A CRITICAL ANALYSIS OF THE 2012 MERIDIAN MARITIME SERVICES NAVIGATIONAL REPORT -
regarding the feasibility of a Gold Coast Cruise Ship Terminal

Ex Tropical Cyclone Oswald January 29th 2013
The Gold Coast Seaway (entrance to the proposed Cruise Ship Terminal)

"Fools rush in where angels fear to tread"

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Navigational Study Background

In 2012, the Gold Coast City Council (GCCC) commissioned 'An investigation into the feasibility of piloting large cruise ships to and from a proposed terminal within the Gold Coast Broadwater' after the following GCCC motion was carried:

> That Council directly engage 'Meridian Maritime Services', due to their substantial knowledge of the navigational issues for Cruise ships arriving/departing the Gold Coast Seaway, as it would be impractical or disadvantageous to invite quotes or tenders for this component of work.
> *(GCCC Committee recommendation CG12.0306.00;, moved Cr Tate, seconded Cr Taylor. 6 Aug 2012. Meeting #643, 7 Aug 2012).*

The study was undertaken at the Queensland State Government's 'Smartship Australia' facility in Brisbane, from the 26th to 30th November 2012, on 'high fidelity Full Mission Bridge simulators'.

Two reports, 'Part A – Simulation Plan' (15 Nov 2012) and 'Part B – Simulation Report' (6 Dec 2012) were completed by Captain John Watkinson of Meridian Maritime Services (MMS) who was the 'Maritime Advisor and Simulation Project Coordinator'.

EXECUTIVE SUMMARY- Analysis of Meridian Maritime Services Navigational report

- The 2012 Meridian Maritime Services (MMS) report claims that two previous navigational simulation studies conducted at Star Cruises Ship Simulator, Malaysia (November 2004, August 2006) 'concluded that well-equipped cruise vessels of less than 300metres LOA [Length Overall] could access the Port [Gold Coast] in nearly all weather conditions that the port normally experiences' (MMS 2012, p.3)

  However, independent assessments by ports and harbour constructors, ship masters and engineers concluded in 2005 that the base meteorological data inputs for the 2004 Malaysian study were grossly undervalued for the wind, tide, current, swell, sea and wave conditions encountered on the Gold Coast.

- In 2006, Angus MacLeod, port and marina developer, concluded that in relation to cruise vessels attempting to enter a Gold Coast port, even with the undervalued, wind, tidal and wave inputs used in the Malaysian studies, '95% of the world's cruise vessels would expose their passengers to 'absolutely unsafe' conditions, even in light winds and small waves.'

- In August 2006, the Qld. Govt. abandoned the cruise terminal component of the 'Notional Gold Coast Marine Development Project' with Deputy Premier, Anna Bligh, citing the GHD Environmental Impact Study (2006). Bligh publicly stated that one of the major reasons for abandoning the Cruise Ship terminal (CST) was, 'The hydrology of the Gold Coast was something

that indicated it wasn't possible to effectively put a cruise ship terminal there.' (Media Statement, 2006)

- Similar to the Malaysian Navigational Simulation studies, the MMS 2012 Navigational Simulations used base meteorological data inputs that were grossly undervalued for the conditions encountered on the Gold Coast; in particular, in the areas of wind speeds, current velocities and significant wave heights. MMS also ignored wind directions and combinations of sea and swell conditions which regularly occur on the Gold Coast; for instance, no simulations were conducted in NE winds of any speed to ascertain safe navigational parameters.

- MMS claim their channel design criteria for the simulations 'has been set without fully considering PIANC guidelines… All criteria will be subject to and considered in detail with PIANC guidelines after completion of simulation exercises. (MMS Report Part A, p.5)

  Despite admitting that the 'Permanent International Association of Navigation Congresses [PIANC]…*inter alia,* sets guidelines for Approach Channel Design Parameters', there is no evidence that after completion of their simulations the PIANC Guidelines were ever applied or considered by MMS. PIANC guidelines should have been the baseline for conducting all MMS simulations.

- The underscoring of base channel data by MMS with their application of lower values than the PIANC recommended beam multipliers (thus narrower channel widths), minimal UKCs (therefore shallower channel depths) and a smaller than recommended swing basin diameter etc. may have been influenced by the Gold Coast City Council's (GCCC) pressure to keep dredging costs to a minimum, as articulated in the MMS Report:

  > It is understood that there is a wish by council to keep all dredging to a minimum and while pilotage can attempt to meet the various challenges of minimal dredging, safety of the port will remain the priority outcome for all exercises. (Part B, p.4)

- MMS admits the channel designs (widths and depths) in their study proved to be inadequate for the safe navigation of the Gold Coast Broadwater by cruise vessels less than 289 metres Length Overall (LOA) and greater than 311 metres LOA. Within the proposed MMS channel parameters, most of the older vessels (under 289m LOA) currently in service in Australian waters and most cruise ships that will be in service globally post-2015 (over 311 LOA) will be excluded from navigating safely to the proposed Gold Coast CST.

- MMS state that vessels must possess 'equipment levels and propulsion systems having a high degree of maneuverability' (MMS Part B, p.13), including appropriate steering systems, thrusters and heeling tanks to reduce heeling to less than 1 degree, thus excluding many of the older cruise vessels currently operating in Australian waters.

- MMS assume that cruise line companies, maritime insurers and the Australian Maritime Safety Authority will accept MMS's 'subjective' method for assessing navigational safety/risk factors as outlined by MMs below:

  > a subjective assessment of each simulation exercise made by the Pilot, Observer and if necessary the Instructor based on their practical experience in regard to details of then

> particular run including the handling, behaviour and operational aspects of the ship navigating within the port. (MMS Part A, p.9)

- MMS state in their report that 'all simulation exercises will be performed without tug assistance. (MMS Part A, p.8)… [and] the Gold Coast unlike most ports does not have towage available to support other non cruise ship activities', despite also admitting:

> The availability of towage support to the port provides a level of comfort and insurance to the cruise ship companies and others knowing that towage assistance is available if circumstances change. (MMS Part B, p.11)

- Prior to conducting any simulations without towage support, one would expect the simulation project directors to discuss the issue of towage with cruise line companies and maritime insurers. It is highly unlikely these parties will accept/allow cruise vessel navigation to a Gold Coast port without towage support in a location with such complex and unpredictable bathymetry, hydrological action and weather events as exist on the Gold Coast.

- The new Federal 'Navigation Act 2012' and its 'Compliance and Enforcement Policy' came into force on 1st January 2013. Maritime laws that were over 100 years old, especially those related to 'risks to safety and the environment', have been replaced with far more stringent laws by the Australian Maritime Safety Authority (www.amsa.gov.au). The MMS report has not addressed this legislation or these issues.

- MMS did not discuss the need for the Seaway walls, Wavebreak Island, dredged channels, swing basin and berth pocket to be engineered or reconstructed to withstand the scouring effect of ship's thrusters.

- MMS admit that cruise lines must be willing to have flexible itineraries owing to a lag of 20-50 minutes variable after each peak ebb/flood tide before the currents change in the Seaway channel, which varies in timing from day to day. No enquiry was undertaken by MMS as to whether cruise line co's will accept short notice entry/departure delays of up to 3 hours including the possibility of having to delay departures until night or even be 'restricted for arrivals or departures due to environmental conditions above those considered maximum for the port'. (MMS Part B, p.13)

- Vessels will need to safely navigate a two speed current through the Seaway channel especially on ebb tides and therefore deal with the resulting 'sheer' effect on ship steering, which was not tested in MMS simulations.

- MMS assume that their recommended Channel Design and associated dredging will not alter the tidal prism and therefore the tidal high/low range in the Broadwater despite all coastal engineering theories and past dredging reports supporting the opposite point of view.

- MMS recommend a 'small portion' (MMS 2012) or the entire south groyne (Independent Dredging Report) be removed from Wavebreak Island for safe vessel navigation, yet MMS does not analyse potential changes in the Broadwater to hydrological action and bathymetry and therefore the impacts on channels, revetment walls, swing basin, current velocities and directions, sediment transportation etc. with the removal of the southern groyne.

- The MMS report is based on the unrealistic premise that there will never be any sediment infill of dredged channels, swing basin or berth pocket which, if/when it occurs, may cause a ship to run aground and/or instigate 'banking effect' which will cause a ship to 'sheer uncontrollably'(MMS 2012).

- A complex calculation on a daily basis, using a 100% perfect forecast capacity, must be developed and implemented to account for the tidal and meteorological conditions affecting the Gold Coast for cruise companies, insurers and maritime safety authorities to be satisfied safe navigation of cruise vessels can ever take place on the Gold Coast.

- Despite being recommended in several previous dredging reports, the MMS report assumes that a minimum 400 metre extension to the southern Seaway wall and associated increases in sand-pumping will not be necessary to assist in maintenance of the depth, width and batter-slopes of a dredged outer-channel ENE of the Seaway entrance for 'two nautical miles' (MMS 2012).

- MMS make no mention in their report of the necessity for warnings and guarantees of safety for recreational and tourism divers, surfers and boaties; professional and recreational fishing boats; visiting yachts and vessels involved in activities such as whale-watching, who will be required to stand off to sea during delayed and/or scheduled entries and departures of cruise vessels, no matter what the ocean conditions or weather forecasts at that time.

- The discredited 2004 Malaysian Navigational Report was characterised by a litany of flaws, omissions and mistakes; inaccurate and inadequate input of data; and highly questionable and ambiguous conclusions. The 2012 Meridian Maritime Services Report reflects similar qualities.

DETAILED ANALYSIS of the Meridian Maritime Services Navigational Report

Captain John Watkinson was contracted to conduct the 2012 simulations without quotes or calls for tenders being invited for the project by the Gold Coast City Council. In his 'Part A – Simulation Plan' report, Watkinson claimed:

> Two previous studies/simulations into the navigation and pilotage of cruise vessels into and out of the seaway to a proposed terminal situated at the NW corner of the Spit were conducted in November 2004 and August 2006. Both simulations were commissioned by the Queensland Government and carried out at the Star Cruises Ship Simulator at Port Klang, Malaysia.
>
> Both studies generally concluded that well equipped cruise vessels of less than 300m LOA [Length Overall] could access the Port in nearly all weather conditions that the Port normally experiences.

The latter statement is not only a misrepresentation of the two previous studies, it is misleading. In his role as General Manager of Maritime Safety Queensland (MSQ), Watkinson was a project participant and Queensland Government representative in the now discredited Malaysian 'Navigational Study Gold Coast Cruise Ship Terminal, December 2004' (Queensland Government).

Independent assessments by ports and harbour constructors, ship masters and engineers concluded that the base meteorological data inputs for the Malaysian study were grossly undervalued for the conditions encountered on the Gold Coast. Wave heights, wind strengths and directions, tidal current speeds were all lower or not commensurate with those experienced in real time and real situations at the Gold Coast Seaway for 20 years of observations (1991 – 2010) conducted by the Bureau of Meteorology (BoM). The channel widths and depths in the study were also viewed as being inadequate for safe navigation by cruise vessels up to 289 metres LOA (Length Overall).

Additionally, a quantitative scale for Navigational Safety measurements was established for the Malaysian study. The scale scored 0-8 on navigational risk for simulated ship runs in the proposed:

1. Approach Channel (seaward of the Seaway)
2. Inner Channel (Seaway)
3. Swing basin (off the eastern side of Wavebreak Island)
4. Docking area (north-west corner of Doug Jennings Park)

A score of 0 – 5 in any of the 4 sectors revealed an 'unsafe' passage with a score of 0 indicating the ship most likely ran aground. Scores of 6 – 7 indicated 'safe' passage and 8 indicated an 'excellent' run.

While the safety model in itself was not flawed, the participants in the simulations applied a flawed methodology to their interpretations of the model. They applied an averaging technique to the safety scores over the four sectors in an attempt to minimise the impact of the low scores.

However, cruise vessels do not sail in 'averaged' safety conditions. If a vessel scores 5 or below in any sector during a run it should be considered an unsafe run. If a vessel scores zero in any sector they do not get to complete the remaining sectors of the journey. For instance, on 'Run 107' in the Malaysian simulations, where the ship sequentially scored 0, 0, 8, 8 over the four sectors, the two zero scores, where the ship most likely ran aground (absolutely 'unsafe'), were ignored to give a score for a safe passage across all four sectors with a listed average score of '8' ('excellent).

In other words, on runs where there was a score of zero in any sector, the '0' was ignored in the averaging process to give the impression of a safe 'average' score. However, one unsafe run-sector makes the whole run unsafe.

In 2006, Angus MacLeod, port and marina developer, concluded that even with the undervalued, wind, tidal and wave inputs in the Malaysian study, '95% of the world's cruise vessels would expose their passengers to 'absolutely unsafe' conditions, even in light winds and small waves.'

Further reading:

'Navigational Study No Secret' at
www.saveourspit.com/No_Terminal/news/NewsArticle.jsp?News_ID=111

'RIP Angus' at
www.saveourspit.com/No_Terminal/news/NewsArticle.jsp?News_ID=163)

Captain Watkinson, as a key State Government representative and participant in the Malaysian study and in his role as General Manager of MSQ, signed off on the conclusions in the 2004 Malaysian report.

The flawed Malaysian study stated clearly, 'All recommendations and conclusions were discussed during the final meeting and mutually agreed upon between all parties'. (Malaysian Navigational Study, p.7) The 2004 Malaysian report was 'approved' by another participant, Captain Peter Listrup, who was employed at the time by Star Cruises Ship Management Sdn. Bhd. Malaysia.

However, after independent analyses and reports by MacLeod and others, including independent Australian Ship Masters, it was revealed that rarely if ever would cruise vessels up to 289 metres LOA be capable of safely berthing in the Gold Coast Broadwater, even after a massive dredging campaign to accommodate them.

Consequently, in 2006 the Qld. Govt. ordered further studies at the Malaysian Simulation Centre. The second study convinced the State Government that there were significant navigational problems related to cruise ships attempting to visit the Gold Coast.

In August 2006, the Qld. Govt. abandoned the cruise terminal component of the 'Notional Gold Coast Marine Development Project' with Deputy Premier, Anna Bligh, citing the GHD Environmental Impact Study (2006). Bligh publicly stated that one of the major reasons for abandoning the Cruise Ship terminal (CST) was, 'The hydrology of the Gold Coast was something that indicated it wasn't possible to effectively put a cruise ship terminal there.' (Media Statement, 2006)

Bligh's statement belies Watkinson's 2012 claim that the second Navigational study in 2006:

> concluded that well equipped cruise vessels of less than 300m LOA could access the Port in nearly all weather conditions… (Watkinson in MMS Report 2012 – Part A, p.3)

In relation to the GCCC engaging the services of Watkinson in 2012, Mayor Tate's motion (6 Aug 2012), passed by the GCCC in August 2012, proposed that it would be 'disadvantageous to invite quotes or tenders for this component of work' from other than Watkinson and his Meridian Maritime Services company. Captain Peter Listrup, who 'approved' the 2004 Malaysian Navigational report, was also employed again as a participant in the 2012 'Smartship' simulations in Brisbane.

2012 Navigational Study Participants

In addition to Capt. Watkinson, some of the other personnel involved in the Meridian Maritime Services simulations at the 'Smartship Centre' Brisbane in November 2012 included:

Smartship Australia

- Capt. Peter Listrup (Director and Principal Instructor) and others.

GCCC

- Darren Stewart (Manager Major Projects)
- Michael Parrish (Exec. Coordinator. Program and Project Delivery)
- Luke Adair (Coordinator Major Projects).

Maritime Safety Queensland (MSQ) – Capt. Watkinson's previous employer

- Captain Richard Johnson (Regional Harbour Master Brisbane) and
- Captain Trond Kildal (Pilot Manager Cairns)

Gold Coast Waterways Authority (GCWA)

- Russell Witt (A/CEO GCWA).

Russell Witt is also Regional Director (Gold Coast) for Maritime Safety Queensland (MSQ). Witt previously served under MSQ General Manager, Captain John Watkinson, until Watkinson retired from that position in 2009 to enter private enterprise.

The GCWA was established 'to manage the sustainable use and development of the Gold Coast waterways…A board made up of local community and industry representatives will be responsible for overseeing the better management of the Gold Coast waterways…[and] report directly to the Transport and Main Roads Minister…' (www.tmr.qld.gov.au/gcwa accessed 30/09/2012) The GCWA recently had its members appointed following public advertisements for nominations to the board.

The appointments to the GCWA board consist of three members directly or substantially involved in Liberal National Party politics (Mayor Tate; Transport Asst. Minister, Steve Minnikin; & Verity Barton LNP MP for Broadwater).

Also appointed to the GCWA board were Raymond James, Icon Energy CEO and mining geo-physicist, whose website reveals he is an expert in coal-seam gas 'fracking'; Mike Bartlett, co-founder and life member of the cruise promotion organisation 'Cruise Downunder'; Martin Winter, outspoken supporter of a GC Cruise Ship Terminal and CEO of Gold Coast Tourism, an organisation dependent upon approx. $1.4 million in funds per year from GCCC; and Rodger Tomlinson, Director of the Griffith Centre for Coastal Management (GCCM) at Griffith University, a research centre which is partially dependent upon research grants and contracts from the GCCC and states on its website it is, 'in partnership with Gold Coast City Council'.

Of relevance to the latter two members of the GWCA board is the recent change to State Legislation which gives executive powers to local government Mayors to determine their Council's budgets, that is; who and what the Mayor chooses to fund or contract.

The GCWA Chair is former Gold Coast Mayor Gary Baildon, however, another former Gold Coast Mayor, Dennis O'Connell, applied for a position on the GCWA board but was not appointed. O'Connell was the GC Mayor who commissioned all the major reports leading up to the GCCC's construction of the Gold Coast Seaway in 1985-86. O'Connell sat on the original Gold Coast Waterways Authority during that period and is totally conversant with the dredging, flood, engineering and cruise ship terminal reports (mostly by Delft Hydraulics, Netherlands) produced in the lead up to the construction of the Seaway Training Walls and the setting up of the Sand-Pumping facility on the Spit. O'Connell is also a retired professional fisherman. Apparently his experience, knowledge and qualifications were not sufficient to be appointed to the GCWA board.

Not one local, independent Harbour Engineer, Dredging Engineer, Marine Biologist, Environmental Engineer/Scientist, Recreational or Industry Dive rep.; Recreational or Industry Surf rep.; Recreational or Tourism Fishing rep.; Recreational or Industry Boating Association rep.; or an independent Gold Coast Community Member was appointed to the Board of the GCWA. This is despite the State Government declaring:

> Gold Coast Waterways are at the heart of the region's recreational and tourism industry as a playground for locals and tourists who come to experience the Queensland lifestyle. The Gold Coast's world class marine precinct is a significant contributor to the region's economy and these waterways are home to key fish habitats and part of the Moreton Bay Marine Park. (www.tmr.qld.gov.au/gcwa accessed 30/09/2012)

In January 2013, commercial dredging of the southern and northern recreational boat channels in the Gold Coast Broadwater commenced despite the GCWA apparently not having discussed these actions.

Brisbane Marine Pilots (BMP) – previously a unit within the Queensland Government, BMP was privatised in 1989.

- Captain Graham Stratton (Senior Pilot)

During the early 2000s, while Steve Pelicanos was BMP Chairman, he alerted the developer and lobbyist, Mike Evans (National Party Secretary in the Belke-Peterson/Hinze era) to the Beattie Government's desire to build a cruise ship terminal on the Gold Coast. Evans had coveted the precious coastal land on the Spit since the 1980s and the CST was his perceived means to obtain and commercialise public land in the area. Evans had been thwarted in the past by National Party MP, Doug Jennings' determination to preserve the Broadwater and Spit as public open space. Apparently, Pelicanos assisted Evans in his application for the tax-payer funded $150,000 grant to conduct the 2004 Malaysian Navigational Study.

In 2008, Pelicanos was also the main driver of a proposal to annex public land next to the sand-pumping jetty on the Spit for the construction of a privately owned ship-simulator and associated accommodation facilities.

A CST on the Gold Coast would potentially bring substantial commercial gains to Brisbane Marine Pilots owing to the ongoing payments required for pilots and/or tugs to be constantly on standby on the Gold Coast and/or the expense of bringing them down from Brisbane on the rare occasion that conditions might allow for a cruise ship to visit the Gold Coast.

CST 'Option 3'

The MMS simulations carried out at Smartship Australia focused mostly on the GCCC's 'Option 3' for a CST inside the Broadwater, north of Seaworld and just south of the Marine Stadium on the western foreshores of The Spit.

Channels

In 'MMS Report - Part A, p.5', Watkinson claims to have used the following parameters for navigable channels to simulate cruise vessels visiting and departing the Gold Coast.

1. Approach Channel, two nautical miles seaward of the entrance to the Gold Coast Seaway
2. Seaway Channel within the Seaway breakwaters (sic)
3. Channel Bend (the curved channel joining channels 2 and 4)
4. South Channel (the channel joining 3 and the swing basin off the terminal)

The MMS planned dimensions for channels were:

- The Channel width for the Approach, Seaway and South Channel = 130 metres
- Swing Basin = 500 metres
- Navigation depth for all channels and swing basin -12m LAT (lowest astronomical tide)
- Channel width between Wavebreak Island and western extremity of the Spit = 210 metres (Channel Bend)
- Batter slopes – 1v:6h (vertical:horizontal) offshore of seaway training walls
  1v:4h inner channel (sic) and swing basin

Ignoring Recommended PIANC Guidelines

The MMS Report states:

> It should be noted that the above design criteria has been set without fully considering PIANC* guidelines…All criteria will be subject to and considered in detail with PIANC guidelines after completion of simulation exercises. (MMS Report Part A, p.5)

*(Permanent International Association of Navigation Congresses. An Association that *inter alia* sets guidelines for Approach Channel Design Parameters).

PIANC guidelines should be the baseline for conducting all simulations. There is no evidence in the report that after completion of the simulations the PIANC Guidelines were ever applied or considered by MMS.

Channel Widths

The suggested widths of 130m (used in the 2004 Malaysian simulations) for the Approach and Seaway Channels were expanded during simulation runs to a 'minimum channel width' of 140 metres for both channels owing to 'leeway' problems. This is despite Watkinson having previously declared of the 2004 Malaysian study that with channel widths of 130m 'well equipped cruise vessels of less than 300m LOA [Length Overall] could access the Port in nearly all weather conditions.' (MMS Part A, p.3)

The 2012 Meridian report states:

> near beam wind caused some leeway problems that could not be overcome with the set channel widths…and consequently the channel width was increased by approximately 35m. (MMS Part B, p.10)

Thus the South Channel had to be expanded to 165 metres in width. Also the 210 metre Channel Bend width was:

> appropriate for all vessels but an adjustment is required near Wavebreak Island as the channel reduces and as a result of the further adjustment to the South Channel [which] will also remove a small portion of the Southern edge of Wavebreak Island's rock groyne…(MMS Part B, p.10 – 11)

No attempt was made to ascertain the hydrological and bathymetric changes caused by the widening of channels or removal of a portion of Wavebreak's rock groyne, nor were these changes calculated into the simulations.

PIANC guidelines provide a 'beam multiplier' to calculate the safe width of channels, based on a ship's beam (width) and other elements such as cross-currents, cross-winds, longitudinal currents, bank clearance etc. In the MMS 2012 Report-Part B, a PIANC guide appears in Appendix 4, Table 1.

The MMC simulations used the following beam multipliers to calculate channel widths even though the PIANC guidelines are higher (indicated in brackets beside the 'multipliers' selected by MMS).

Approach Channel: beam x 3.8 (PIANC 4.3)
Seaway Channel: beam x 2.9 (PIANC 3.4)
Channel Bend: beam x 4.2 (PIANC 4.83)
South Channel: beam x 2.9 (PIANC 3.4)

Taking the vessel most cited in the report as being capable of safely entering and departing the Gold Coast Broadwater, 'Voyager of the Seas' with a beam of 38.6m, the following calculations were made based on both the MMS multiplier and PIANC recommended multiplier. Both figures are well over the figure of 140m width recommended by MMS for the Approach Channel e.g.

'Voyager of the Seas' (VoS)
38.6 x 3.8 (MMS) = 146.68m wide Approach Channel
38.6 x 4.3m (PIANC) = 165.98m wide Approach Channel

MMS claim:

> In the Approach Channel and under extreme conditions (25 knots wind, and 0.5 knot coastal current acting on the beam) the VoS produced a maximum leeway of 3 to 4 degrees at a ship speed of 10/12 knots resulting in a swept path of +55m which when combined with the stated safety factor of one beam width of the channel edge requires a minimum channel width of 140m in the Approach Channel. While this figure is less than the PIANC Guidelines for the Approach Channel… (MMS Part B, p.9),

The MMs report then goes onto to justify the narrower than recommended Approach Channel width with the following vague and ambiguous statement:

> It can be defended by a detailed evaluation of some of the input parameters in the Guidelines and comparison with the simulation exercise. (MMS Part B, p.9)

Similarly, lower channel width calculations were assigned by MMS for all the other channels which used MMS selected multipliers rather than the PIANC Guideline multipliers.

Swing Basin

The swing basin dimensions in the 2012 simulations remained the same as the Malaysian simulations at 500m diameter even though three of the five vessels tested in the 2012 MMS study were longer (294m, 311m, 345m LOA) than the longest vessel tested in 2004 (289 LOA).

The recommended formula for navigational safety with swing basin diameters is: 1.8 – 2.0 times the vessel LOA, 'if these involve swinging the vessel through 180 degrees' (Malaysian Study 2004, p. 15).
A 180 degrees swing was required for all vessels arriving and departing the Option 3 CST location in the 2012 Smartship, Brisbane simulations.

Taking the mid-range calculation of 1.9 x LOA as the swing basin diameter for vessels tested in the MMS, the simulations would have been more accurate using the following parameters:

Emerald Princess	289m	LOA x 1.9 =	549 metres diameter (swing basin)
Queen Victoria	294m	LOA x 1.9 =	558.6 metres diam.
Voyager of the Seas	311.12m	LOA x 1.9 =	591 metres diam.
Queen Mary	345m	LOA x 1.9 =	665.5 metres diam.

Channel Depths

The MMS simulation plan (Part A) intended all channel depths to be 12 metres below the lowest astronomical tide (LAT) to ensure a minimum under keel clearance (UKC) for all vessels of 2 metres, based on the vessels' drafts. The UKC can be affected by tide, wave and swell heights; and wind speeds and directions; and vessel speeds or turning which cause heeling, squat and pitching of the vessel and therefore potentially increase the draft of the ship. The UKCs in Smartship simulations were adjusted when:

> The results indicated UKCs for all vessels of over 2m with the minimum UKC being 2.38 for the Queen Victoria. (MMS Part B, p.10)
>
> The draft of the Queen Mary at 10.4 metres could not satisfy UKC requirements within the dredged approach channel other than with a tide above 0.4m and extremely smooth conditions, something that could not be guaranteed on the day of entry. (MMS Part B, p.12)

Despite the statements above, MMS did not set UKCs above 2.0 for any of the simulations and often much less in some channel sectors, as indicated by the final MMS recommendations for channel depths:

> Approach and Seaway Channels: - 12m LAT
> Channel Bend: - 11m LAT
> South Channel: - 10m LAT
> Swing Basin: - 9.2m LAT
> Berthing Pocket: -8.9m LAT
>
> based on the deepest draft vessel simulated i.e. 'Voyager of the Seas' at 8.6m draft. Deeper drafted vessels will obviously require corresponding increases to depth limits. (MMS Part B, p.13)

MMS claimed a maximum 2.0m increase in draft is the limit for safe navigation in the Approach Channel and 1.4m when underway in other sectors. This was deemed 'safe' by MMS on the basis that no heel over 1% was caused by wind or the ship turning. The MMS report claimed:

> The exercises were performed without wind induced heel noting that all vessels would have heeling tank arrangements that would effectively reduce heel to less than 1 degree. (MMS Part B, p.10)

'Voyager of the Seas' with an 8.6 metre draft had as little as 0.3m UKC at LAT while in the berthing pocket and 0.6m UKC in the Swing Basin during simulations without applying wind or ship turning induced heel or squat which would cause increases in the draft of the vessel.

Batter Slopes

The angle of the slope of the channels for safe navigation is, according to MMS, based on the formula:

1v:6h (vertical : horizontal) offshore from the seaway walls
1v:4h (vertical:horizontal) inner channel and swing basin
(MMS Part A, p.5)

However, MMS does not define how these slope ratios would be maintained in the dynamic environment of the two nautical miles of Approach Channel seaward of the Seaway entrance or the Seaway Channel or in the Channel Bend, Inner Channel or Swing Basin inside the dynamic environment of the Nerang/Coomera River estuary system, commonly known as The Broadwater.

Previous reports by Delft Hydraulics, Netherlands (1986 and post-1986) suggest the batter slopes in the Broadwater would need to be in the range 1v:10h to 1v:30h; that is, for very 1 metre dredged vertically, 10 – 30 metres must be dredged horizontally to account for the mostly alluvial sand and occasional indurate (Independent Dredge report 2013) found in Seaway and Broadwater.

The MMs report Part A, Tidal Atlas - Attachment 2, suggest CST Option 3 requires approximately 3.7 Million cubic metres of dredging to 'develop a channel of 130 metres wide'. Based on the MMS increased channel widths, an independent dredge study suggests the amount of dredging required will be closer to 5 Million cubic metres, which would be greater again if PIANC Guidelines were applied.

Dredging Conclusions

The underscoring of base channel data by MMS with their application of lower values than the PIANC recommended beam multipliers (thus narrower channel widths), minimal UKCs (therefore shallower channel depths) and a lower than recommended swing basin diameter etc. may have been influenced by the GCCC's pressure to keep dredging costs to a minimum as articulated in the MMS Report:

> It is understood that there is a wish by council to keep all dredging to a minimum and while pilotage can attempt to meet the various challenges of minimal dredging, safety of the port will remain the priority outcome for all exercises. (Part B, p.4)

It seems the GCCCs objective of keeping 'initial dredging' for a CST to a minimum and therefore at the lowest cost estimate is in conflict with safety as a 'priority' as stated by MMS. And to compound the potential safety risks the values indicated under PIANC Guidelines for Approach Channel designs and Beam Multipliers were ignored by MMS. Furthermore, the following elements were also disregarded:

> Note that depths in this report are minimum levels for navigational requirements only and do not include any margins for infill as a result of coastal processes. (MMS - Part B, p.4)

Without taking account of 'margins for infill' during the simulations, the 'safety of the port' as a 'priority' claim by MMs seems ludicrous especially when MMS suggests that:

> Bank interaction can cause a vessel to sheer uncontrollably and an additional width factor has been allowed in this and all other channels to counteract or minimalise the "Bank Effect". (MMS Part B, p.6)

Not only have additional width factors not been factored in to account for minimising 'bank effect', the prospect of 'infill as a result of coastal processes' that are most likely to cause 'bank effect' have also not been included in the study.

Ship Pilot/Operator Navigational Risk Assessment

The 2004 Malaysian Navigational Study employed an appropriate quantitative scale to assess navigational safety and risk on each sector of a cruise vessel's entry into the Broadwater for berthing. However, the scale in the Malaysian study was perverted because of the application of a faulty method of averaging low safety scores with high safety scores and through arithmetical errors which did not include zero scores in the safety averaging technique. This gave the impression of a greater number of safe ship runs than were actually achieved in the simulations.

Surprisingly, the 2012 MMS study did not employ any objective scale or quantitative technique when addressing navigational safety/risk factors but instead applied:

> a subjective assessment of each simulation exercise made by the Pilot, Observer and if necessary the Instructor based on their practical experience in regard to details of the particular run including the handling, behaviour and operational aspects of the ship navigating within the port. (MMS Part A, p.9)

This hardly seems to be good science for setting up a risk assessment mechanism when such huge sums of public monies and potential for loss of life and property and huge environmental damage are at risk with cruise vessels attempting to enter a port on the Gold Coast.

The MMS report also states that:

> All simulation exercises will be performed without tug assistance. (MMS Part A, p.8)… [and] the Gold Coast unlike most ports does not have towage available to support other non cruise ship activities. The availability of towage support to the port provides a level of comfort and insurance to the cruise ship companies and others knowing that towage assistance is available if circumstances change. (MMS Part B, p.11)

Prior to conducting any simulations without towage support, one would expect the simulation project directors to discuss this issue with major cruise ship companies and their insurers regarding their expectations and legal obligations in relation to no towage support in a port that has such complex and unpredictable bathymetry, hydrological action and weather events as the Gold Coast.

The legal situation for commercial vessels visiting Australian Ports has become much stricter with the new Federal 'Navigation Act 2012' and its 'Compliance and Enforcement Policy' which came into force on 1st January 2013. Maritime laws that were over 100 years old, especially those related to 'risks to safety and the environment', have been replaced with far more stringent laws by the Australian Maritime Safety Authority (www.amsa.gov.au). The MMS report has not addressed this legislation or these issues.

An example of what can go wrong in Queensland waters with the existing type of vessel used by companies such as Carnival's P&O Australia line is described by Professor Ross Klein in his expert testimony to the US Senate 'Hearings on Oversight of the Cruise Industry' in 2012. www.iztzg.hr/UserFiles/File/novosti/2012/2012-Testimony-of-R-Klein-in-US-Senate.pdf

2010 Pacific Dawn
(P&O Australia)

> A pilot averted a possible disaster by bringing the out-of-control ship to a stop just 70m away from the six-lane Gateway Bridge over the Brisbane River. Two tugboats got the ship under control, bringing her to a complete standstill 70m shy of the bridge.
> (Klein 2012, p.46)

Tides and Currents

The MMS report claims:

> Tidal flows were manually input as a constant for all exercises until day three when tidal data was input in real time. (MMS Part B, p.3)…[and] The ship's [sic] passage from entry to the approach channel to the berth can be safely handled at winds up to 25 knots provided tidal flows do not exceed approximately 50% of peak flow values on the flood tide. (MMS Part B, p.9)

The MMS report suggests that the peak flood tide for the Seaway Channel is 2.6 knots and the ebb tide 2.7 knots (MMS Part A, Table 2, p.6). Yet in the same report the 'Tidal Atlas' in Attachment 2, declares that for a 'Spring Tide' recorded 'on the 11 January 2005':

> the maximum tidal velocities expected under normal tidal cycles **without any climate change allowances**…shows a maximum flood tide velocity approx. **1.4m/s** [and] maximum ebb tide velocity of **1.6m/s.**

When transposed from metres/sec to knots, the MMS figures should read, 'maximum flood tide velocity approx. 2.72 knots' and 'maximum ebb tide velocity of 3.11 knots', which in both cases is greater than the 2.6 and 2.7 knots quoted above in the MMS report, p.6.

However, further contradicting the MMS current estimates, Mirfenderesk and Tomlinson measured the velocity of the middle of the channel at peak flood tide at 1.7m/sec (3.3 knots) and a maximum 2m/sec (3.88 knots) in the northern half of the channel on the ebb tide. They also maintain the maximum current velocity at the Seaway can be approximately 10% greater than the measured value. (Journal of Coastal Research, Vol. 24, No 5, Sept 2008, p.1235)

Nevertheless, the majority of simulated ship runs were conducted at no greater than the MMS nominated 50% peak values on flood and ebb tides (1.4 knots, 1.6 knots) combined with tides no lower than .60 metres LAT.

Furthermore, given the predominantly semidiurnal tidal regime of the Broadwater, a visiting ship has a maximum window of opportunity of less than 3 hours on each tide to safely enter or depart a Gold Coast port, which is further narrowed because the tides do not necessarily coincide with ship's itineraries of morning arrival and late afternoon departure.

Also the Seaway encounters anything from 20 to 50 minutes lag after peak and ebb tides before the currents change and this varies from day to day in the semidiurnal tidal cycle. In other words, peak current speeds do not necessarily correspond with the predicted Astronomical Tides. This further reduces the safe window of opportunity for ships to enter and depart through the Seaway and further complicates calculations and forecasts on any day as to whether tidal conditions are safe for ships to enter.

Watkinson suggests these problems can be countered by delaying a ship's entry and departure:

> Vessels would be delayed or restricted for arrival and departure due to environmental conditions above those considered maximum for the port. (MMS Part B, p.13)

Also,

> Entry on a flood tide or departure on an ebb tide should be carefully evaluated when spring tides are at peak flow. This condition can be easily mitigated by changing arrival and departure times by about 1.5 to 2hours. (MMS Part B, p.13)

No enquiry was undertaken by MMS as to whether cruise companies would be willing to take the chance of visiting the Gold Coast if a ship's itineraries were 'delayed' by 1.5 – 2 hours or 'restricted for arrival and departure'. Nor were the implications of delaying afternoon departures until night-time discussed by Watkinson, other than to conclude that:

> Two night time simulations were undertaken to assess temporary aids to navigation number and placement. The runs were largely ineffective due mainly to the inability of the simulator software to assign increased brightness to the aids. (MMS Part B, p.5)
>
> e.g. (Run 39): navaids was (sic) very poor. Inbound leads not visible at all, front lead only visible in the lights of the ship. No navaids in the bend or inner channel. (MMS Part B, p.82)

And even in daytime simulation runs the conclusion was:

> The current set of approach leads will be inadequate for the expected type and size of vessel as will the absence of any channel leads in the South Channel. (MMS Part B, p.14)

The MMS Report - Part A, Tidal Atlas – Attachment 2, also states:

> Maximum velocities vary within the modelled area and those plotted in the time series below are indicative of that single cell only.

In other words, the Seaway Channel contains a variety of current velocities in action at any time on both the ebb and flood tides, for example; the southern part of the Seaway channel runs at a slower speed than the northern part of the channel, clearly seen in the ebb and flood tide diagrams in MMS – Part A.

This strong asymmetry in horizontal velocity distribution is most pronounced on the ebb tide when the 'horizontal velocity from the middle of the canal to the southern wall runs between 0.5 [0.9 knots] and 0 m/s [zero knots], whereas on the northern half, the velocity is well above 1 m/s [1.94 knots] in most parts; and reaches a maximum close to 2 m/s [3.88 knots].' (Journal of Coastal Research, Vol. 24, No 5, Sept 2008, p.1235 - 1236)

This 'sheer' effect in the tidal currents through the Seaway is a potentially dangerous navigational obstacle to any ship attempting to enter and pass through the Seaway and yet no ship simulations were conducted with these variable current speeds.

Mirfenderesk and Tomlinson also measured vertical eddies in the Seaway reaching up to 0.35m/sec (.68 knots) during ebb tide (Journal of Coastal Research, Vol. 24, No 5, Sept 2008, p.1236) which were not factored into any of the ship simulation runs by MMS to test the effects on steering and navigational safety.

No comment was made in the MMS Report regarding the likely frequency and intensity of weather events that could increase the current speeds (especially during the Summer cruise season Oct-March).

Nor did MMS account for the increases in tidal current velocities and changes to the tidal prism caused by the increased depths and widths of dredged channels that are required in the hope of safely hosting cruise ships in the Broadwater. Furthermore, Tomlinson (et al) maintain:

> Recently, the proposed construction of a cruise ship terminal, involving a required 400m extension of the southern training wall, raised high community concerns and environmental issues. The impact of this engineering work is qualitatively investigated in this study. In particular, this study shows that such a project would significantly change the ebb-tidal delta morphology and would aggravate channel infilling problems and would result in a significant increase of the dredging costs. (Journal of Coastal Research, Special Issue 50, 2007, p.1090)

One of the 'out-clauses' given by MMS for any inaccurate tidal inputs, in addition to not applying 'any climate change allowances' or '400m extension of the southern training wall' was:

> The supplied tidal information was in a file format that could not be used and therefore real time tidal information could not be aligned with the simulation exercises. (MMS Part B, p.2)

Winds Speeds and Directions

The MMs report claims:

> The ships passage from the entry to the Approach Channel to berth can be safely handled with winds up to 25 knots provided tidal flows do not exceed approximately 50% of peak flow values on the flood tide (MMS chose 1.4 knots)…wind speeds between 20 and 30 knots occur only 2.4% of the time…(Part B, p.9)

For the ship run simulations Watkinson insisted:

> All wind conditions will be constant (including gusting) for each run and input manually. (MMS Part A, p.7)

However, the Bureau of Meteorology (BoM) clearly states on its website that in its daily wind forecasts:

> **Please be aware**
> **Wind gusts can be 40 percent stronger than the average given here.**

MMS simulated wind conditions that were 'constant (including gusts)' for each run. Therefore, the BoM forecasts of **18 knot** winds would indicate **winds gusts up to 25 knots (**taking into account the 40% stronger gusts).

The important input data that Watkinson has obfuscated, by implying that only 2.4% of the time would winds be at their maximum for navigational safety, is contradicted by the percentages revealed by the BoM's 'Total Observations of Wind Direction versus Wind Speed (1991 to 2010) at the Gold Coast Seaway'. The percentages of 18 knot wind forecasts are far greater than the 2.4% suggested by MMS.

The Bureau of Meteorology wind speed values (in parenthesis) have been converted from kmh to knots in the Overall Wind Averages for the Gold Cost Seaway (1991 – 2010) in the following statistics:

Overall 9am 16.2 knots (30 kmh) to 21.6 knots (40kmh) = **9.5% of time**
(+ 40% gusts = 22.7 kts – 30.2 kts)

Overall 9am Over 21.6 knots (40kmh) = **3.5% of the time**
(+ 40% gusts = greater than 30.2 knots)

Overall 3pm 16.2 knots – 21.6 knots = **17.5% of time**
(+ 40% gusts = 22.7 kts – 30.2 kts)

Overall 3pm Over 21.6 knots (40kmh) = **5.5% of time**
(+40% gusts = greater than 30.2 knots)

(from BoM Annual Mean Wind Roses in MMS Report Part A, Attachments 3A & 3B)

The maximum unsafe (actual) winds for cruise ships at 18 knots for entering and departing the Gold Coast occur **9.5% of the time at 9am** and **17.5% of the time at 3pm**.

The MMS report also states:

> The primary limitation in the South Channel is caused by the force exerted by the wind when the vessel slows to enter the swing basin. The worst conditions apply when the wind is from the SE to the NE sector. (MMS Part B, p.7)

NE to SE winds occur overall **28% of the time at 9am** and **66% of the time at 3pm** (BoM Wind Rose, MMS Part A -Attachments 3A, 3B). Yet, during the 63 ship runs no simulations were conducted in NE winds and only eight runs in Easterly winds.

In summer (Oct-March), the overall figures for NE to SE sector winds (1991 – 2010) were **47% of the time at 9am** during ship arrivals and **71% of the time at 3pm** during ship departures. (BoM Website, accessed 14/01/13)

MMS claimed in their simulation plan that:

> Wind conditions will be combined with real time tidal streams and increased to a level to represent the worst conditions for entry, departure and maneuvering. (MMS Part A, p.7)

In fact, the BoM data reveals that the simulations did not fully investigate the 'worst conditions' for departure of vessels through the Approach channel as stated above. MMS suggest that in the Approach Channel:

> Maximum tidal stream in knots are Flood 0.4 and Ebb 1.6 (MMS Part A, p.6)

and

> Departing vessels will generally complete simulation (sic) as soon as the vessel is steady on outbound heading (MMS Part A, p.8)

This decision to complete departure simulations as soon as the vessel was 'steady on an outbound heading' was taken despite Tomlinson pointing out that:

> tide-induced currents are significant up to 1500m offshore. ((Journal of Coastal Research, Special Issue 50, 2007, p.1089),

thus contradicting the above MMS estimates for Approach Channel tidal streams.

In the Approach Channel the MMS report also states:

> A beam or near beam wind will cause both a directional problem and a heeling problem that effectively leads to an increase in draft…a general northerly coastal drift (up to approximately 0.5 knots) also effects the vessels progress in the Approach Channel. (MMS Part B, p.6)

No simulated runs were conducted in W, NW, or SW winds. The MMS report claims:

> Winds from the western sector are very limited. (Part A, p.6)

Yet, analysis of the BoM Wind Rose (1991 – 2010) in Attachment 3A (MMS Report - Part A) reveals the following:

Overall, **NW winds** occur **18% of the time, W winds 8%, SW winds 4% at 9am.** In total, winds from the **western sector** occur **31% of the time at 9am** during 20 years of BoM 'Total Observations 1991 – 2010', which hardly constitutes the MMS description of 'very limited'.

Also, given the nature of westerly winds being beam and near beam winds in the Channel Bend, Southern Channel, Swing Basin and Berth Pocket, one would have expected some simulations to be conducted using westerly winds.

And although MMS suggested,

> an additional tidal stream of 0.5 knots to the north will be input manually to represent general northerly drift in the approach channel' (MMS Part A, p.6),

there are no indications in the MMS report summaries as to which of the 63 ship simulation runs had the 0.5 knots northerly drift inputted and the effect this had on vessels' swept paths, except for a general statement regarding the 'Voyager of the Seas':

> under extreme conditions (25 knots wind and 0.5 knot coastal current acting on the beam) the VoS produced a maximum leeway of 3 to 4 degrees…resulting in a swept path of 55 m. (MMS Part B, p.9)

Wave Climate

The MMS Report states:

> The wave height (Hsig) in the Approach Channel is not to exceed 2.5 metres providing the vessels heeling angle does not exceed 1 degree. (MMS Part B, p.14)

The contraction 'Hsig' above denotes the average of the top third of wave heights measured during a designated time period. However, navigational safety decisions should be made on the actual wave heights (not average wave heights) that will be encountered when ships enter and depart ports. The BoM on its forecast website 'South East Queensland Coastal Waters Boating Weather' clearly states:

> **Please be aware**
> **…maximum waves may be up to twice the height [of the forecast heights].**

Therefore, a forecast of Seas or Swells of 1.25 metres in height would indicate waves of up to 2.5 metres during the forecast period. While MMS suggests waves with heights above **2.5 metres occur 1.29%** of the time, the conditions in which a vessel could expect 2.5 metre waves would be during forecast waves of 1.25 metres.

The Qld Govt. 'Wave data recording program' suggests wave heights of 1.25m and above will occur for all wave periods throughout the year **26% of the time** and over Summer (the main cruise season, Oct - March) **38% of the time** (Qld Govt. EPA 'Gold Coast Region' - Daily Wave Recordings).

In referring to a safe wave height of 2.5 metres, MMS suggests that safe navigation is also dependent upon the vessel's heeling angle not exceeding 1 degree (heeling being the action of a vessel leaning to one side temporarily as a result of wind, waves or turning). This pre-supposes that all vessels visiting the Gold Coast will have the technology known as 'heeling tanks' in order to adjust their heeling angle to below 1 degree, so as not to increase the draft of the vessel to unsafe depths and they can respond quickly enough to wind or wave induced heeling over 1 degree for safe navigation.

The waves generated by local winds are referred to as 'Seas' and are generally indicated by 8 – 10 seconds (sometimes less) between the crests of the highest energy waves (Tp) in a system and being wind waves, they often come from the same direction as the wind.

Wave periods greater than 8 - 10 seconds are generally referred to as 'Swell'. The winds generating swell with Tp = 12 – 15 seconds are often some distance from and/or not even evident in the coastal zone being hit by the swell. No wave Tp less than 12 seconds or above 12 seconds was ever tested in the MMS simulations.

It is common on the Gold Coast to have a Sea and Swell (sometimes from different directions) occurring at the same time, for example; the BoM forecast issued for Tuesday 8th January 2013 predicted the following 'mixed sea':

> Double Island Point to Point Danger
>
> Tuesday:
>
> **Winds**: SE to NE 10 to 15 knots, tending N to NE 10 to 15 knots in the afternoon and reaching 15 to 20 knots in the evening.
> **Winds** tending NW to NE 15 to 20 knots in the evening and reaching 20 to 25 knots at times.
> **Seas**: 1.2 to 1.7 metres, reaching 2.2 metres during the evening.
> **Swell**: E to SE 1.5metres

On the Gold Coast a 'mixed sea state', that is; a combined Swell and Sea is not uncommon. Also a local 25 knot wind will generate a 1.5 metre or greater 'wind sea'. It is very improbable to have a moderate to strong wind and 'nil' Sea or even a sea breeze and 'nil' Sea. Yet, of the entire 63 simulated ship runs conducted by MMS, all were conducted with a 'nil' Sea.

Even on the numerous ship simulation runs with 10 – 30 knot wind inputs, the 'Sea' input was 'nil'. Also 32 runs of a total of 63 had 'nil Sea' and 'nil Swell', that is; completely calm Seas and Swell while 10 – 30 knot winds were blowing during those runs. These are seemingly fictional meteorological conditions for the Gold Coast (or anywhere else for that matter).

The MMS report also states:

> no significant wave heights will be used or input from The Bend into the Broadwater proper (MMS Part A, p.7)

There is no indication in the MMS Report that significant wave heights were input into any Channels other than the Approach Channel during simulations, even though there is much socio-historical evidence including archival photographs of significant wave action inside the Seaway Channel sector and also on Wavebreak Island's eastern shore.

For instance, the BoM forecast issued for SE Queensland Coastal Waters on Sunday 27th January 2013 was as follows:

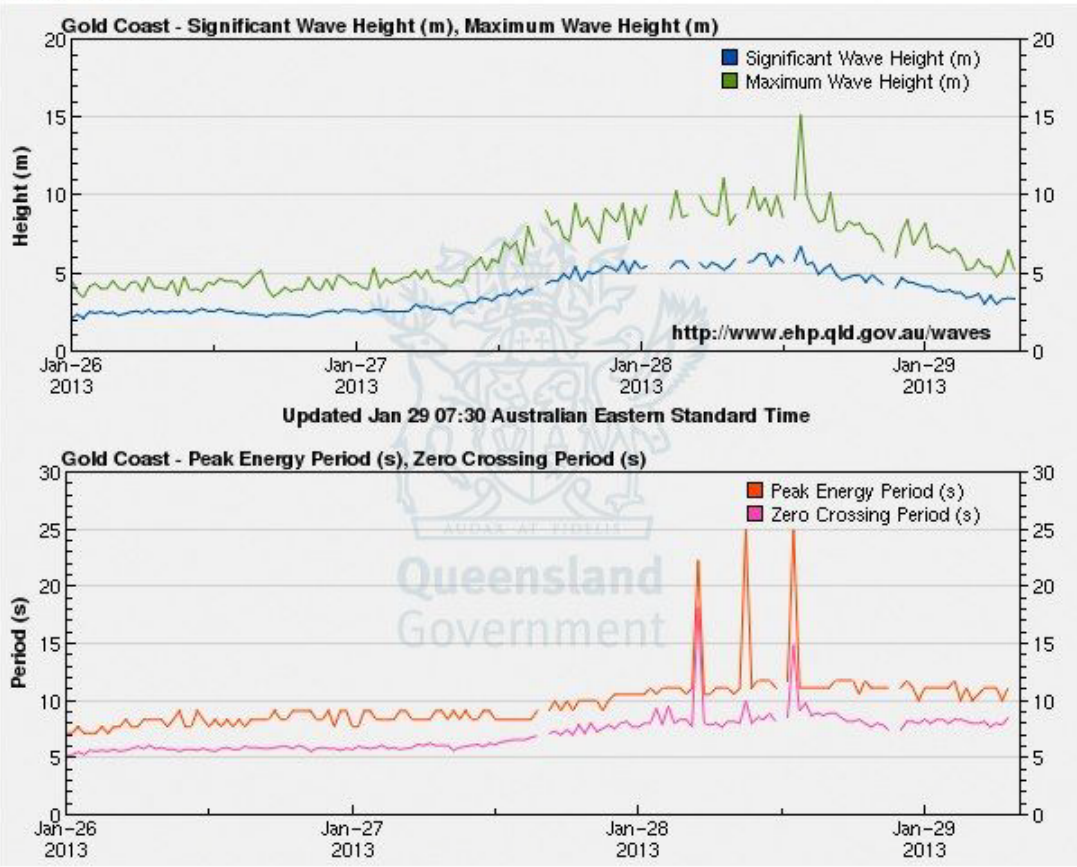
Double Island Point to Point Danger

A Wind Warning is current

Sunday until Midnight:
Winds: E to NE 40 to 45 knots, increasing to 45 to 50 knots south of Noosa…Winds dependent on the position and strength of Ex-TC Oswald.
Seas: 4 to 5 metres, increasing to 6 metres south of Noosa, breaking dangerously inshore.
Swell: E to NE 4 metres, breaking dangerously inshore
Heavy rain areas inshore with gusts to 75 knots.

Recordings on 26, 27, 28 January 2013 of Significant Wave Heights (m) and Maximum Wave Heights on the Gold Coast, support the BoM warning that 'maximum waves can be up to twice the height' of forecast (significant) wave heights. On 29 January, one wave peaked at 15 metres (49 feet).

Southport wave buoy



Over the same three days, the period between the most energetic wave peaks (Tp) varied from 7 – 25 seconds, yet the MMS simulations only tested vessels in Tp=12 seconds.

The Ships

The simulation study used five different cruise ships 'representing vessels that are or about to trade in Australian waters and are available as validated models at the Smartship facility in Brisbane.' (MMS Part A, p.7)

The selected ships were:

Name	Length	Beam	Draft	Propulsion	Thrusters
Pacific Dawn/Jewel (Regal Princess)	245m	32.3m	7.83m	Twin prop. Single rudder	2x1.8mW bow 2x2.08mW stern
Queen Victoria	294m	32.26m	8.0m	Twin Azipod	3x2.2mW bow
Emerald Princess	289m	36.05m	8.5m	Twin prop. Twin rudders	3x2.2mW bow 3x1.7mW stern
Queen Mary 2	345m	41m	10.4m	Twin Azipod Twin fixed	3x3.2mW bow
Voyager of the Seas	311.12m	38.6m	8.6m	Twin Azipod Single fixed	4x3.omW bow

'Option 3' Terminal - Summary of Ship Runs

The **'Regal Princess',** which most closely approximates the current P&O Australia (Carnival) fleet operating in Australian waters, could not handle other than the absolute minimum conditions during simulations. The vessel had problems in 7 out of 8 runs including 'did not make the turn' (Run 32). The most 'successful' runs had nil sea and nil swell. MMS concluded:

> The conditions for arrival and departure for this vessel would need to be reduced slightly to provide better risk management. (MMS Part B. p10)

Presumably this would require the winds, currents, seas and swells to be turned down a notch by someone on the days of arrival/departure of the 'Regal Princess'.

The '**Queen Victoria',** had problems in 8 runs of 16, including 'touched southern bank [twice], very difficult to maintain course' (Run 13) and 'East wind [20 knots] gave problems on beam in bend in South Channel' (Run 41). And although for 'Safe Navigation' MMS designated,

> speed in the inner channels [is] not to exceed 10 knots. (MMS Part A, p.9),

most of the Queen Victoria's 'successful' runs were conducted in sections of the inner channels at speeds of 12knots, 'used a (sic) arrival speed of 12 knots…reduced to 10 in the bend' (Run 14); 'arrival no issue at all 12 knots' (Run 17). This is despite the warning by MMS:

> The correct vessel speed is critical, firstly it should be fast enough to ensure the vessel could overcome external forces and maintain directional capability and secondly slow enough to allow the vessel to stop within a certain distance. (MMS Part B, p.9)

Also the pilot of 'Queen Victoria' stated in the report of Run 42:

> used to (sic) much power to get off the dock and got into trouble departing the swing basin. Transit out of the channel was to (sic) close to the bank…' (Run 19); [and] misjudged the amount of leeway and gave too much port helm resulting in the ship spearing across channel and closing on the port channel edge (Run 42).

The **'Emerald Princess'** had problems in 13 of 17 runs, including 'issues' (Run 4) before 'the exercise froze'; 'minimum clearance' when the vessel came within 24.9 metres and 13.9 metres of channels (Run 6) and within 17.5 metres of the southern bank after the 'vessel drifted' and then 'passed within 19.7m of South Channel bank and then 12.4metres…'(Run 5); 'maximum distance of bank 13.2 metres…vessel heel up to 4 degrees with list at 1.26m' (Run 8); and '21.1 metres off the south bank' (Run 12)

As stated by MMS, for safe navigation the 'Ship's Position in Channel' should have been:

> Ship's swept path not to encroach within one beams width of the channel toe lines (MMS Part A, p.9)

The beam of the 'Emerald Princess' is **36.05 metres.**

And on (Run 7) the 'vessel could not make the turn and grounded on the western bank, just out of the channel bend'. On the same run, in 25 knot SE winds on a 2.5 metre swell and 0.6 metre tide, the 'UKC in the Approach Channel reduced to 0.9 metres minimum', when for safe navigation of the Approach Channel, MMS stated:

> The results indicated UKC's for all vessels of over 2 metres. (MMs Part B, p.10)

The 'Emerald Princess' appears to be the only ship that had its entry and berthing times documented in simulation summaries (Run 1). From 'Approach Channel to Entrance to the end of the South Channel…to berth' took 54 minutes in a 10 knot SE wind, slack tide, nil swell, nil current, and nil sea. Given these are 'idealised' conditions which would rarely or never exist on the Gold Coast, one would expect the total time for cruise ship entry and berthing to be substantially greater than 54 minutes. It appears that no timing was done on departures of any vessels.

The '**Voyager of the Seas'** had problems in 7 out of 10 runs, including 'overshot the swing basin' (Run 33); 'grounded' (Run 49); 'vessel cannot safely depart under this [sic] conditions in a 130 metre channel' (Run 38).

The 'Voyager of the Seas' had its most successful runs in 'nil seas, nil swell' or when running at a speed of '11.5 knots in the outer channel and 9 knots after the bend' (Run 31).

The **'Queen Mary',** at 345 metres LOA is the anticipated minimum length of most cruise ships that will operate globally after 2015. This vessel had problems on all four of its simulated runs including, 'ran

aground due to roll' (Run 45); 'took a big effort to maintain position in the channel' (Run 48); and all Queen Mary' simulations were conducted:

> noting the length but not accounting for the draft [10.4metres] of the vessel (MMS Part B, p.11).

MMS concluded that '**this vessel and possible vessels of similar size were considered unacceptable at this time'** (MMS Part B, p.11).

Wavebreak 'East Shore' Terminal - Summary of Ship Runs

Simulations were conducted using the 'Emerald Princess' to test the docking of vessels near Wavebreak Island:

> in a mock up using barges to outline both the berth arrangements [however] the port model was mocked up without changing bathymetry and hydrodynamic inputs. (MMS Part B, p.12).

The Wavebreak 1 option (eastern shore) simulation was conducted in nil wind, nil seas and nil swell conditions which rarely, if ever, exist at the Seaway. The BoM Total Observations (1991-2010) reveal that 'calm' conditions occur less than 1% of the time overall and less than .5% of the time during Summer Observations. The other simulations at Wavebreak 2 option (eastern shore) and Wavebreak 3 option (southern location) were conducted in 20 knot SE winds with nil sea and nil swell conditions.

The Wavebreak simulations failed to address so many 'bathymetry and hydrodynamic' issues e.g. swing basin design, location and diameter; northern channel current speeds, engineered structure of Wavebreak and north groyne wall; blockage of existing boat channels; storm/cyclone surge and ordinary wave action through the Seaway; and the same navigational issues confronted in previous simulations in the Approach and Seaway Channels, that the location and conditions under which the Wavebreak simulations were run were pure fantasy for the Gold Coast Seaway.

MMS declared, 'All simulations were carried out successfully' but 'the results should be subject to specific testing using a properly constructed port model'. (MMS Part B, p.12) In other words, MMS wish to be contracted to conduct more studies at ratepayers' expense on port locations on Wavebreak Island, locations that are even more geographically inappropriate than Option 3 at the north end of Seaworld.

Conclusions from Analysis of MMS Report 2012 - Part A and Part B

In order for ships such as the **'Voyager of the Seas' -** 311m Length Overall (LOA); 38.6m beam; 8.6m draft, to safely access a port inside the Gold Coast Broadwater, the following conditions and features would be necessary:

Ships must have a minimum 2.0 metre Under Keel Clearance (UKC) in Approach and Seaway Channels and the Channel Bend to take into account increases in draft leading to decreases in UKC due to heeling, assuming heel does not surpass 1 degree within the dredging parameters outlined below:

- Approach and Seaway Channels should adhere to the PIANC guideline recommendation of a minimum 166 metres wide (not the Meridian Marine Services recommendation of 140m) and a depth 12 metres below the Lowest Astronomical Tide (LAT).

- South Channel a minimum 165 metres wide and MMS recommended -10.6m LAT, assuming no wind-induced heeling or squat causing increases in draft above 1.4m.

- MMS recommends a Channel Bend minimum 210 metres wide with a depth of -11m LAT and a 'portion' of the southern groyne on Wavebreak Island 'removed'. However, an independent dredge assessment calculated that the 1v:4h batter slopes required would necessitate a 279 metres wide channel and the removal of the entire south groyne on Wavebreak Island.

- Swing Basin minimum 591 metres diameter (not the MMS recommended 500 metres) as per PIANC guidelines and using the recommended formula for navigational safety with swing basin diameters of 1.8 to 2.0 times the vessel LOA (if these involve swinging the vessel through 180 degrees); and MMS recommended -9.2 metres LAT (0.6 UKC), assuming no heel above 1% caused by wind or ship turning and no squat induced draft increase when 'underway'.

- MMS recommended a Berthing Pocket 420 metres by 50 metres and 8.9m LAT (0.3m LAT), assuming no wind-induced heeling or squat when ship gets underway
  Note: a vessel of 8.5m draft at 4 degrees heel will increase its draft by 1.39m and at 6 degrees by 2.02m.

In addition to wind induced heeling there should be no further decrease in UKC through increased draft due to the vessel turning or wind, current, wave or vessel speed induced squat, rolling or pitching (all untested in MMS simulations).

The draft of a vessel is to be no deeper than 8.6 metres which excludes the Queen Mary and most ships that will be in service post-2015.

Within the above channel parameters, ships must also be a minimum 289 metres LOA (Malaysian Report 2004) to maximum 311 metres LOA (MMS Report 2012). This excludes most of the older vessels under 289m LOA that are currently in service in Australian waters and most cruise ships that will be in service globally post-2015.

The Bureau of Meteorology (BoM) weather forecasts on days of 'scheduled' cruise vessel visits should be within the following parameters:

- no wave heights over the forecast maximum 1.25 metre swells and/or seas for safe navigation (allowing for twice the forecast wave height to 2.5m). In the Gold Coast Region, wave heights of 1.25m and above occur **26% of the time** overall and **38% of the time** over Summer, the main cruise season (not 1.29% of the time suggested by MMS).

- winds must be 18 knots or less for safe navigation (allowing for 40% gusts to 25 knots) Wind speeds of 18 knots and above occur on the Gold Coast **9.5% of the time at 9am** and **17.5% of the time at 3pm** (not 2.4% of the time suggested by MMS).

- the worst conditions for ship navigation 'apply when the wind is from the SE to the NE sector' (MMS Part B, p.7).

- in summer (Oct-March), the overall figures for NE to SE sector winds (1991 – 2010) were **47% of the time at 9am** during ship arrivals and **71% of the time at 3pm** during ship departures (BoM Website, accessed 14/01/13).

- no simulations were conducted by MMS in NE winds of any speed to ascertain safe navigational parameters.

- at all times in up to 25 knot winds and gusts there should be 'nil seas', as all MMS simulations were conducted in 'nil seas' at these wind speeds. However, nil seas at any wind speed is highly unlikely.

- there must never be any 'seas' combined with 'swells' as all MMS simulations were conducted without combined sea/swell conditions, even though combined seas and swells are common on the Gold Coast.

- overall, **NW winds** occur **18% of the time, W winds 8%, SW winds 4% at 9am.** In total, winds from the **western sector** occur **31% of the time at 9am** during 'Total Observations 1991 – 2010' (BoM Website, accessed 14/01/13) which contradicts the MMS description of westerly winds being 'very limited'. No simulations were conducted by MMS under westerly sector wind directions at any wind speed to ascertain safe navigation parameters.

- vessels can only safely navigate at 40% of peak current velocities which are 3.11 to 4 knots variable as measured by Mirfenderesk and Tomlinson (Journal of Coastal Research, Vol. 24, No. 5, Sept 2008, p.1235), not 50% of the peak values nominated by MMS (2.6 to 2.7 knots).

- entry and departure of vessels must be excluded at times of local weather events such as heavy rains or large swells and major weather events such as floods, storm surge and cyclone swells when values will exceed Mirfenderesk and Tomlinson's peak current velocity estimates.

- entry or departure with wind speeds up to 25 knots should not be attempted (MMS Part B, p.13) when tidal flows are in excess of 40% of peak velocities (based on Mirfenderesk/Tomlinson study, 2008).

Other limitations include:

There must never be any sediment infill of dredged channels, swing basin or berth pocket as this may cause a ship to run aground and/or instigate 'banking effect' which can cause a ship to 'sheer uncontrollably'.

The Gold Coast port must be able to maintain batter slopes on a day-to-day basis of at least 1 vertical: 6 horizontal in the Approach Channel and 1v:4h in the inner channels (MMS estimate) or more likely at 1v:10h to 1v:30h (Independent Dredge report estimate) in all channels despite continual hydrological action, especially sediment transportation within the Gold Coast estuary and off-shore coastal systems.

MMS maintain that the northerly current seaward of the Seaway walls must not exceed 0.5 knots although MMS did not provide detailed documentation of which simulations had an input of 0.5 knot northerly current in vessel simulation data. A southerly current of any velocity caused by low pressure

systems, storm cells or cyclone activity NW, N or NE of the Gold Coast was not tested by MMS in any simulations.

Vessels will need to safely navigate a two speed current through the Seaway Channel especially on ebb tides dealing with the resulting 'sheer' effect on ship steering (not tested in MMS simulations)

Ships need to be able to handle Seaway Channel tidal eddies up to .68 knots (not tested by MMS)

Cruise lines must be willing to have flexible ships' itineraries owing to a lag of 20-50 minutes variable after each peak ebb/flood tide before the currents change, which varies in timing from day to day through the Seaway Channel.

A complex calculation on a daily basis, using a 100% perfect forecast capacity, must be developed and implemented to account for the tidal and meteorological factors mentioned above.

Vessels must possess 'equipment levels and propulsion systems having a high degree of maneuverability' (MMS Part B, p.13), including appropriate steering systems, thrusters and heeling tanks to reduce heeling to less than 1 degree therefore These operating parameters exclude the majority of Carnival Cruise's P&O fleet currently operating in Australia.

The Seaway walls, Wavebreak Island, all the dredged channels, swing basin and berth pocket will need to be engineered or reconstructed to withstand the scouring effect of ship's thrusters.

Ships using thrusters must slow to less than 6 knots to enable the thruster doors to open and for thrusters to be effective, despite potentially causing steering problems in some vessels because of the slower speed.

Despite being recommended in several previous dredging reports, MMS assumes that a minimum 400 metre extension to the southern Seaway wall and associated increases in sand-pumping will not be necessary to assist in maintenance of channel depths/widths and navigational safety (not mentioned in MMS report).

The assumption by MMS that dredged channels will not alter the tidal prism and therefore the tidal high/low range in the Broadwater despite all coastal engineering theories and previous dredging reports supporting the opposite point of view.

The MMS report assumes there will be no tidal current velocity increases caused by deeper and wider dredging for navigational channels thus contradicting all previous independent dredging reports for the Gold Coast.

The total amount of dredging required for 'Option 3 CST' will be in excess 5 Million cubic metres with the increases in channel widths proposed by MMS after conducting their simulations, and even greater if PIANC Guidelines were applied to the channel widths needed for safe navigation rather than the 'approx. 3.7 Million cubic metres' of dredging to 'develop a channel of 130 metres wide' suggested in the MMS Report - Part A.

MMS assume that a portion (MMS Report) or the entire south groyne (Independent Dredging Report) on Wavebreak Island can be removed without changes to hydrological action and bathymetry and

therefore dredged channels, revetment walls, swing basin, current velocities and directions, sediment transportation etc. in the Broadwater.

MMS assume that Cruise Line companies will accept at short notice, entry/departure delays of up to 3 hours including the possibility of having to delay departures until night.

MMS do not discuss the need for fool-proof systems to be in place for adequate warnings and guarantees of safety for recreational and tourism divers, surfers and boaties; professional and recreational fishing boats; visiting yachts and vessels involved in activities such as whale-watching, who will be required to stand off to sea during delayed and/or scheduled entries and departures of cruise vessels, no matter what the ocean conditions or weather forecasts at that time.

Channel leads/markers for daytime navigation need to be expanded and improved and lights for night-time navigation must be constructed in case a ship's departure is delayed until night.

The assumption that Cruise Line Co's, Maritime Insurers and the Australian Maritime Safety Authority will accept Meridian Maritime Services 'subjective' method in assessing navigational safety/risk factors as outlined below:

> a subjective assessment of each simulation exercise made by the Pilot, Observer and if necessary the Instructor based on their practical experience in regard to details of then particular run including the handling, behaviour and operational aspects of the ship navigating within the port. (MMS Part A, p.9)

An unproved assumption that Cruise Line Co's, Maritime Insurers and the new Federal 'Navigation Act 2012' (enforced from 1st January 2013) will accept/allow for cruise vessel navigation of a Gold Coast port without towage on permanent standby and with or without tugs being available at short notice from another port .

Conclusion

The discredited 2004 Malaysian Navigational Report was characterised by a litany of flaws, omissions and mistakes; inaccurate and inadequate input of data; and highly questionable and ambiguous conclusions. The 2012 Meridian Maritime Services Report reflects similar qualities. Captain John Watkinson and Captain Peter Listrup were leading players in both reports.

Watkinson claims in the Meridian Maritime Services 'Simulation Report' 2012, that:

> All simulations were planned to ensure all design ships were assessed appropriately in the three channel areas and the swing basin under normal and extreme seasonal conditions… (MMS Part B, p.5)

Following a detailed analysis of the MMS Reports, the phrase under 'extreme seasonal conditions', does not seem believable.

In 2006, Angus Macleod, after analysing the Malaysian report, concluded that '95% of the world's cruise vessels would expose their passengers to "absolutely unsafe" conditions, even in light winds and small waves' on the Gold Coast.

Only two major physical elements have changed since 2006; firstly, cruise vessels today are longer, higher, wider and deeper and therefore less likely to safely navigate within the parameters suggested by MMS for a Gold Coast port and secondly, local and major weather events have become more frequent and more intense.

The GCCC recently commissioned a 'Business Case' report by the AECgroup in which the following statement appears:

> consultations with cruise lines have indicated strong industry interest in the Gold Coast Cruise Ship Terminal. (Final Report Dec. 2012)

Cruise lines have indicated 'strong interest' but not 'strong commitment' as revealed by Gavin Smith, Royal Caribbean's Managing Director for Australia, who stated in 2012:

> The challenge for the Gold Coast is the marine navigation of the area and building a facility that could be reliably accessed by visiting cruise ships.
> www.royalcaribbeanblog.com/2012/07/25/-royal-carribean-supports-new-gold-coast-terminal

The MMS Navigational report is further proof (albeit by default) that the world's cruise ships will rarely if ever be able to safely enter or depart from a massively engineered and continuously dredged Gold Coast port.

Thus the perceived (and totally misconceived) business case for and economic benefits derived from a cruise terminal are based predominantly on the input of deficient technical data and the application of inappropriate meteorological conditions for determining the safety and feasibility of cruise ships visiting the Gold Coast.

Further Reading:

'A Letter to the Premier' at www.saveourspit.com/No_Terminal/news/NewsArticle.jsp?News_ID=146

'A History Lesson' at www.saveourspit.com/No_Terminal/news/NewsArticle.jsp?News_ID=174

'Cruise Ship Squeeze' by Ross A. Klein www.trove.nla.gov.au/work/20325841?version1d=24014413

'Paradise Lost at Sea' by Ross A. Klein www.fernwoodpublishing.ca/Paradise-Lost-at-Sea-Ross-Klein/

'Is the Spit Man Made?' at www.saveourspit.com/No_Terminal/news/NewsArticle.jsp?News_ID=142

'Shoals vital to quality waves at Strad' at
www.saveourspit.com/No_Terminal/news/NewsArticle.jsp?News_ID=171

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Anna Bligh – former Deputy-Premier and Premier of Queensland
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Bureau of Meteorology, Queensland
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Gavin Smith – Royal Caribbean, Australian Managing Director
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PIANC – Permanent International Association of Navigation Congress
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Save Our Spit Alliance Inc. – Queensland
Tom Tate – Mayor of Gold Coast

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Note: all attempts have been made by the editorial panel and advisors to refer to reputable published data and to be transparent and honest in their appraisals and analyses of reports and data mentioned in this article.