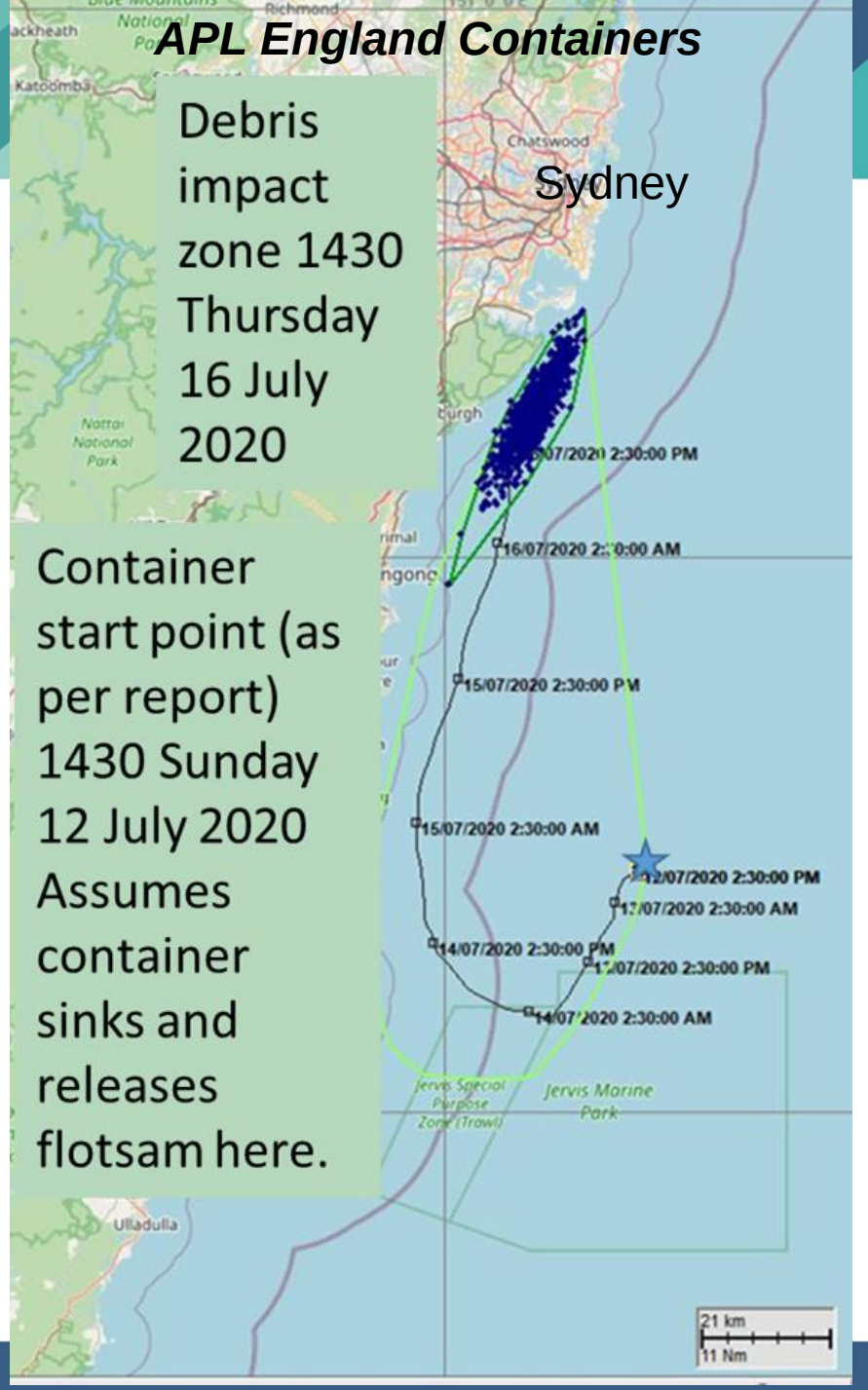
SAR – Net Water Movement - GEMMS

- Primarily for SAR – linked with Nexus, AMSA's IM tool – to predict objects movement over time.
- Proprietary to Global Environmental Modelling and Monitoring Systems, using their GCOM3D model.
- Well tested and validated over many years.
- Uses winds, tides, currents and bathymetric data at all scales (global, regional and local).
- Can ingest SLDMB data to fine tune results.
- Combines actual and forecast BOM data.
- Typical SAR run is 48 hours.
- Generates within Nexus drift confidence & proposed search areas.



The ‘Maps’ – RPS

- SARMap, OilMap and ChemMap – different products of RPS Group, with SimMap as the impacts engine available.
- All use the same underlying modelling engines, fueled by the RPS EDS (Env. Data Server).
- SAR used as a secondary for Net Water for smaller objects, on local server.
- OilMap/ChemMap 3D spill plume fate & behaviour models, as remote service, for Aust. National Plan partner agencies.
- Ingests GIS data for sensitive resources & response tools.
- Algorithms for surface & subsurface spreading, evaporation, emulsification, entrainment, oil-shoreline, oil-reed bed, oil-ice interaction, oil-response technologies interaction.
- Outputs in pre-set, user defined graphics, tables, GIS PowerPoint, and movie formats.

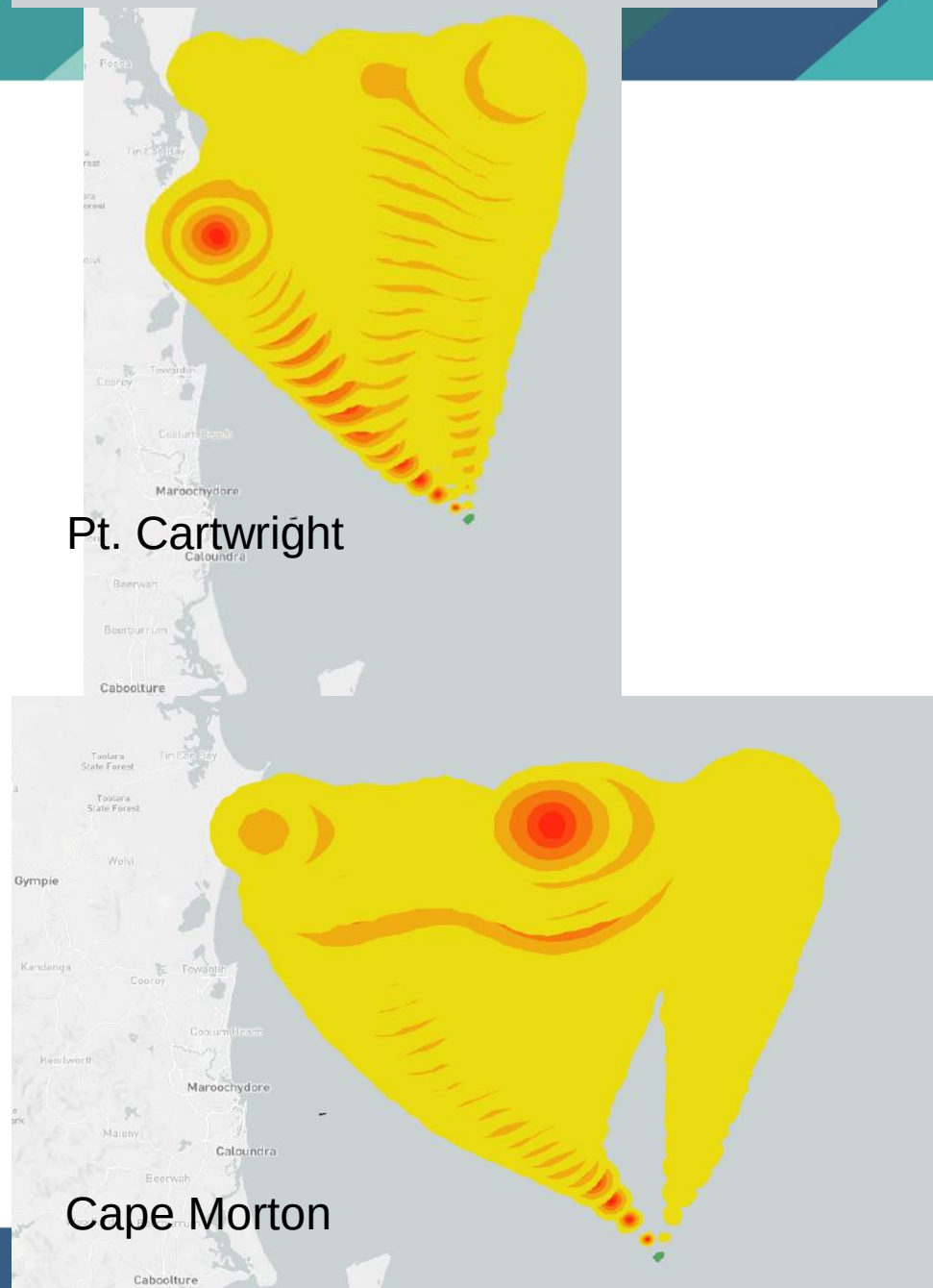


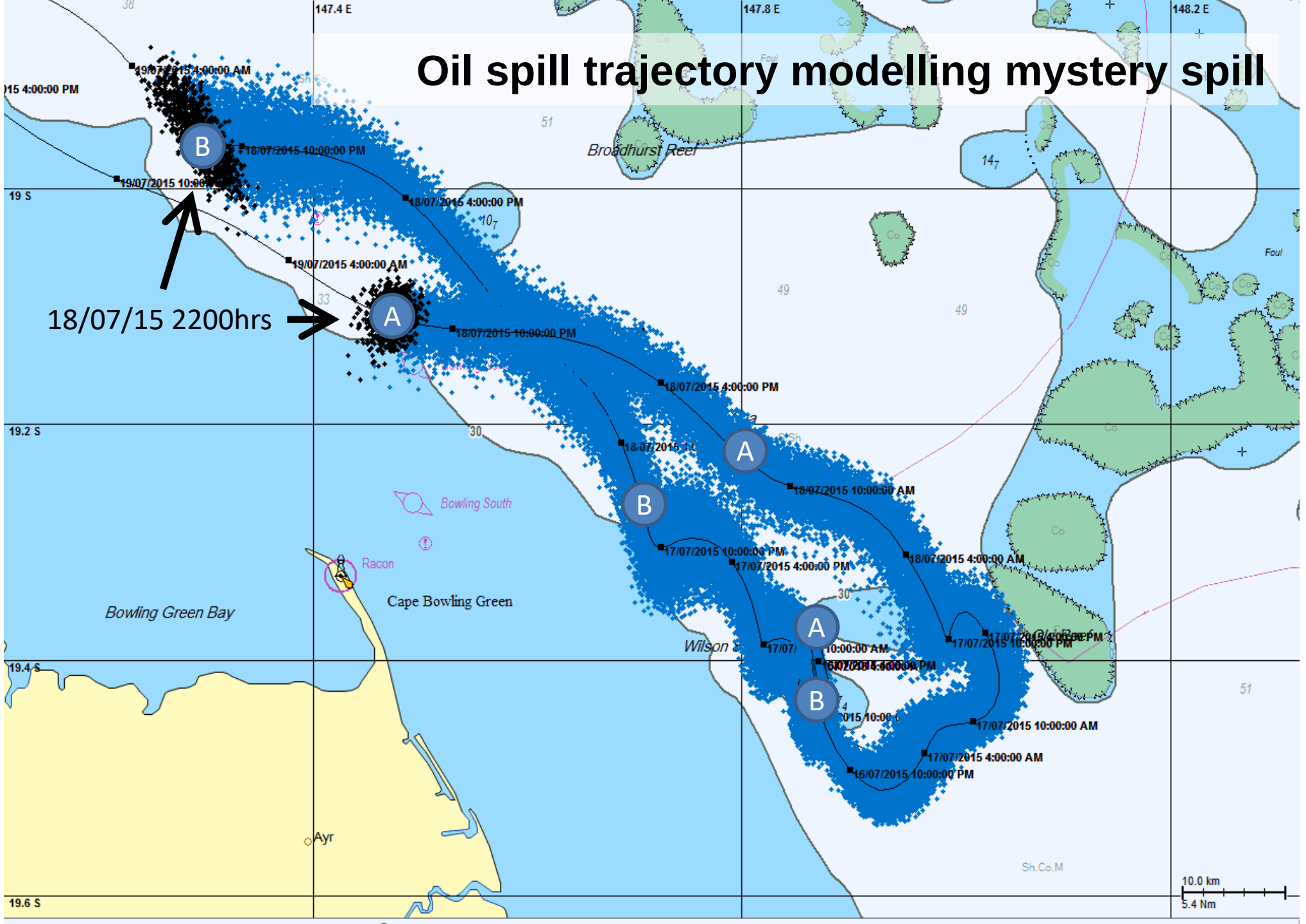
OzSeaSAR – DHI

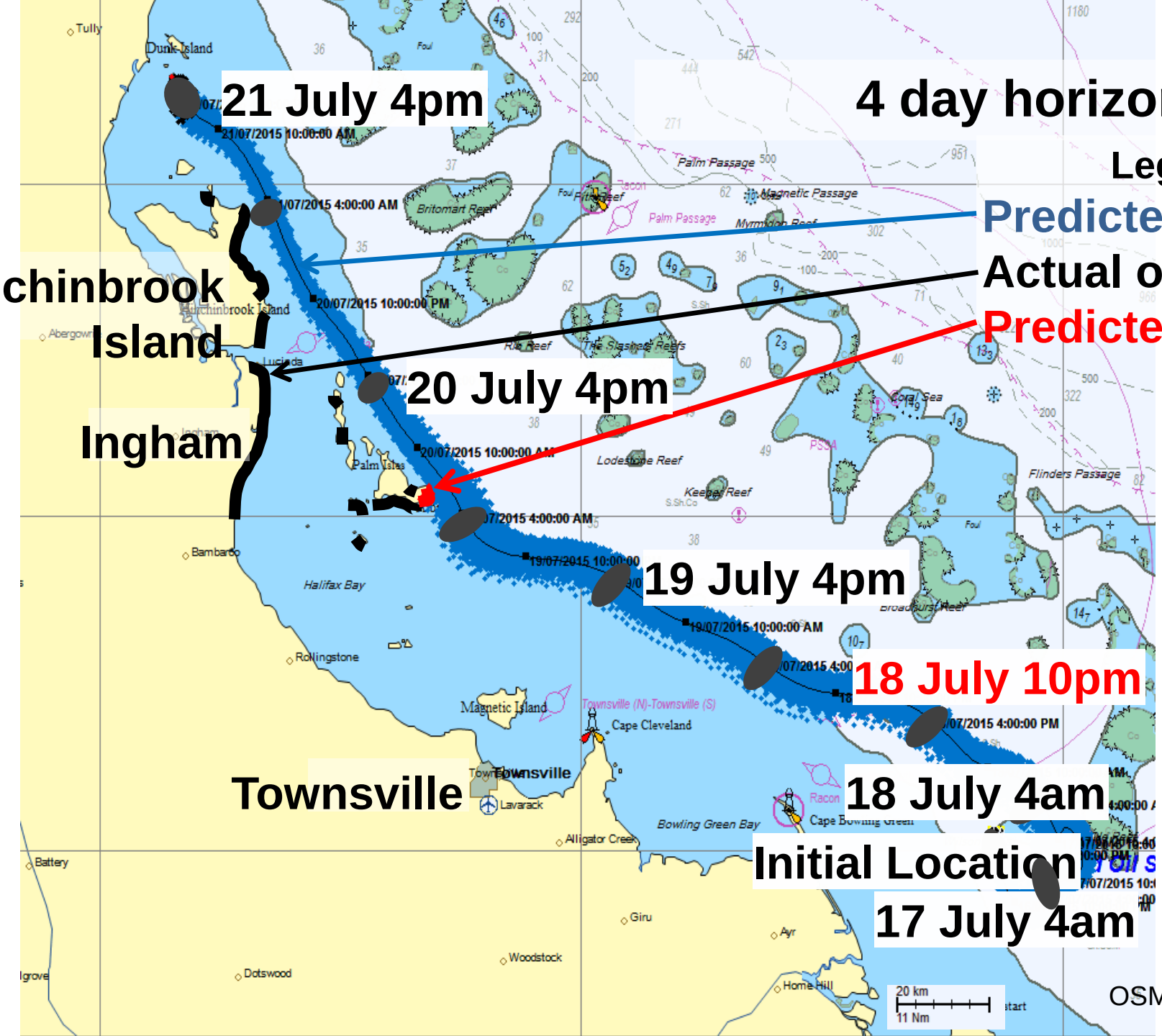
Co-developed with AMSA to address the gap of big ship drift.

- Accounts for the full 3D modelled physics of the drift environment (AMSA hindcast models) and the drift particles (e.g. ship parameters – windage, draft, shape, loading, orientation, etc.) on NCI's Gadi.
- Addresses the forcing of local wind, local waves and regional swell, and tides and currents, in high resolution forecasts on a flexible mesh.
- As a physics-based environment, it covers any particle constellation (a drifting ship with or without tug support, a swimmer, any defined object, i.e. sailing boat, container, downed airliner, iceberg, etc.)
- User-defined ingestion of live data correction from a virtual buoy (as a AIS feed or SLDMB).

MV Maryam 24-36 hr personnel delivery




Oil spill trajectory modelling mystery spill
18/07/15 2200hrs
A
B
Broadhurst Reef
Bowling South
Racon
Cape Bowling Green
Bowling Green Bay
Wilson
Ayr
147.4 E
147.8 E
148.2 E
19 S
19.2 S
19.4 S
19.6 S
10.0 km
5.4 Nm

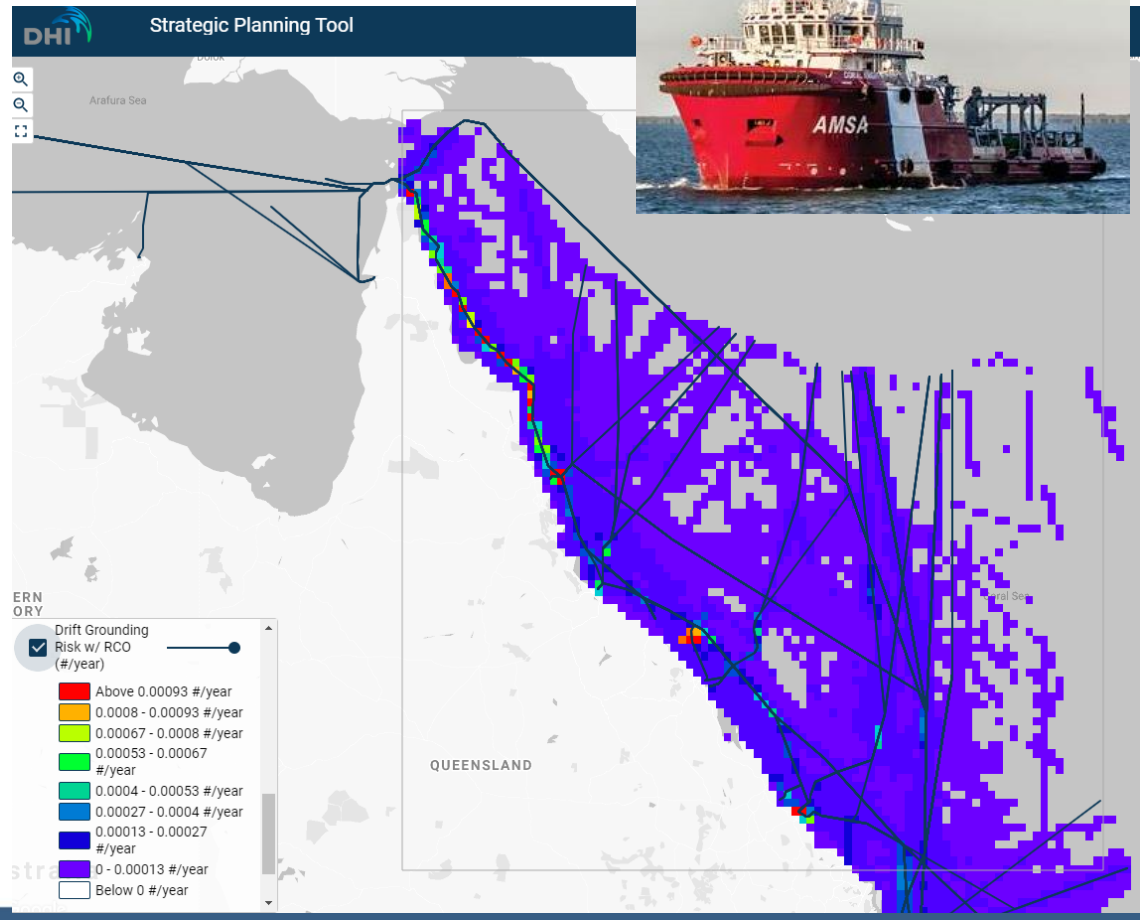


OSMH, Fig 6.3 p114

All models can be more ***strategically*** useful

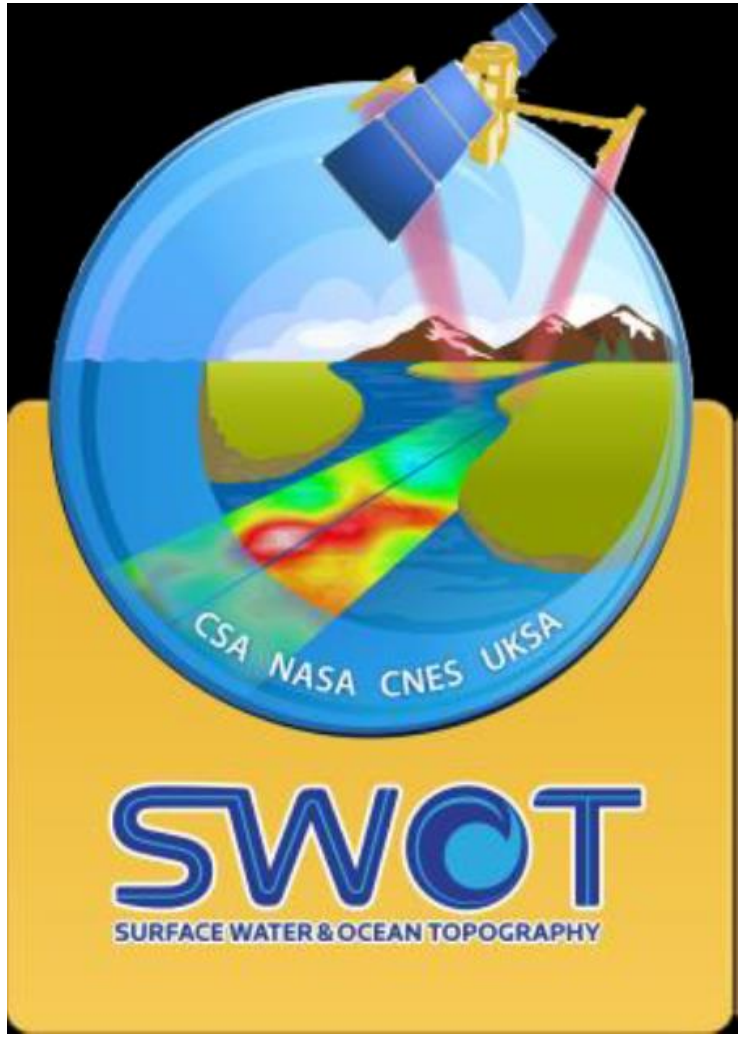
AMSA starting to use for strategic rather than just operational or tactical purposes – Emergency towage vessels(ETVs)

- To assist ASMA identify options for the placement & capability requirements for AMSA's future ETVs.
- Utilises annual traffic data, met-ocean data & vessel specific values to assess risk of drift groundings.
- Generates a whole of Australia ETV risk control model.
- the ETV Risk Control Option is being assessed & compared with other RCOs.
- Analysis of various scenarios to determine highest risk areas & best use of ETVs.
- Accounts for tug size/bollard pull requirements, speed, range & route wayfinding for risk reduction.



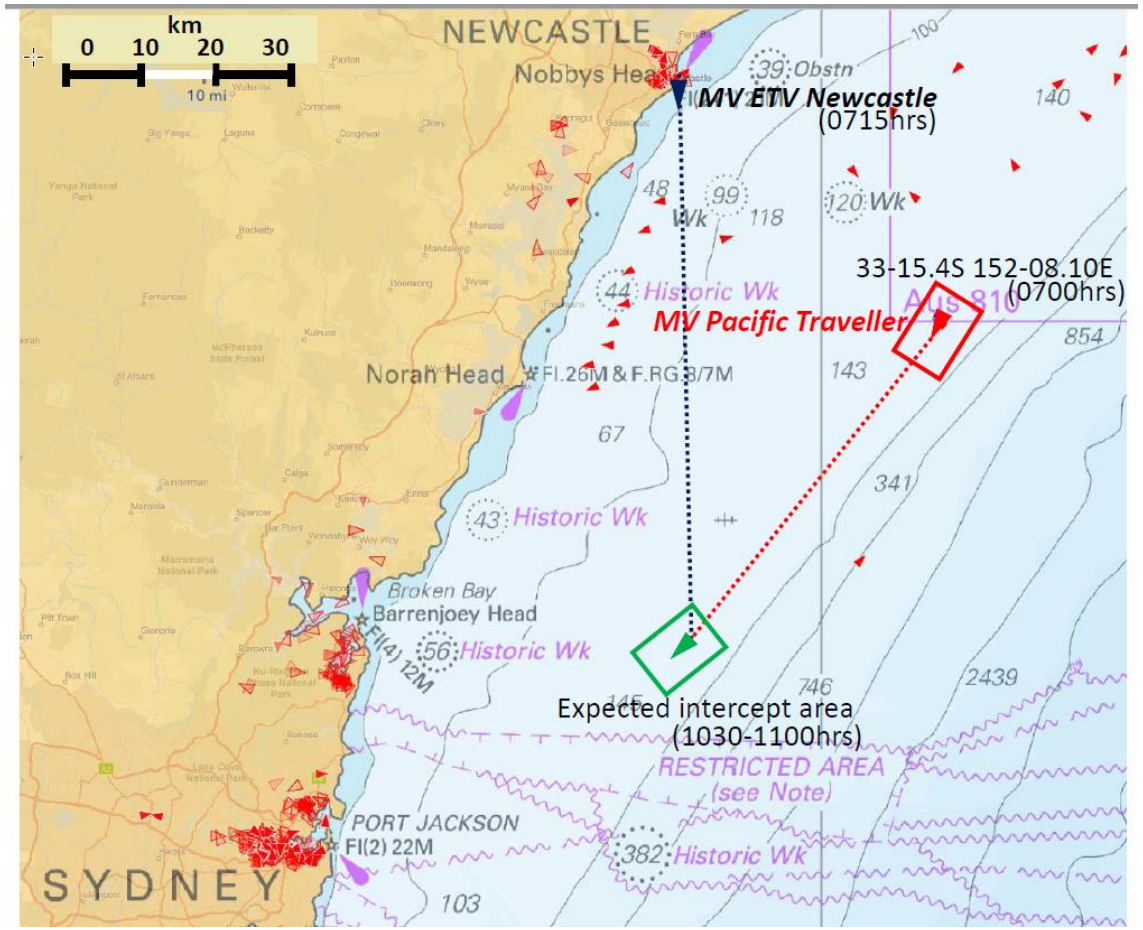
All models can be more ***operationally*** useful

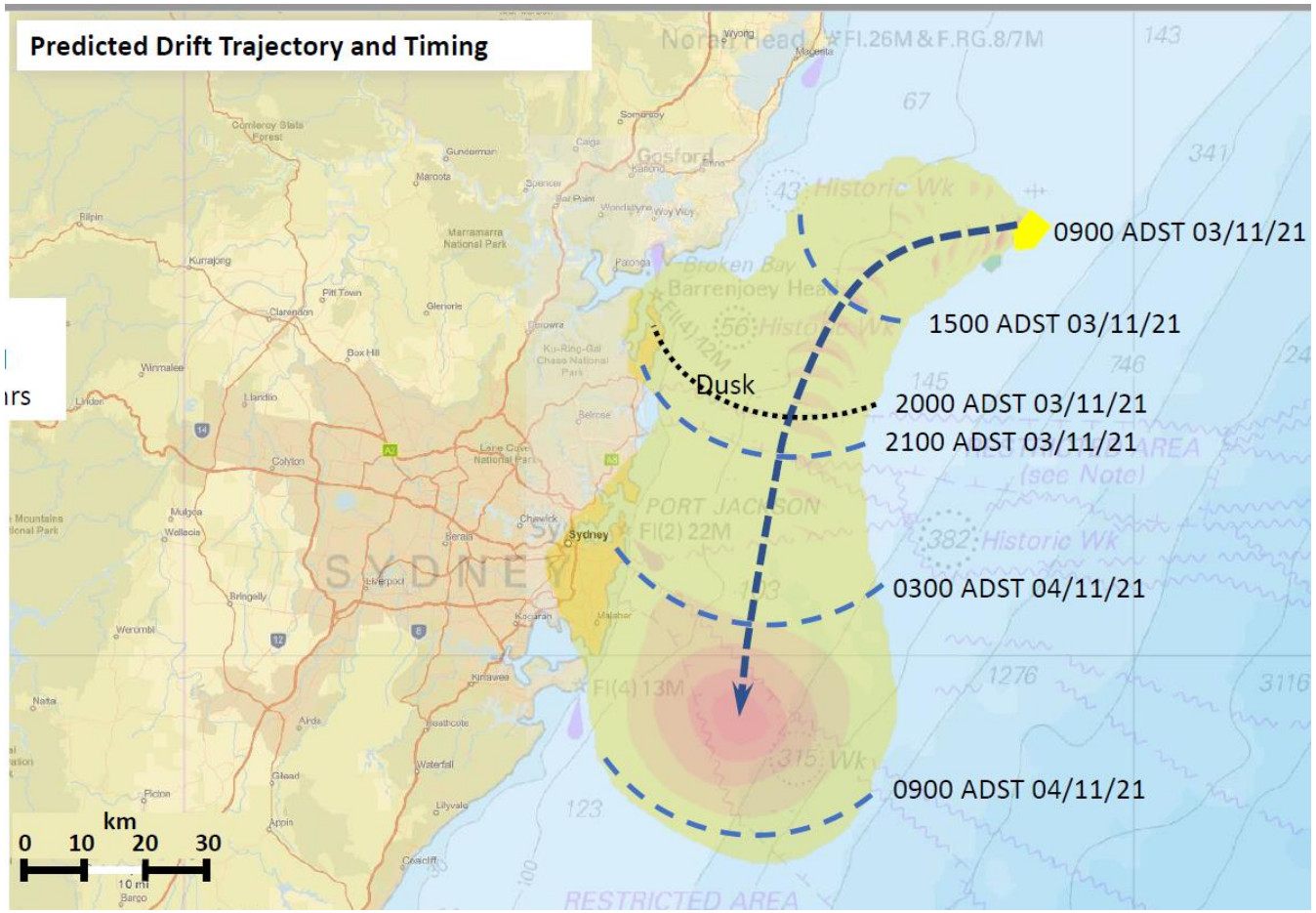
- Pro-active partnerships for improved data, analysis & application.
- UNSWL/BOM proposal "*AUSWOT: Satellite mapping and prediction of ocean currents in Australia's marine estate"*.
- NASA-CNES Surface Water and Ocean Topography (SWOT) satellite, scheduled for launch in March 2022.
- Maps of sea-surface elevation at km scales – 10 times the resolution of current generation of satellite altimeters.
- New ocean current reference datasets – ocean current forecasts, model evaluation, to assist maritime operations.
- Enhanced maps of currents and major ocean features (EAC, LC) for improved ship routing & navigation.
- Assessment of impact of the SWOT mission, for deliverables and transfer of knowledge & skills to operational functions.



All models can be more ***tactically*** useful

Exercise "***How Deep***"





AMSA will better understand its world!

In-house capability

- Needs
- Training
- Partnerships – academic, futures,
- Education
- Provider understanding of operational priorities and applications

- Thank you.