"Business Post NAIAD" - Stability Investigations

Notes on investigations to 3 June 1999.

undertaken by Warwick J. Hood &o, Consulting Naval Architect.

1. The investigations have been based on information supplied by Sgt. Constable Upston of Sydney Water Police and Australian Yachting Federation. The information included construction plans - particularly a Lines Plan and the rating certificate (IMS) for the subject yacht.

2. A file of offsets was compiled working from the lines plan. This was not easy because the drawing is a little distorted and some of the offsets given on the drawing are inaccurate. It is believed, however, that the hull offsets file totalling more than 50 Ks is adequately representative of the shape of hull shown by the lines plan.

3. Utilising the "Nautilus" computer programme - the same as that embedded in the IMS programme, and other data taken from the yacht's documents, particularly freeboards & vertical centre of

gravity position, the file was processed.

4. It is to be borne in mind that the computer programme is simply a means of performing classical naval architecture calculations which are riddled with small approximations. So it was not to be expected that the results from the yacht measurement and the plan "measurement" would be exactly the same. The writer is, however, surprised at some of the differences.

5. While the displacements - 7161 Kg. from the yacht and 7155 from the plan, are so close as to be in the "too good to be true" class, the angle of vanishing righting moment is 107.8° from the plans and 104.7° from the yacht. It is in the righting arm area ratio where there is a much greater difference. From the yacht it is 1.296 and from the plan it is 1.770.

6. The work on which this brief report is based was finished about 2130 last night and it is

believed that the programme should be run again but the results are not expected to vary significantly.

Recommendations

1. The hull shape as shown on the lines plan is a "nasty" one with deliberate bumps & discontinuities. While these can be incorporated & have been in the compilation of offsets & from the plan, it is not known to what extent the yacht measurer included them. Mr. David Lyons has commented on the small size of the offset file used for the IMS calculation.

2. Because of the bumps & discontinuities referred to above, the builder needs to take special care in the hull construction. It is not unknown for builders to "fair" these out if they are unaware of the designer's reason for including them.

3. It is recommended that the measurer's hull file be obtained

so that the measured hull lines may be compared with the designer's hull lines with the object of explaining the differences.

4. There also needs to be better understanding of the inside ballast situation. As designed the yacht was to have a large amount of inside ballast common in yachts of the type. [redacted].

Other Work

1. The work described above was accomplished in spite of 2 computer "crashes". This has delayed the estimate of the effect on the yacht's VCG when the wreckage of the rig is lashed on the deck in the positions shown by photographs supplied. This work will be completed on Monday next and the results advised.

Warwick J. Hood
4 June 1999.

Notes on Sr. Martin Renilson's Proposal for Stability Tests of 1998 Sydney/Hobart Yacht Race Participants

1. If all the tests proposed i.e phases 1, 2 & 3 were carried out, the results ~~would~~ may represent a substantial contribution to the understanding of ocean racing yacht stability in very bad weather. (NOTE 2)
2. Phases 1 & 2 are related specifically to the stability, or rather, the self-righting tendency of the yacht "Business Post Naiad". For the tests covered in phases 1 & 2 the height of the vertical centre of gravity (VCG) of the yacht must be known.
3. The February, 1995 issue of the Australian yachting magazine "Sailing"

contains an article headed "Bombed" and with a sub-heading "How storm-force winds took out the middle of the fleet and how six men died".

On page 20, the writer commences his description of the events leading to the death of 2 men from "Business Post Naiad". He describes how the yacht under "bare poles" (no sail set at all) was rolled right over - presumably through ~~to~~ 360°, breaking the mast in 2 places and causing major structural damage. Even though some of the crew were ~~overboard~~ overboard secured by their harnesses, they were brought back

broken.

on board. The mast & rigging were cleared on board & the yacht then began motoring towards Gabo Island, away to the north west.

P. Later, the yacht was rolled again, this time to 180° and stayed inverted for ~~for~~ 4 or 5 minutes. It was at this stage when 1 crew member was drowned, trapped in his harness.

P. Then the yacht was righted by another wave, the yacht having about a metre of water in it. ~~The~~ Another crew member fell into this water and, upon getting up, died of a heart attack.

P. On the assumption that this description is approximately correct, & the author writes with some authority, then it is submitted that the proposed tests by Dr. Renilson will have little use. The subject yacht was 1 of a number which were rolled through 360° and with the exception of ~~"Business Post Naiad"~~ That yacht did not suffer the alleged stability deficiency.

P. If the alleged stability deficiency results in a yacht remaining inverted for a considerable time, then it will be difficult to

to maintain that proposition in the present case as, during the first (360°) roll, the mast was broken, thereby ~~substantially~~ increasing the yacht's stability. In addition, when the yacht righted itself or was forced back into the upright position by wave action, all the crew were alive.

Vote 1.

P. When the yacht was rolled over next time it remained inverted for "four or five minutes" according to the narrative. As a consequence of this roll, 2 crewmen died.

P. It ~~will~~ may be impossible to make

a suitably accurate assessment of the stability of the subject yacht when it was rolled + remained inverted for some time. The stability in this situation was ~~much~~ greater than for the intact yacht. In any case, the proposed testing relates to the intact yacht and, while it might be possible to build a model of the damaged yacht with the mast wreckage lashed to the model's deck, the test would hardly be any help in support of an allegation about insufficient stability in the intact condition.

Note 1

As a guide, I offer the following:

The yacht Zeus II, a competitor in the race was dismasted. This yacht is usually moored directly in front of my apartment at Kirribilli. Without the mast, the yacht was observed by me to have a rolling period of about 2 seconds. With the new mast & associated rigging, fitted, the rolling period was observed by me to be about 3½ seconds. The metacentric height, a primary measure of stability, is increased by about 28% without the mast & associated components. The

~~reducing~~ lowering ~~of the height~~ which reduces of the centre of gravity, is beneficial throughout the range of stability.

The effect on "Business Post Naiad" would be comparable.

Note 2

It may be that the work has already been done - see, for example: Claughton & Handley "An investigation into the stability of sailing yachts in large breaking waves" - University of Southampton, Jan, 1984

Proposed Literature Survey

1. "Fastnet Report – too few answers", "Sail" Feb 1980
2. Jack Wight "Fastnet Inquiry Report" Yachts & Yachting Jan 1980
3. J. A. Kenning – "On Stability of Sailing Yachts at Large Angles of Heel". Delft Uni R N 499 April 1980
4. Stephens O et al "Sailing Yacht Capsizing" SNAME 1981.
5. Kirkman K et al " " " SNAME 1983
6. SALSICH V Experimental Studies of Capsizing in Breaking Waves". 13th AIA Symposium Vol 29, 1983
7. Kirkman KL "on the avoidance of inverted stable equilibrium". Ocean Interface Symposium XIII Oct '83
8. Claughton A. An Investigation into the Stability of Sailing yachts in large breaking waves" Soton Uni Jan 1984. + more by Claughton + Handley.