

Safety of Wightlink Propulsion Units on Lymington – Yarmouth Ferries

Summary

BMT was contracted to carry out trials with extensive measurements of thruster flows in relevant conditions. In the event none of these were carried out.

Those measurements which were carried out against the dock wall were worthless. The equipment used was not fit for purpose, the measurements would have been radically influenced by the adjacent dock wall, the measurements were time averaged at the time of measurement so that turbulent eddies would be ignored.

The only reason for the failure to carry out the measurements which can be found in the BMT Phase 2 Report is for reasons of safety of those involved. However this concern for the dangers of the thrusters is not reflected in the risk assessment tables included in the report.

A fatality has already occurred with the C-Class ferries, the danger from the W-Class ferry thrusters has been demonstrated in a MOB test. The much higher power through the unprotected bow thruster of the W-Class ferries indicates that they are likely to be significantly more dangerous than the C-Class vessels. This is confirmed by available data on incidents, where about 1/3 of reported incidents were apparently caused by or contributed to by the thrusters.

LHC should considering banning operation of the W-Class ferries until the safety problems described in this report have been resolved.

Background

- 1 It first became evident that Wightlink intended to introduce much larger vessels on the Lymington – Yarmouth route during the latter part of 2007. For unknown reasons the vessel size was disregarded by all of the organisations who Wightlink claimed to have consulted at that time. The Lymington River Association (LRA) was formed at that time as result of the failures in the local community to seek satisfactory assessments of any of the potential impacts of the new design.
- 2 The propulsion arrangements on both the C and W-Class vessels which allow them to navigate in the shallow Lymington River have the potential to make a significant hazard contribution. These “thrusters” are Voith-Schneider propulsion units – there is no conventional propeller or rudder. There are two very large units and Figure 1 shows a unit which is of very similar size to that on the W-Class ferry, the blades are 1.35m long and 2.1m in diameter. The thrusters push a large flow of water from one side of the unit to the other – the propulsion flow, really a big and high velocity jet of water. The existing ferries have similar but significantly smaller units (see Figure 2). Wightlink have found it necessary to increase the power output of their engines from 800hp to over 2360hp, nearly

3 times as much¹. Simple analysis of the effect of strong (Force 8-9) winds on the side of both ferry designs indicates that the designers recognised that this power was required to maintain the W-Class vessel in the river channel when its speed through the water would be constrained. This concern was identified by the LRA at a public meeting arranged by the Lymington Society in late 2007. Unfortunately these concerns have not yet been adequately addressed by any of the “stakeholder” or regulatory organisations involved with Wightlink or the W-Class vessels.

- 3 Wightlink’s navigational consultants ELP² have drawn attention to a number of serious effects with the new ferry hull design which they suggest will require the ferries to travel very slowly in the river to limit the damage to the banks and to reduce the hazard to passing craft. The ELP report only made passing reference to the possible significance of the thrusters.
- 4 The only fatal accident involving a C-Class ferry occurred when a person in the water in Yarmouth was killed³

Effect of Thrusters

- 5 The overall position is that:

- 5.1 Preliminary safety studies undertaken on behalf of LHC by BMT Seatech⁴ drew attention to the effects of thrusters on the slipstream and on large eddies which will develop with a stopped vessel, but failed to recognise the full effects of the much larger units on the W-Class vessels and the turbulent eddies which also form as the slipstream breaks up.

- 5.2 Considerable effort was put into finding a method of avoiding the unacceptable wash from the stern thruster. The solution was to put double the power through the bow thruster so that the suction at the bow essentially sucked the bow wave under the ferry and hid the thruster flows beneath the hull. The resulting flows have never been investigated, particularly when components of the flow break away from the hull and exit in the midship region of the hull.

- 5.3 Much was promised (and presumably included in the contract with BMT)⁵:

“This (risk) assessment will have regard for the safety of all craft using or moored on the river including the ferries themselves. The assessment will include (but not be limited to); an assessment of the impact of the hydrodynamic effects including some quantification of what those effects are; an analysis of the navigation of the new vessels including the effect of windage, thruster power and direction when transiting the reaches of the river in all operating wind speeds and direction; an analysis of passing in the river; and an analysis of the effects of increased wind shadow on sail powered boats.

¹ <http://www.lymingtonriver.co.uk/Ferry%20Dimensions%202.0.pdf>

² ELP Report ELP-55272-1206-57219-Rev 1

³ <http://www.lymingtonriver.co.uk/Yarmouth%20fatality%20combo-1.pdf>

⁴ BMT Seatech Ferry Operations at Lymington, Phase 1: The Present Situation and Future Predictions, C13537.R01, Feb 2008

⁵ BMT Seatech Ferry Operations at Lymington: the W-Class Ferries, C13537.01.R01.V7, May 2009

Thruster Effects on Safety. It is proposed to measure thruster efflux effects on both sides of the ferry during the waiting trials. These will be done as close to the ferry as possible, consistent with safety requirements. Some attempt will be made to measure flow effects while the ferries are on the move, but safety considerations may rule out measurements close to them.”

- 5.4 In the event, the equipment used was crude and simplistic:

“Propeller-type Hand-held Current Meter

This comprised a strut-mounted propeller which rotated in any flow into which it was placed. The original support strut was made of plastic and proved to be unsatisfactory. Its lack of rigidity was dealt with by replacing it with a steel tube just over a metre in length. The length of the strut was determined by the ability to hold it steady in some of the disturbed flows in which measurements were made, but it was nevertheless considered adequate to cover the area of flow of most interest to the study: that encompassing the hulls of many of the smaller leisure craft most likely to be affected by the ferries and also that encompassing much of the submerged torso of anyone in the river. In the measurement of flow, both in the thruster slipstreams and in peak ebb tides near the bank at the Cocked Hat bend, counts over thirty seconds were used.”

- 5.5 Worse was to follow, apparently it was unsafe for those involved in the measurement exercise to carry out any measurements in a professionally defensible manner!

“Several trials were carried out with the ferry waiting in the river and the Section on stop-and-hold manoeuvres has described those in a wind. The main effect of interest from a safety perspective relates to the disturbance created in the river by the thruster slipstreams and their effect on small craft. Accordingly measurements of the slipstream velocities were made for both the Wand C-classes. The only way these could be carried out in safety was with the ship berthed at the North End jetty with the appropriate thruster operating. This necessitated temporary closure of the river local to the ferry for the duration of the trials due to the cross-currents created.”

Apparently it was unsafe for measurements to be carried out from a substantial craft in the vicinity of the ferry, but perfectly acceptable for thousands of craft to pass close to the ferries with no knowledge of the hidden dangers which caused BMT and LHC such problems. Moreover, the failure to carry out any measurements from on board a ferry suggests that the data which would have been measured would have caused BMT and LHC embarrassment which they were not prepared to consider.

- 5.6 The limited measurements carried out against the dock wall of mean surface water flows are of no relevance to the water flows adjacent to an operating ferry. With the ferry tied up to the pier wall, no attempt is made to determine whether the close presence of the wall affects the thruster flow. Measurement of suction will be totally invalid against the wall as the flow will be stalled by the wall. The slipstream flow will also be considerably distorted by the presence of the wall and no attempt has been made by BMT to consider this effect, invalidating the results.

- 5.7 Moreover they time averaged the data over 30seconds, which would ensure that the turbulent eddies which will have a considerable effect on any craft in the vicinity were averaged to zero. Notwithstanding this it is apparent that the measurements carried out were significantly limited by the severe turbulence which they avoided measuring! They also avoided measuring flows below 1m., which ensures that effects which will interact with keels and rudders on keelboats would not be observed.
- 5.8 Wightlink have carried out model tests and fluid dynamics calculations (referred to in a presentation at a Saltmarshes Conference and in the ABPmer Report⁶) which are relevant to the performance of the ferries and their thrusters in the river, but Wightlink refused to release these despite a number of requests, including one through the LHC.
- 5.9 On the C-Class ferries (in Force 9 crosswind), each thruster will be moving about 7.4te/s of water at a mean speed of about 5.2m/s across the channel and its banks; on the W-Class, the figures for each thruster are 15.6te/s at 5.8m/s. For the W-Class ferries in strong wind conditions, the flow of the water column across the river channel, re-circulated by the thrusters, will take as little as 30-60 seconds.
- 5.10 As a late alteration to the BMT programme and as a result of agitation from Stakeholders, an experiment was carried out in which a safety mannequin was thrown overboard. It was destroyed by the bow thruster at a speed of 4kt, confirming the expected danger of the propulsion units on the ferries.
- 5.11 LRA's list of river incidents shows that about 1/3 of the incidents were either caused by or significantly contributed to by the effects of thrusters. The effects are known to be radically different from the C-Class, which showed a clear wake from both thrusters and it was obvious to other users where to keep clear.

Conclusions

- 6 The BMT was contracted to carry out trials with extensive measurements of thruster flows in relevant conditions. In the event none of these were carried out. It is reasonable to assume that LHC endorsed this change of contract scope.
- 7 Those measurements which were carried out against the dock wall were worthless,
- a) the equipment used was not fit for purpose,
 - b) the measurements would have been radically influenced by the adjacent dock wall,
 - c) the measurements were time averaged at the time of measurement so that turbulent eddies would be ignored,
 - d) depth was limited to 1 metre, so that the full effects on keelboats would not be observed.

⁶ ABPmer Wightlink – Replacement Lymington – Yarmouth Ferries: Information for Appropriate Assessment R/3772/1 May 2008

- 8** The only reason for the failure to carry out the measurements which can be found in the BMT Phase 2 Report is for reasons of safety of those involved. However this concern for the dangers of the thrusters is not reflected in the risk assessment tables included in the report.
- 9** A fatality has already occurred with the C-Class ferries, the danger from the W-Class ferry thrusters has been demonstrated in a MOB test. The much higher power through the unprotected bow thruster of the W-Class ferries indicates that they are likely to be significantly more dangerous than the C-Class vessels.
- 10** A significant proportion of incidents in the river are believed to be caused by or significantly contributed to by the action of the W-Class thrusters.
- 11** LHC should considering banning operation of the W-Class ferries until the safety problems described in this report have been resolved.

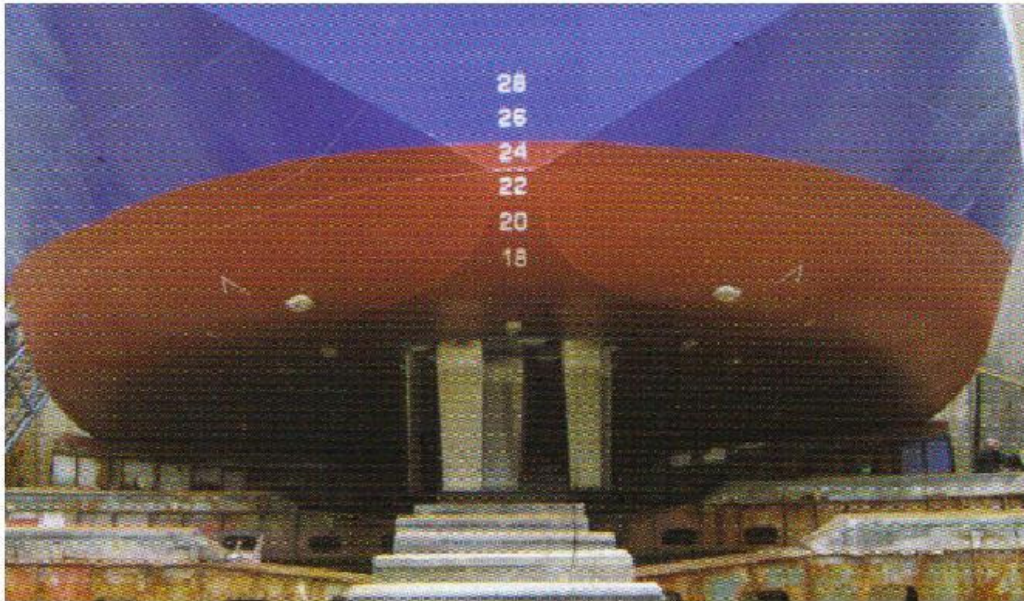
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Figure 1 - A Voith Schneider propulsion unit of similar size to that fitted on W-Class ferries



Figure 2 – Comparison of thrusters on C and W – Class ferries

**Current C Class Ferry
Small thruster on one side**



**New W Class Ferry
Large thrusters on centre line**