DETECTIVE SENIOR CONSTABLE GRAY

Q1 This is an electronically recorded interview between Detective Senior Constable Stewart Gray and Mr David Lyons at 3 Foundry Road, Seven Hills on Thursday, the 28th of January, 1999. The time on my watch now is 10.38pm. Also present seated to my right is Senior Constable David Upston from the New South Wales Water Police. As I explained to you, Mr Lyons, we're making inquiries in relation to the 1998 Sydney to Hobart Yacht Race and, in particular, speaking to you in relation to your expertise, expertise in the area of yacht design. Just for the record, could you please state your full name?

A David Henry Lyons.

Q2 Your date of birth?

A The 25th of April, 1964.

Q3 And your current address?

A 32 Merelyn Road, Belrose in New South Wales.

Q4 Thank you. Basically, first, if you could just give me your qualifications as they stand now.

A I'm a Bachelor of Engineering with honours from the University of New South Wales.

Q5 Right. Your current employment?

A Is at Daminoseal International Pty Limited in Sydney and as a director of my own company which is called Seaflyer Pty Limited and it trades as Lyons Yacht Designers.

Q6 O.K. Can you give me some more background in relation to your yacht designers position? What are you sort of involved in in that particular area?

A O.K. The first yacht I designed which was built was in 1988, built by Maconachie Boats in Sydney, a seven and a half metre offshore sailing yacht and in the intervening 10 or 11 year period I've designed approximately another 50 sailing yachts up to a maximum size of approximately 20 metres long. About half a dozen of those have competed in numerous Sydney-Hobart races over the last 5 or 6 years, including the overall handicap winner of the 1993 race and several other place getters in the race since then.

Q7 O.K. In your capacity as a, a yacht designer and consultant, I suppose that you are often called upon to write papers in relation to certain aspects of yachting design?

A Yes, I'm a member of the Offshore Racing Council's International Technical Committee. The Offshore Racing Council is the body nominated by the International Sailing Federation, which is the peak governing body for the sport of sailing, to handle the offshore arm of the sport of sailing with regard to race management, administration, handicap rule development and communications and the International Technical Committee, of which I said I was a member, is principally charged with the responsibility

for the technical development of, of the Offshore Racing Council's rules for offshore sailing, including the international measurement system.

Q8 O.K. And how long have you been involved with that committee?

A I first joined the committee in 1996 - - -

Q9 Yep.

A - - - and was an observer to the committee for a year and a half prior to that before being accepted as the Australian member.

Q10 And what's the tender for that committee?

A The tender is to remain a member of the committee for an indefinite period and to oversee the technical development of the handicap rules that the Offshore Racing Council publishes which are adopted by the member national authorities, which within Australia is the Australian Yachting Federation, and they in turn promulgate those rules through their state yachting associations to member clubs such as the Cruising Yacht Club of Australia for, for use in the races they conduct.

Q11 Right. So is it your responsibility as part of that committee to report back to the Australian Yachting Federation on changes or - - -

A Yes.

Q11 - - - events and that sort of thing?

A Yes. All submissions to the Offshore Racing Council are formally channelled through the Australian Yachting Federation for consideration by the main council of the Offshore Racing Council, of which I am also one of the two Australian councillors, together with David Kellett, and on a committee level I have a remit to correspond on a, on an informal basis with the International Technical Committee in the process of, of what you might call behind the scenes rule developments before they're put up for voting on by the, the main body of the council and then promulgation to the, the member national authorities.

Q12 Right. Now, have you in that capacity or in your capacity as a yacht designer or, and with the company you're with, attended many conferences?

A Yes. Probably more than I could number at the moment. The International Technical Committee meets three or four times a year in different venues around the world. For example, tomorrow I'm heading off to the United States for the January meeting of the ITC in Annapolis in Merryland and the members of the International Technical Committee are also generally specialists in their own right in the areas of hydronamics, aerodynamics, yacht structures, handicapping and that sort of thing, and myself and the others publish papers at various technical symposia. The last one that I submitted such a paper for that was

published was the Southampton University ..... School on Sailing Yacht Design which was held for a week in September, 1998.

Q13 Right. Now those papers that you complete and submit, have they sort of become a worldwide .....?

A Yeah, they go into the public domain, generally speaking, and they're available for dissemination to interested people. They form part of the body of information which finds its way, at least in some small part, into the rules under which we sail in the areas of handicapping or safety or race management. It's an ongoing process.

Q14 Right. Now, the International Technical Committee, you said before were involved with the IMS which is the International Measuring Standard, is that correct?

A International Measurement System.

Q15 Right, yep. Could you explain that system to us?

A Well, broadly the, the IMS or International Measurement System is a handicapping system for offshore racing yachts between seven and a half and 24 metres in overall length. It seeks to provide a mechanism for handicapping yachts based on their particulars, such as size, sail area, the weight of the boat, the number of crew, it's power to carry sail and what have you, and it does this, the core of it by means of what's known as a velocity prediction programme or VPP which takes into account the known forces

that act on a sailing yacht which are known as the driving forces and it performs a balancing equation between those driving forces and the drag which is present due to the yacht being in the water. And the programme which actually runs on a, on a computer predicts the speed of yachts at different points of sail and different wind strengths and then this information can be used retrospectively after a race has been completed to compare between a yacht's predicted speed and its actual speed as measured by the time it takes to complete the course to work out which yachts have performed best, if you like, against their predicted performance and the yacht that performs the best is obviously deemed to be the winner, and this enables big yachts and small yachts to compete on a handicap basis in races up to and including the Sydney to Hobart or, or even a trans-ocean passage or, or a short race within Sydney Harbour. There's no real limit to the scope of application that it can be used for.

Q16 So it's quite conceivable that a 6 metre yacht in the Sydney to Hobart could in fact beat a 10 - - -

A Well, the lower limit of acceptable size as deemed by the race organisers for the Sydney to Hobart is actually larger than that. From memory, I think it's nine and a half metres in overall length. So, yes, if you had a minimum sized acceptable boat it, it can and, and in fact

has won overall the Sydney to Hobart. The last example I think I've, would be the immediate past race where a 35 footer AFR Midnight Rambler won the race overall on IMS. The first boat to finish the course, which was Sayonara, a 78 footer, came, I think, third or fourth overall on corrected time, so a much smaller boat actually won the race.

Q17 Won, yeah. O.K. Now, previous to IMS there was a system called IOR, is that correct?

A That's correct, yeah, that, that stands for the International Offshore Rule. It was also developed by the Offshore Racing Council in the 1960s as a replacement for its forebears which were basically split between an American rule called the Cruising Club of America Rule or CCA Rule and the rule that was used in the UK and other parts of Europe which was the RORC Rule or Royal Ocean Racing Club Rule, and the objective was to produce an international handicap rule which could have application on both sides of the Atlantic and other parts of the world and the first version of the IOR rule was published in the late 60s and through three major revisions it was used up to and including about 1993 or 1994. And the Offshore Racing Council at a meeting in about 1989 decided to promote the International Measurement System rule as the eventual replacement for the IOR rule, because it was felt

at the time that the IMS rule would provide for the handicapping of a more diverse range of sailing yachts than the IOR rule had come to do due to its specialisation. It was being followed by fewer and fewer boats and the ORC recognised this and wished to win back the constituency, as it were, of, of, of sailors who had sought other handicapping solutions around the world which were basically not international, they were localised systems, Danish systems, American systems, Italian systems, et cetera. The time was right for an international replacement to try and standardise the world practice again.

Q18 Right. So is it the case that prior to the IMS coming into situ, that if a boat was given a certain rating under IOR would that rating be the same under IMS?

A No. It's not because the means of expressing the rating is different in the two systems. The IOR, the former rule was complex in the derivation of the handicap that it assigned to a yacht, but at the end of the day there was only one number given to a yacht which was used to handicap its performance, regardless of the conditions, whether it was a windy day or a, or a, not a windy day, rough seas or flat seas, et cetera, and this gave rise to the notion that every dog has its day under IOR because some days a yacht which liked heavier conditions would do

well if it was, if it was breezy and other days yachts that excelled in light airs would have their day. And the notion of the IMS was that it would be possible to predict the difference in performance of a given note given the conditions from an understanding of, of yacht design science and naval architecture. So the, the IMS rating system provides for a multitude of handicaps for any one yacht which vary depending on the conditions and either prior to the race based on forecasts of the weather or after the race has been completed based on recording of actual weather conditions, it's decided what the handicap for the yacht will be based on those conditions.

Q19 O.K. Now, if I could just take you to around the 5th of January when you attended a funeral for the three men who were lost at sea off the Winston Churchill. Prior to this interview I was speaking to you and you mentioned that you were privy to some information on that day. Would you be able to explain that to me?

A Yes. We were standing outside the church after the funeral service for Jim Lawler, who was lost off the Winston Churchill, and there were many hundreds of people standing around outside waiting for the cortege to depart to the cemetery, and people were standing in, in conversation circles, as you would imagine they would, and an individual who was a former director of the Cruising

Yacht Club of Australia and still a current member, active member of the club, whose name is Colin Wilson, mentioned to me in the course of the discussion that one of the yachts in the race, he understood, started the race with a limit of positive stability of, I think he said, approximately 104 degrees. This was the first I'd ever heard of this and it surprised me in as much as I knew that the threshold of acceptability into the race was 110 degrees for so-called grandfather yachts of which, knowing the particulars of Naiad to some extent I knew would qualify her as a grandfathered yacht. So it would appear on the face of it that she had a, a limit of positive stability deficiency of 6 degrees, this is the immediate calculation I made mentally. I was also a little sceptical as to the accuracy of this information because it, it seemed unlikely, knowing the requirements for the race and the controls that were in place, that this could have happened. But I kept the information to myself and after I returned home after the service looked up my own records which, as it turned out in retrospect, were incomplete in as much as yachts receive a new handicap certificate whenever they are remeasured and the copy of the certificate I had for this boat, which was really only held for my own information purposes rather than to be current, indicated that it in fact had a limit of positive

stability of, of more than the, the threshold of 110 degrees, i.e. it was acceptable, and that was where I left the matter until I was contacted some days later and it was confirmed to me that in fact a new certificate had been issued for the yacht in October, 1998 where the limit of positive stability was in fact less than the threshold and that figure was 104.7 degrees limit of positive stability.

Q20 Could I just, when you mention the 112.9 - - -

A Yes.

Q20 - - - that's in attachment 1 in your document, is that correct?

A Yes, that's right.

Q21 And that's the document that you had in your records?

A It's not actually. This is, the only difference between this one and the one I had at the time was the issue date. If a yacht's owner doesn't make any changes to the boat but renews his certificate on an annual basis and pays the annual fee, he will get an updated certificate which generally won't reflect any changes in stability because there's been no physical change declared on the yacht.

Q22 Right.

A So attachment 1 of my document is, is effectively the same document, only it's a 1997 certificate instead of a 1996 certificate. But the, the limit of positive stability

remained unchanged between the '96 and the '97 certificate.

Q23 O.K. And if we go to attachment 2 in your document, which indicates 104.7 - - -

A Yes.

Q23 - - - that was forwarded to you from the CYCA?

A Yes. After, after I first learnt of this incident, Peter Bush, who had been appointed the chairman of the CYC's Review Committee into the race, contacted me on the following Monday, I think that was the 11th of January, and indicated that he wanted to speak to me in confidence about the particulars of, of a yacht whose stability was, on the face of it, less than the threshold for the race and he named the yacht as Business Post Naiad, which was the yacht that I'd previously been told of, and requested me to comment as far as I felt I could in my own experience as to the material significance of this decrease in stability. And in so doing the first thing I did, effectively, was to try and find out if there was an obvious mistake in either of the two certificates which would either invalidate the result of the stability prior to actually then investigating the material significance.

Q24 Right. You did that?

A I did that and the summary of, of the work I did is contained in the, the main body of, of the report dated

the 23rd of January, 1999 which I sent to Peter Bush at the CYC on that date. And the, the report is broken up into several components, there's an introduction and some, some background information and then there's a significant amount of, of argumentation which attempts to get to the bottom of the derivation of the information on the certificate, particularly the freeboards which are indicative of the weight of the boat at the time that it was measured in the water. In brief, if the freeboards are incorrectly recorded on a certificate, that's the height of the boat out of the water near the, the bow or the front of the boat and near the stern or the back of the boat, then the calculated stability data will be incorrect. It's, it's critical that within acceptable measurement tolerances that the freeboards are accurately recorded or the stability information will be wrong. It could be overstated or understated, depending on what the numbers were.

Q25 So are you satisfied that there was no mathematical error?

A No, I'm not. The computer programme that issues the IMS certificate will produce a faithful result based on whatever you tell it within certain limits. There are controls in the programme which will, which will halt the operation of the programme in the middle of its run if there are any gross errors. For example, if, if you

entered freeboards which indicated that the yacht was actually completely submerged or perhaps there was no boat in the water at all, you indicated that it was in mid air, then the programme cannot run 'cause it can't divide something by zero. But it doesn't have the capability to scrutinise for what you might call sensible measurements versus measurements which are polluted by, by error or, you know, numbers being mixed up, back to front numbers. And I'm, I'm not on balance a hundred per cent satisfied that the input data to the certificate, which gave rise to the inadequate stability, is to be a hundred per cent relied upon. I, I think it's, in my view, impossible to be certain one way or the other, so what I have sought to do is to arrive at a conclusion based on the probability that it was sufficiently right, if you can put it that way, and, and I think that there's sufficient ground for concern that the stability of the yacht was still below the threshold, irrespective of measurement error. I can't be a hundred per cent certain on that, but I think on balance it's likely. I did raise the comment in the conclusion that several yachts in the race which were well above the threshold for acceptability still suffered similar incident in, in the, the area of the race. Some of the yachts, for example, were upside down for a matter of minutes which passed the threshold and I can't,

similarly, be sure whether Naiad may not have suffered the same inversion for a similar period of time, even if its stability was clearly in excess of the requirement. But to be accurate, I think it's necessary to raise the concern that there is quite a strong likelihood, in my view, that the stability deficiency cannot be disregarded.

Q26 O.K. So far as the stability with the Business Post Naiad which we have here is indicated as 104.7 on the '98 report, does that have a bearing on the amount of time that a vessel with that rating would stay inverted?

A Yes, it does. Model testing and practical experience in the field with incidents such as this, for example, indicate that there is a correlation between propensity to capsize and difficulty to recover from a capsize, where capsize is a complete inversion of the boat rather than just being knocked on its side with the mast parallel to the water. There is a correlation between a decrease in that figure and the increase in likelihood of capsize and this can't be disputed, it's a naval architecture fact which is borne out by physical testing as well as theoretical analysis, but it goes to the importance of making sure that the, the data for the Business Post Naiad that we're looking at here is in fact robust and as I've alluded to, I'm, I'm not satisfied that it's a hundred per

cent robust. Specifically in my report I raise the fact that although there's sufficient evidence that approximately 300 kilos of lead was removed from the boat, i.e. lightening the boat, the freeboards on the 1998, the latest certificate, indicate that the boat actually got heavier. Now, this obviously can't be true, you can't have both, which leads me to suspect that knowing that it's factual that the lead was removed, either there was some degree of measurement error in the freeboards or some items were left on board the boat during its measurement which were not disclosed and should have been disclosed as part of the IMS rule procedure. If I'm indicating that the situation is unclear, that's because it is unclear, but I think it's, it's only right to err on the side of caution and I think there's sufficient evidence that the boat's stability was certainly in question.

Q27 All right. Now, if I turn to page 3 on your document you've got a little paragraph there, well, a little statement there ..... just to summarise, DSPM - - -

A Yes.

Q27 - - - ..... got a couple of figures, what does the DSPM stand for?

A That's the IMS nomenclature for the displacement in measurement trim of the boat. So that figure, given

accurate measurement data from the freeboards should truly reflect the physical weight of the boat in kilograms.

Q28 So is it fair to say then that the figure of 6287 was the figure in 1997, the weight of the boat?

A That's, that's the predicted weight of the boat as based on the freeboards that were recorded, yes.

Q29 Right. And the figure of 6020 kilograms is the figure was presented in the report or the certificate 1998?

A 1997.

Q30 1997.

A Yep, ...

Q31 Sorry?

A ..... the difference between those two is, is 267 kilos, so to summarise here, the, the, the difficulty that, the, the conflict that we've got here is that the freeboards indicate the boat got 267 kilos heavier, whereas in fact we know from reports of the crew who were involved in the removal of some of the lead ballast from the boat, that approximately 300 kilos was removed. And I actually asked one of the crew, who knew the location of the lead, to go and recheck the weight of that lead in, in January, '99 after the, the incident and he came back with a facsimile which was attachment 5 in my report indicating what the weight of that lead was. I asked him not only to attempt to weigh it but to record the physical dimensions

of the lead so that knowing the density of lead I could check independently what the weight should be and I agree with his figures.

Q32 So does that 300-odd kilos have a significant bearing on the, the limit of positive stability?

A Well, yes, it would, it would. What's compounding the error here, if we can call it that, is that if you couple a situation with a sailing yacht whereby you make it heavier, and I'm saying heavier because the IMS programme, as far as its input data was concerned, calculated correctly the yacht to be heavier, even though we, we suspect it was lighter, but also simultaneously reduce its, its righting moment which is the, the resistance of the yacht to being tipped over sideways. The programme will predict a reduced limit of positive stability and that will be the case for a broad range of boat types, not just the Business Post Naiad. So it's recognising that that's a fact, it was my intention to try and work out a sensitivity to error here, to attempt to find out if, for example, the measurer was, was out in his freeboard figures. Recalling that they indicate the physical weight of the boat, if he was out by, say, 10 millimetres, approximately 20 per cent, for example, what difference would that make to the predicted figure. And in doing that my report concludes that the likely positive increase

in, in the limit of positive stability would still fall in the range of approximately 5 to 8 degrees which, if those figures are added to the figure that's on the 1998 certificate of attachment 2, put us on or about the threshold of acceptability, but it can't be confirmed that it would have actually been even then above the limit. And this is the sort of analysis you have to do and I've called that a sensitivity analysis to find out what the sensitivity is to error in the measurements. We have to accept there was error made, it's a case of how much error and what the effect of that error would have been, and that's what lead me to conclude, well, even if we give the boat the benefit of the doubt to a fairly reasonable extent, I'm still worried that the stability was on or just under the threshold for the race. We should also point out that this 110 degree threshold, as I was saying, is a grandfathered, a so-called grandfathered threshold. The notice of race for the Sydney-Hobart permits yachts which have gone in the race before to race with a limit of 110 degrees, whereas the general limit for other yachts, acceptable to entry, is 115 degrees and this has been in operation for a few years now by the race organisers and it's become a generally accepted precedent in Australia that this be used. But the reason I point it out is that even if we're, if the sensitivity analysis indicates that

the yacht's stability might have been bumping up against the lower limit under the grandfathered clause, it's still somewhere around 5 degrees below the 115 degrees that other yachts need to conform to, irrespective.

Q33 Can you just sort of in basic terms explain to me what, how these figures work so far as when a boat heels over, what's it supposed to do, does the sail empty and it comes, it rights itself or -?

A Yes. Well, as a yacht heels over there are two main forces that will bring that about, either in combination or separately and they're the forces of the wind in the sails and the waves. And generally these yachts, these ocean racing yachts can be flattened to the point where the mast is parallel with the water's surface or perhaps slightly below, just dipping into the water by virtue of the force of the, the wind alone, but in order to tip one of these yachts completely upside down, in my experience it always requires the presence of very large and powerful waves which hit the yachts approximately transversely and perhaps trip the leeward gunwale which is the edge of the yacht on the side opposing where the wave hits and this causes a hinging effect and the yacht rotates about that edge as it digs into the water like a shovel and tips the boat upside down. I think it's reasonable to say that probably three quarters of the yachts which enter the

Sydney-Hobart race are capable of being tipped completely upside down by the conditions you may expect to, to see in the Sydney-Hobart, but the number of incidences where this happens is minimised by crew experience, knowing how to negotiate the waves because a lateral wave hitting the side of the boat is much more dangerous than one which hits it bow on from in front, or even stern on perhaps. The real danger zone, if you can call it that, is roughly between the aft quarter, so approximately, say, 45 degrees off the stern of the boat through an angle directly across the boat to somewhere just forward of that point and so the, the helmsman of the yacht should attempt to always avoid steering the yacht on a course that places it at risk of getting waves from those angles. The difficulty is that even in a fully formed sea state with wind and current waves like this, there will be waves which come from unexpected directions and this is what catches a lot of these boats out. Whether they are tipped completely upside down or not then becomes a matter of, of the particulars of the yacht as well as the skill of the, the helmsman and crew to redirect the course of the yacht and avoid the ultimate, which is being tipped upside down.

Q34 All right.

A Well handled yachts, irrespective of this, always keep their hatches and storm boards closed in those very rough

conditions so that in the eventuality that they are tipped upside down, the likelihood of the yacht sinking is virtually zero because there are no openings to the inside of the yacht. If there's damage occasioned to the yacht by the mast breaking in the case of the yacht tipping upside down, the crew will always direct its attention to clearing the wreckage of the mast before the mast hanging over the side has the capability of perhaps poking a hole in the side of the boat and breaching the watertight integrity of the boat.

Q35 Now what's the physics, when the boat is actually inverted, how it rights itself?

A Well, if you get any of these yachts and put them in a, a perfectly still pond upside down, they will stay that way, that's a fact and it's simply because unlike a cylinder or a drum, for example, an oil drum, any other shape has a range of what you could call positive inverted stability. It's quite happy sitting upside down through a range of angles and the ability of the yacht to be tipped back up the right way would rely on either the actions of the crew or more likely the presence of other large waves which will come along and hit the boat and tip it far enough that the keel tips some angle away from the vertical and, and helps to start the yacht on its righting process. And the particulars of the yacht are taken into account in the

physics of how likely it is that the yacht will come up from an inverted position with ease, or conversely how difficult that may be to achieve by virtue of the yacht's beam and length and weight. These are the principal particulars that identify yachts which are more capsize prone than other yachts and the recognising of this as a physical fact, these measurements and data are taken into account in the International Measurement System to arrive at a threshold of what is deemed to be acceptable stability, recognising that no yacht is immune from being completely upside down in the absence of a restoring force. The only exception to that that I can think of is that some radical designs which are not even permitted in the Sydney-Hobart race which have a mechanism to tilt their keel laterally by using a hydraulic ram or something similar inside the boat, will actually induce an asymmetry in the shape of the boat about its longitudinal axis, so it'll start to actually right itself because the keel is off centre line. But as I was saying, none of these yachts is permitted in the race for other reasons to do with, with their equipment levels or their structure, et cetera, so we rely on the skill of crew, the integrity of the rules and the presence of another large wave to help tip the boat up the right way, usually without its rig by this stage.

Q36 Yeah.

A And one thing that should be mentioned about that is that, I think I refer to it in my report, that once a yacht has lost its rig, which comprises its mast and boom and any sails which were up at the time when it tipped upside down, its vulnerability to a repeat incident is increased which may sound the opposite of what you would expect, because the weight of the mast in the air you would think would help to tip the boat over, but in actual fact, and it's been shown in quite a lot of tests, that the mast acts as an inertial force, it helps to slow down the period of transverse roll and make it harder for the boat to be tipped upside down. However, most of these masts have holes in them through which control ropes for raising and lowering of sails, which are called the halyards ..... and as a result when the mast dips below the surface it'll fill with water and then you have a negative buoyancy effect helping to hold the boat down, in effect, and that means that there's probably only one occasion upon which the presence of the mast in the boat will help to prevent you from tipping upside down and the next time it happens in all likelihood the mast will have already broken. So the conclusion I come to is minimise the risk of it happening in the first place by virtue of design particulars, the weight, the length and the beam of the

boat, which I was referring to.

Q37 So is it fair to say that the waves or the conditions should assist in righting that boat as opposed to being, as you said, an - - -

A It's essential. Without those big waves a yacht could stay upside down, well, forever, basically, or until those conditions are repeated. In the last ..... globe single-handed non-stop round the world race there were some fairly alarming photographs of yachts which had capsized which just stayed upside down for, for days and one of the reasons that happened is because they don't have the same stability criteria as the Sydney-Hobart race does, for example. It's caused the organisers of that race in France to re-evaluate their requirements in the interim.

Q38 Now, can you explain to me exactly what the degree reading of 104 means, I mean, like, what does it mean in the layman terms?

A What it means is that when a yacht is upright with the mast pointing towards the sky, it's angle of transverse heel is zero degrees and the yacht needs to be heeled or tipped over transversely 104 degrees before it wants to keep tipping by virtue of it's own shape and buoyancy forces to an inverted position. If it's tipped anything between zero and 104 degrees and then that force causing

the tipping is removed then it will just pop upright again and bob backwards and forwards until, until the movement stops. That's the physical meaning of 104 degrees. So, for example, it means that it will tip 14 degrees or, or 14 degrees more than 90 degrees of heel before it will want to keep on going by virtue of its own shape and weight.

Q39 The time is 11.21, this interview is suspended for change of tapes.

INTERVIEW SUSPENDED

INTERVIEW RESUMED

DETECTIVE SENIOR CONSTABLE GRAY

Q40 The time is 11.25am, interview between Detective Gray and Mr Lyons is continued. Mr Lyons, if I could just take you back to the freeboard information you supplied to us. Could you -?

A Yes. I pointed out before that I have a significant reservation about the integrity of the data on the certificate, the 1998 certificate and one of the principal reservations is the freeboard values that are recorded on, on that certificate which in turn tell us what the weight of the boat was at the time of measurement and I, I said in the first part of the interview that the, that with 300 kilos of lead being removed, one would expect, obviously to find that the freeboards indicated a reduction in the

weight of the boat, whereas in fact the opposite was found to be the case with the freeboards recorded. The only explanations for this could be one of two. Either the measurer submitted incorrect data and, as I mentioned in my report, there was some considerable correspondence that transpired between the measurer and the Australian Yachting Federation in Sydney that issues the certificate prior to the certificate's issue because they realised that there was a non sequitur, if you like, between the two and also, of course, the thing that really stood out on the certificate was the vastly reduced stability. And the measurer recorded that he did in fact also pick up on this inconsistency and did an informal second check of the boat in the water, but concluded that he wanted to let his, his figures stand, they were in fact, he was satisfied that they were the correct figures. The other explanation for this other than measurement error would include the fact that items were left on board the boat for measurement which the IMS rule does not permit to be left on board and the most obvious one of those is sails. A Far 40 like Business Post Naiad would number somewhere around 10 or maybe more sails which the boat would sail with, there's only ever a maximum of three up the mast at any one time, but there are 10 or more in the inventory of sails. They're usually quite light when they're bone dry,

but if they're wet they can be quite heavy indeed and if, if they're all packed up and positioned down near the stern of the boat, the back of the boat, they would have a significant effect on the freeboards of the boat, they would tend to depress the back of the boat and lift the bow and that could give rise, or some other heavy items of which we don't know their, their source, could give rise to part of this freeboard discrepancy, recognising the fact that they shouldn't have been there by, by rule requirement, they shouldn't have been there.

Q41 O.K. Is that evident in the figures?

A Well, something is evident in the figures, yes. It's evident in the figures that for some reason, accepting for a moment that the figures were 100 per cent accurate - - -

Q42 Yeah.

A - - - something must have been pushing the stern of the boat down, the back of the boat down, and the weight of the sails in the anticipated position down under the cockpit somewhere could produce something of the order of the same decrease in the aft freeboard which, I think, checking the certificates was said to be the original freeboard aft which appears as FAN on the certificate was 1.088 metres. So that's the distance, the vertical distance from the water up to the, to the sheer which is

the edge of the deck at the back of the boat in a specific location which is identified there by two other figures, the sum of FGO and LBG, so those two figures respectively are .554 of a metre and 9.97 of a metre. So in other words, that freeboard was taken the known distance aft of the bow and that's important. We must know the location of that freeboard because the height of the yacht varies over its length. The freeboard on the latter certificate, attachment 2 certificate, was 1.037, so there was actually a decrease indicated of 51 millimetres or .051 of a metre and I, I'm saying that the weight of wet sails could bring about something of that order of freeboard aft decrease, and correspondingly, there is a freeboard forward increase. One would expect an increase in the forward freeboard if you got a decrease in the aft freeboard, the boat is tilting down by the stern and that difference is, formerly it was forward freeboard of 1.198 metres, attachment 2 indicates 1.231, so an increase forward of 31 plus 2, 33 millimetres or .033 metres, that would be consistent. The measurer is expected in the course of a measurement to verify the contents of the yacht before freeboards are taken and the owner or the owner's representative is to sign a separate attachment which attests to the accuracy of the description of the inside of the boat and they're attachments 3 and 4, the

measurement inventories. They don't make any mention of the presence of sails on board or anything else, including tankage, for example, water tanks and fuel tanks that would be sufficient to cause this trim. So in my experience the thing that stands out is the possibility of sails and if he, the measurer were asked now it would be of interest to note whether he has a clear recollection of sighting the absence of sails ..... on board.

Q43 So far as that 51 millimetres you just mentioned, what sort of weight would equate to that sort of difference, do you think?

A Well, it depends on how far forward or aft of the centre of gravity the weight is applied. To my mind, if the yacht is somewhat over 12 metres long, and for the purposes of the argument we assume that the centre of gravity in the longitudinal direction is it roughly the half way mark after the bow. The weight of wet sails would need to be somewhere around three or four metres aft of that to bring about that decrease and that's why I think it's feasible that sails or some other items could have been, perhaps wet weather gear or food or, or other equipment, all of which are specifically excluded by the rule, being present when the yacht's measured afloat, may have contributed to this, to this anomaly.

Q44 So attachments 3 and 4 in your document indicate some

initialling by, it looks like, BR Guy.

A Yes.

Q45 BRG, and I assume that the other signature with the initialling is done by Mr Fisher?

A Yes, I think that's right, 'cause the initials match the, the fuller signature at the end there and that, his measurer's number 7006 - - -

Q46 Right.

A - - - is present against the signature and that indicates, 7 is for Tasmania and 6 would be he's the 6th registered measurer in Tasmania.

Q47 So technically speaking, this little map here with the boat on it would be drawn together by Guy?

A That's correct, yeah. It's drawn up on a blank form and you follow the measurer usually in the presence of the owner and they, together with any other helpers, record the particulars of permitted items which are left on board such as anchors and bilge ballast if it's present and then its initialled by both measurer and owner or representative. But it should be noted that the, another requirement is that the weight of any bilge ballast, which is normally lead or cast iron or something dense, is recorded but on the former measurement inventory of attachment 3, the presence of the lead is noted but not its weight and that gave rise to me making extra inquiries

to find out what it was.

Q48 So most certainly if this has been done correctly with Mr Guy and Mr Fisher, there's nothing that sort of indicates anything that we suspect, like sails or other wet weather gear - - -

A That's correct.

Q48 - - - as you see it?

A That's correct, which would lend strength to the argument that it was a straight measurement error and that lead me into my sensitivity analysis that I was talking about to determine, well, how far out could we be with the certificate.

Q49 Now, supposing these measurements were correct and we had a rating of 104, from your experience how would that affect the boat in the conditions of a Sydney to Hobart .....?

A Well, it would be, it would be substantial, it would be significant. The limit of positive stability is one very useful indicator of the boat's capsize tendency and I make mention in my report at the conclusion stage also of the importance of another piece of data that's on the certificate which is termed the ratio stability curve areas positive to negative. And this is a ratio which divides the amount of energy required to right a boat by the amount of energy required to invert the boat, thereby

the higher the number the better in the sense that it's more capsize resistant. And attachment 1, the former certificate has a ratio figure of 2.013. What that means is the amount of energy required to invert the boat is roughly double, just over double the amount of energy required to tip it back up the right way, whereas on the attachment 2 certificate that figure is dropped from 2.013 to 1.296 and I've indicated that that's a 36 per cent decrease in, in that figure. If I could do a quick sketch

- - -

Q50 Certainly.

A - - - that shows graphically what this means. If you plot a graph whose horizontal axis is the angle of heel and a vertical axis which is the righting moment of the boat, the righting moment is the weight of the boat multiplied by the righting arm and the righting arm is the transverse distance between the lateral centre of buoyancy which shifts with increasing heel and the centre of gravity of the boat which always remains in the same place. And what you get is a curve that looks like a wave basically where initially we have zero degrees of heel and the righting moment increases to a maximum at a given value of heel angle which for a Far 40, I actually show some of this graphically on attachment 6, as derived from the IMS data, it's only a quick Excel spreadsheet chart, the software

doesn't permit the lines to be contiguous curves, they're only straight line segments, but it gives the idea. It would appear that the maximum righting moment occurs in the region of 40 to 60 degrees, depending on which of the two certificates is in question. With the former certificate it's 60, with the latter certificate it's 40, so this is in the region of 40 to 60. So at this point the boat looks like this, there's the keel, there's the hull, there's the mast, that's the upright position, and the boat has heeled by that angle from the vertical 40 to 60 degrees. Here the boat is upright, zero degrees. The point where the righting moment tails off to a value of zero is the limit of positive stability as appears on the certificate, and of course we now know what those figures are from these certificates, they were respectively 104.7 degrees and 112.9. Now, this is all positive righting moment from the zero value and this is all negative righting moment, so at this point the boat looks like this and that angle is there, 104 or 112 and beyond that point the yacht, by virtue of its geometry and its centre of gravity will, of its own accord, continue to invert until 180 point where it's upside down.

Q51 Right.

A And the ratio of stability curve areas positive to negative, which is recorded on the certificate, that's the

positive area and that's the negative area, and on the former certificate, attachment 1, we'll call that area A and that area B, area A divided by area B is 2.013, for attachment 2, A on B is 1.296, I think it was, yep. So if we can do, in fact, what I'll do is I'll differentiate these, I'll, I'll refer to them as A and B, and A and B with a square around it and then we'll draw in the other curve. The other curve would look something like this, it's not graphically correct but it gives the impression. You can do this to scale or you can do it freehand. Now A without a square around it is that curve there and B without a square around it is that curve there, that's that one and that's that one, perhaps not terribly well drawn, but you can see that with the shift the limit of positive stability, that's the 112.9 and that's the 104.7. The decrease in the angle it only tells part of the story, the significance here is that the area under the positive curve gets smaller in going from 112.9 to 104.7 and the area under the negative curve as a proportion of that area under the positive curve becomes much more significant, and this here, this area is a direct measure, the units of that area, if you like, is energy, whether it be a 65 tonne wave moving at 10 miles an hour possessing that energy, that's what's required to tip the boat upside down and this is energy as well. So you can see that the

bigger this positive area is and the smaller this negative area is the better. There's a lot more detail on this in the Fastnet Race Inquiry report which I can give you a copy of. It details the particulars of this investigation on two similar size yachts in terms of length after the 1979 Fastnet which highlighted the importance of this and it forms the basis of the stability treatment in the International Measurement System now and I think it's important to highlight the decrease in capsize wave energy as a result of the limit of positive stability dropping, because one might look at the 8.2 degree shift and wonder whether that can make much difference, but it only tells part of the story. I also did point out in my report that as a matter of technical policy the IMS only takes into account the buoyancy of the hull from the gunwale, the deck edge down and not the volume of the deck area and any cabin top coachhouse arrangement which is a conservative decision because it means that the physical limit of positive stability of a yacht will always be more than its IMS measured figure, to be on the conservative side. But notwithstanding, limits are limits and the limit for grandfathered yachts by the IMS method, which relies on normal naval architecture but defines the measured points only up to the deck edge, is 110 degrees and attachment 6, as I was saying, is limited to investigation of the range

from 2 to 90 degrees simply because that's the data range which is available from the certificate. But it's important to note that it does indicate this reduction in energy, capsize wave energy.

Q52 Could you just explain to me the term "grandfathered yachts"?

A Yeah, grandfathering, as I was saying, I think, earlier, is the allowance within the notice of race for the Sydney-Hobart, and it's a term that's used in other competitions as well, whereby yachts are given exemption or alteration to their requirements based on pre-existing information or achievements of the yacht. It's an allowance, if you like, for demonstrated capability in the past, notwithstanding more contemporary information about the boat. I think it's generally valid that, for example, if a yacht wished to enter the Sydney-Hobart race and applied to the organisers to do so and had just sailed all the way across the Pacific in some of the worst storms you can ever imagine, then there's a lot of circumstantial evidence that the yacht will be able to make it from Sydney to Hobart if it's just gone all the way from America or whatever. And if that were, that information were accompanying the application for entry together with at least 110 degrees stability then the yacht would probably stand a good chance of so-called being

grandfathered into a race, whereas a yacht fresh out of the builders' factory with nothing known of its past performance would have to conform to the slightly more stringent 115 degree limit.

Q53 Right. How could an owner of a yacht increase that rating?

A Several measures. One is to add more weight below the centre of gravity of the overall yacht. If the bilges are deep enough it could be determined that there's space and distance to add lead in the bilge below the existing centre of gravity and that will increase the limit of positive stability. The further away from that centre of gravity that you add it the less weight you need, so a bulb attached to the bottom of the keel could be physically lighter in order to achieve the same result. So quite a lot of yachts undergo modifications including bulbs being put on the bottom of keels or lead in the bilge or even lightening up of the masts or deck structure because whatever is above the centre of gravity has the opposing effect. And there are numerous examples of yachts undergoing physical modifications in order to gain eligibility above the threshold. Far 40s are representative of a type of yacht which was originally designed to the IOR, International Offshore Rule which were, it's fair to say, on the, a cluster of them if you

did a plot of all of the particulars of these yachts in the fleet, they were clustered around the lower region of acceptable stability, bearing in mind that some of the yachts that enter the race exceed the lower limit of 110 or a 115 degrees by a substantial margin, sometimes as much as 30 or 40 or even 50 degrees, although the further you go away from the threshold the numbers thin out that actually achieve that. The so-called IOR types like the Far 40s and others which populated the race, again this, in 1998, were some of the prime candidates for modification to increase their limit of positive stability and most of them have already undergone those modifications because the IMS has been the dominant rule now for quite some years in Australia, and owners would have recognised this requirement before now in most cases.

Q54 Now could it be a dangerous practice to increase the rating by using those sort of methods to a boat, an already made boat?

A You've always got to look at the whole picture. For example, the bolts which hold the keel onto the bottom of the hull are of a finite strength and in my view you should never add weight to the bottom of a keel without taking into account the strength of the bolts that hold it to the bottom of the hull because in a knock down situation, particularly if you have the added force of a

wave landing on top of the keel, further stress on the keel bolts, as a result of a bulb which has been placed there, would not be advisable. So alternative means such as bilge ballast or lightening the rig should be investigated or strengthening the keel bolts if it's, it's decided that that's the way that the limit would be increased.

Q55 What's your attitude and your considerations as an expert so far as having a grandfathering type clause?

A I think it's been shown to work in as much as a grandfathering provision was introduced some years ago recognising the fact that the race, the Sydney to Hobart race used to be run under IOR and many of these yachts completed the course in very arduous conditions without incident, but nevertheless, a new criterion came along, being the IMS stability and some of these yachts didn't quite meet it. In an effort to be inclusive of some of those yachts and taking into account what I was saying before about demonstrated capability, this decision was made. My view is it's probably a sound decision generally for the fleet provided the individual yachts which qualify under that grandfathering provision are sound in all other regards. It still is a requirement that the person in charge of the boat in question satisfies themselves of the, of the boat's adequacy. The reason I say that

particularly is that it brings to mind the case of yachts which meet the criteria which still got into trouble, or could get into trouble in the race. I think uniformity of requirements for all boats is probably the most desirable objective rather than shades of grey, depending on which boat you are. Up until now, that hasn't happened and there's quite a lot of precedent for some differentiation and I think with the passage of time and attrition of older yachts there'll be a likelihood that in the future there'll be a uniform standard, provided the IMS prevails indefinitely, because it's encouraging a type form which is generally more resistant to capsize and has better handling characteristics in very rough conditions. Boats get older and, assuming they don't endure what boats like Business Post Naiad did, eventually they fall out of favour from people who want to take them in these races by virtue of their age anyway and they cease to be a consideration.

Q56 If I was to put this to you, if you were about to buy a boat, say a Far 40, and it had a limited stability and positive stability rating of 104, how would you feel about that?

A Well, the rules are clear on this, the yacht as it stands would be acceptable into only a category 3 race in Australia or virtually all other countries under the IMS.

The IMS rule has a lower limit of positive stability to even grant a rating of 103 degrees and that's an example of one of the areas where the computer programme actually crashes if it detects a limit of less than 103, it ceases running and prints a message to the screen saying exactly that. So fine, the boat is suited to the category 3 type races, which are limited duration races along coasts, including night time passages. An example might be or is, in fact, a race from Sydney to Bird Island and return or Sydney to Port Stephens, including in night time conditions. But the normal course of events would certainly include increase in the stability of that boat if the intention was to take it in a category 2 race, such as the Sydney to Coffs Harbour Race or the Sydney to Mooloolaba Race or a category 1 race such as the Sydney to Lord Howe Island or Sydney to Hobart, by addition of lead or modification of keel or some of the methods I've described, and part of the work I do, and others that do similar work to me do on a daily basis, is to advise on how to modify boats to increase their limits.

Q57 Right. Anything you'd like to ask?

SENIOR CONSTABLE UPSTON

No, I've, I've no further questions.

DETECTIVE SENIOR CONSTABLE GRAY

Q58 Is there anything you'd like to say further, any opinions

or ideas that you have about the race or the, you know, the way that it's conducted .....?

A I think we all need to have the time to be very thorough in the consideration of all aspects of, of this race. My view is that it's an overall hazardous race which, notwithstanding that, attracts a very high level of skill sailors and well equipped boats, but you should never be complacent about it. It's, the conditions are very extreme or can be very extreme and I commend everybody that's involved in the investigations to be as balanced but as thorough as they can and not be afraid of saying something that may appear controversial, provided they can back up their suggestions with some facts. Most of the information that's required to deal with these issues is already available, it's a case of managing it properly and that requires skilled people and it requires quality control as well. It requires knowing the boats, knowing the people and being sensible ..... commonsense and that's probably the limit of the comment, I think, that I'd make.

Q59 O.K. Anything else?

A No, I think that's, that's it.

Q60 O.K. The time on my watch is now 11.58, this interview is now concluded.

INTERVIEW CONCLUDED