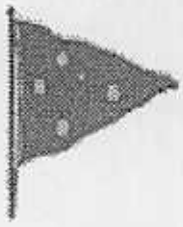

Cruising Yacht Club of Australia

Report

of the

1998 Sydney Hobart Race

Review Committee

May 1999

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FOREWORD

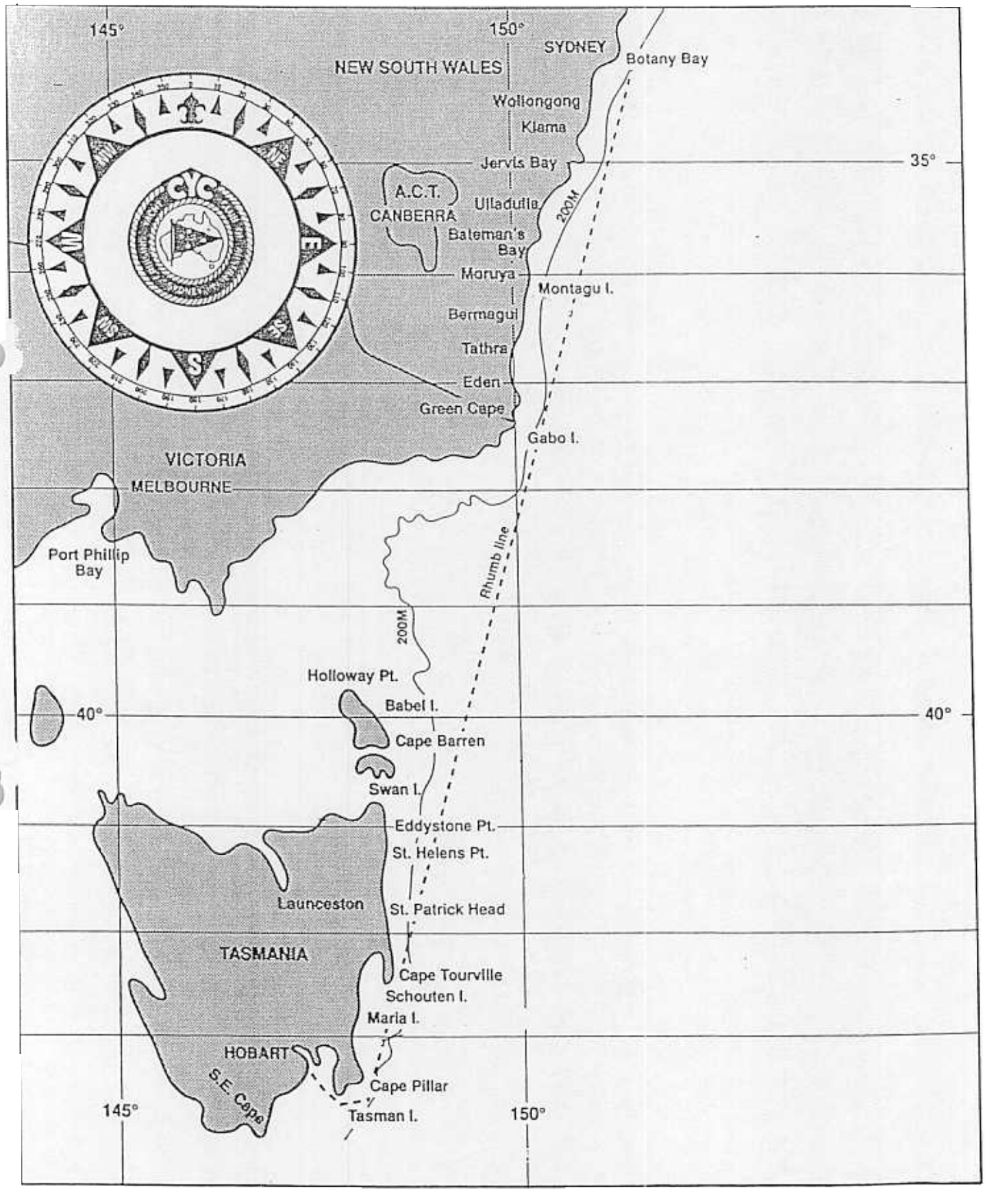
The tragic loss of six lives during the 1998 Sydney to Hobart Yacht Race stands as a stark reminder of the unpredictable and awesome force of the sea. The Cruising Yacht Club of Australia sincerely regrets the loss of life that occurred during the event and offers its sympathy and condolences to the families and loved ones of those who died.

The Board of Directors of the CYCA appointed the 1998 Sydney Hobart Race Review Committee to examine all of the circumstances of the 1998 event. This report outlines in detail the findings of that committee and makes numerous recommendations to change various aspects of race organisation, preparation of yachts and their equipment, and the required preparedness of crews. The Board is committed to ensuring that all of the recommendations made by the Review Committee and detailed in this report are considered fully, referred to third parties and authorities where appropriate, implemented [to the extent that we are able to do so] and administered rigorously.

Whilst it would be unreasonable to believe that these recommended changes (or anything else for that matter) could ensure the ultimate safety of every participant in future Sydney Hobart races - there is no doubt that the safety of all competitors in future events will be improved as a result.

The CYCA is committed to ensure that the findings and recommendations contained in this report are widely publicised and circulated to yacht clubs and related parties around the world. It is our hope that the thorough and factual nature of this report will assist other organising authorities to consider safety issues as they make effect to their races, and have a profound and long lasting effect on the attitude of skippers and crews when contemplating and competing in future blue ocean water races.

Hugo van Kretschmar
Commodore, Cruising Yacht Club of Australia


145°
150°
SYDNEY
Botany Bay
NEW SOUTH WALES
Wollongong
Kiama
Jervis Bay
35°
A.C.T.
CANBERRA
Ulladulla
Batemans Bay
Moruya
Montagu I.
Bermagui
Tathra
Eden
Green Cape
Gabo I.
VICTORIA
MELBOURNE
Port Phillip Bay
Rhumb line
200M
Holloway Pt.
Babel I.
40°
Cape Barren
Swan I.
Eddystone Pt.
St. Helens Pt.
Launceston
St. Patrick Head
TASMANIA
Cape Tourville
Schouten I.
Maria I.
HOBART
S.E. Cape
Cape Pillar
Tasman I.
145°
150°

PREFACE

This report has been prepared by a Committee appointed by the Board of Directors of the Cruising Yacht Club of Australia (CYCA). In order to establish an analytical framework for the Review process, Terms of Reference (refer to Appendix 1) were drafted, drawing on the 1979 Fastnet Report. Findings and recommendations are based on data collected from the following sources:

Questionnaire (distributed to 115 yachts – 110 returned)

- Interviews with Crews (formal interviews with 28 yachts)

Interviews with Race Management and CYCA officials

Examination of records and databases of the CYCA

Submissions and reports from Third Parties, including:

- Bureau of Meteorology (BOM)
- Mr Roger Badham (independent Meteorological Consultant)
- 1979 RORC Fastnet Race Report

Approximately 250 various independent submissions, including interested parties and the general public

- Mr Andrew Dovell (Yacht Designer)
- Mr Scott Jutson (Yacht Designer)

Mr David Lyons (Yacht Designer)

The data collected from the Questionnaire were collated by the market research firm Yann, Campbell, Hoare & Wheeler. This research provided a quantitative base that enabled the Review to focus on significant issues that were recorded consistently across the fleet. A copy of the Questionnaire has been included in Appendix 2.

Interviews with yacht crews conducted by the Committee provided a clear picture of pre-race preparation and life on board prior to, during and after the storm. They not only gave a picture of what conditions were like but also the strategies and tactics adopted by each boat to endure the storm conditions (refer to Appendix 3).

The Sydney Hobart Race Review Committee (SHRRC) was chaired by Mr Peter Bush, immediate past Commodore and veteran of 14 Sydney Hobart Yacht Races.

Two Sub-Committees were formed, chaired by SHRRC members, to investigate in detail life rafts, and administration and communication. The SHRRC included the following members:

PETER BUSH (Chairman)

- 14 Sydney Hobart Yacht Races amongst 25 years of Offshore Sailing and Racing
- Immediate Past Commodore CYCA
  Accredited AYF Safety Officer
- Business Strategy Adviser experienced in Crisis Management

GREG HALLS

- 33 years in Offshore Surveying/ Marine Geophysical Field
- Consultant to Offshore Engineering & Oil Companies – Survey/Geophysics/Safety
- 13 Sydney Hobart Yacht Races amongst a vast Ocean Racing Career

RICHARD HAMMOND

40 Sydney Hobart Yacht Races, 7 Fastnet Races including the 1979 race which included 19 fatalities
Civil Engineer
Member of the Board of St Vincent's Private Hospital for more than 10 years

ROGER HICKMAN

Master Mariner – 20 years of Merchant Navy experience

- Offshore Yacht Master
  21 Sydney Hobart Yacht Races including finishing the three of the toughest races on record 1977, 1993 & 1998

GRANT SIMMER

- Mechanical Engineer
- Director Australian Yachting Federation
- 4 Admirals Cup Races, 4 America's Cup Races, 8 Sydney Hobart Yacht Races
- Director North Sails (Australia)

HOWARD ELLIOTT

- More than 30 years sailing, 20 years offshore racing

  5 Sydney Hobart Yacht Races

  Telecommunications Consultant

  Umpire, Judge, Race Management (1993 through 1998)

DONALD GRAHAM

  Senior Officer NSW Police Service

- Former CYCA Safety Inspector

  Emergency Management Specialist

- 3 Sydney Hobart Yacht Races, vast Ocean Racing experience

Mr Graham had to step down due to business commitments. Mr JON MEYER, a member of Mr Graham's Sub-Committee joined the Committee as his replacement.

JON MEYER

  11 Sydney Hobart Yacht Races

  AYF accredited Safety Officer

- Investment Banker

The two Sub-Committees included the following members:

Life Rafts:

G. Halls (Chairman), D. Lawson, T. Dalton & J. Hornsby

Administration & Communication:

D. Graham (original Chairman), J. Meyer, S. York, H. Elliott, M. Foley

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APPENDICES

The Appendices are not included in this report. They can be either found in the public domain or on our website (www.cyca.com.au).

1. Terms of Reference
2. Questionnaire
3. Summaries of Interviews Conducted with Yacht Crews
4. Sailing Management Hierarchy
5. "ISAF Racing Rules of Sailing 1997-2000" published by AYF
6. 1998 SHYR Notice of Race
7. Sailing Instructions
8. "IMS Rules" published by the Offshore Racing Council
9. Category 1 Safety Certificate
10. Application for Entry
11. ISAF Management Manual, Section A (Race Planning/Organisation)
12. Bureau of Meteorology – "Preliminary Report on Meteorological Aspects of the 1998 Sydney to Hobart Yacht Race"
13. Roger Badham – "Sydney-Hobart 1998 Race Weather Notes"
14. Roger Badham – "Post-Race Weather Review"
15. CYCA – Review of the 1993 SHYR
16. Statistics of the 1998 SHYR Fleet
17. Andrew Dovell – "Yacht Design Related Safety Issues and the 1998 SHYR"
18. Copies Yacht Pre-Race Preparation Notes from Individual Yachts
19. Business Post Naiad Report
20. Crisis Management Flow Charts

1.0 EXECUTIVE SUMMARY

A brief summary of the major findings follows:

- No one cause can be identified as being responsible for the 1998 Sydney Hobart Yacht race fleet becoming involved in multiple incidents on 27 and 28 December 1998. As a result, there is no single change that can be identified for the future running of the Race that could preclude the repeat of such incidents. However, there is a series of incremental changes, that while on their own may appear of little significance, will together have a substantive and lasting impact on the organisation, running and safety of the event. These changes include a range of issues such as administration (processes and procedures), safety (education and equipment), communications and weather (forecasting and education).
- The Race Committee has the power under the "Racing Rules of Sailing 1997-2000" (RRS) published by the Australian Yachting Federation (AYF) to abandon the race. The Committee did not exercise this power. It was the Committee's view that Rule 4 ("Decision to Race") should remain in each skipper's hands, particularly because of the fact that each yacht was in the best position to evaluate its own circumstances fully in the conditions.
- The competitors, while concerned about the 1998 SHYR itself, and being keen to pursue improvements, generally believe that the rules, safety regulations and safety equipment with which they raced, met their needs in the conditions. From interviews of 28 yachts, it is clear that skippers and crews do not see a single (or several) reason(s) for the incidents occurring and certainly see no need to apportion blame to any particular group – organisers, Bureau of Meteorology (BOM), Search and Rescue (SAR) authorities etc. Furthermore, they do not see as a result, any need for wide sweeping changes to safety regulations and equipment.
- Yachts that experienced problems or encountered difficulties, and even those that continued racing reported that "exceptional" waves were responsible for inflicting the damage or causing severe knockdowns. These waves were always a minimum of 20% and up to 100% bigger than the prevailing seas and always came from a direction other than the prevailing wave pattern.

- Although the precise location, timing and depth of the low pressure system were not accurately forecast, the key issue relating to the weather was the gap in knowledge between the BOM's forecasts and the way they were understood by the sailors. The Bureau assumed that its forecast winds would be interpreted as being up to 40% more than stated and seas up to 86% bigger. The fleet reported expecting winds and seas to be "as forecast" or a bit stronger/bigger.
- There is no evidence that any particular style or design of boat fared better or worse in the conditions. The age of yacht, age of design, construction method, construction material, high or low stability, heavy or light displacement or rig type were not determining factors. Whether or not a yacht was hit by an extreme wave was a matter of chance.
- The level of crew experience exceeded the requirements prescribed by race authorities and the AYF. However, many crews, despite having high levels of ocean racing experience, were poorly informed on aspects of safety equipment use and search and rescue techniques.
- After the 1993 SHYR, when only 38 out of 104 starters completed the race, the CYCA circulated a questionnaire to competitors. The results found safety equipment was satisfactory, but recommended that a series of actions be taken by the Club. These included the improvement of some safety equipment and the skill level and education of sailors in the use of safety equipment and heavy weather sailing. While some of the issues identified in the survey were addressed and implemented, many of the same issues emerged again during the investigations into the 1998 Race. These particularly relate to training and education. The CYCA should have pursued these issues more rigorously.
- The manner of death of the six sailors that lost their lives will be determined by the NSW State Coroner at a Coronial Inquest at a date to be announced.

2.0 BACKGROUND

2.1 History of the Race

The Cruising Yacht Club of Australia (CYCA) has been organising and running the Sydney Hobart Yacht Race (SHYR) since 1945. From the first race of only eight starters, the number of participants has increased. The race is regarded by commentators as one of Australia's sporting icons and one of the world's great yacht races.

The first race in 1945 had eight starters and since then the list of entries has continued to grow. By the late sixties, the fleet size was around fifty and grew to just under the 100 mark by the end of the following decade. The number exceeded 100 for the first time in 1975 and during the early eighties the fleet was typically in excess of 150. The record number of starters outside of the 50th Anniversary Race was in 1985 when 179 yachts contested the event. The 50th Anniversary Race attracted 371 starters with the average fleet in the last ten years being 110.

The Race begins on 26 December, Boxing Day, and sails a course south down the New South Wales coast, across Bass Strait and down the Tasmanian coast to Tasman Island. The fleet then crosses Storm Bay and sails up the Derwent River to the finish at Battery Point in Hobart. The race distance is some 630 nautical miles or 1000 kilometres.

Since the early eighties the fleet has typically taken three to four days to finish the course, as opposed to five or six days in the early races. A new race record of just over two and a half days was set in 1996 by German maxi Morning Glory. Race times are governed by the vagaries of the weather that historically have provided a mix of light and frustrating to strong and tough conditions. The southerly buster on the NSW coast and the south-westerly fronts in Bass Strait have given this race the reputation of being one of the toughest ocean races in the world.

Bass Strait, the stretch of water between the mainland and Tasmania, shallows to around one fifth of the depth of the waters on either side. The shallower water combined with winds funnelled through the Strait have over the years created some challenging sailing conditions that have proven to be exacting on boats and crews.

The size of the fleet has been affected from year to year by various factors, including economic conditions and changing racing rules. The Southern Cross Cup which brings additional boats from overseas and interstate is included in alternate years.

Ocean racing is acknowledged by participants as a sport with numerous challenges, unknowns and risks. Sailors will state that they participate in the sport, and particularly in the SHYR, for the personal challenges it provides and its appeal to the adventurous spirit. The SHYR is sailed in open waters and long distances from assistance -increasing the challenge and risks to boats and crews.

From time to time crew members have been injured as the result of equipment failure, sea and wind conditions and plain bad luck. Four fatalities have occurred in the history of the race, one in each of 1966 and 1973 from heart attacks and one in 1984 lost overboard and presumed drowned. The fatality in 1989 was from head injuries sustained as a result of rigging failure.

Yacht design and construction have changed considerably in the last 50 years. Timber has for the most part been replaced by Glass Reinforced Plastic (GRP) for hull construction and aluminium for masts. Even more recently carbon-fibre has emerged as a construction material and has been applied in both hull and rig construction. In layman's terms, displacement hulls that cut through the waves have been replaced by lower displacement hull forms with fin keels that sail over them. Sailing performance has improved with yachts being faster on all points of sailing and being able to point higher into the wind.

Consistently around 10% of the fleet retires for a variety of reasons, some major, some minor. Some typical causes for retirement include sail damage, dismasting, electrical problems, seasickness and structural damage. The attrition rate is much higher in years where stronger head winds have been a feature of the event. The greatest number of retirements was 104 in 1984 (69%), a race encountering 45 knot south-easterlies on a fast flowing East Australian Current. This produced sea conditions that were particularly hard on yachts, people and equipment. There have been seven SHYR where 25% (or more) of the fleet has retired.

The event is governed by the Racing Rules of Sailing (RRS) of the International Sailing Federation (ISAF) and the prescriptions and safety regulations of the Australian Yachting Federation (AYF). Races are run on a scale from Category 0 to 7, with 0 applying the most stringent safety requirements, for races like the "Whitbread Round the World Race". Category 1 (Cat 1) safety standards apply for the SHYR, one of only a hand-full of races around the world to do so. In Australia the only other Cat 1 race is to Lord Howe Island, some 400 nautical miles off the NSW coast. Cat 1 safety standards prescribe: "Races of long distance and well offshore, where boats must be self-sufficient for extended periods of time, capable of withstanding heavy storms and prepared to meet serious emergencies without the expectation of outside assistance."

Today the event is contested under three separate handicap formulae, IMS (International Measurement System), PHS (Performance Handicap System) and CHS (Channel Handicap System) which was introduced for the first time in 1998. Since inception, the SHYR has also been run under other handicap formulae, on RORC formula in the early years and the International Offshore Rule (IOR) until 1993. To the layman these are fundamentally "design" rules, where boats are designed to optimise performance and handicap within an envelope of parameters. These rules also specify and measure a number of key factors like stability, design standards and construction.

The fleet is monitored by HF and VHF radio for the duration of the event. At fixed times, radio communications called "Radio Skeds" or simply "Skeds" occur. In these, yachts receive weather reports and provide race management with their positions in latitude and longitude. Typically the race has had three Skeds per day – two for position reporting and a third for the transmission of weather and miscellaneous traffic.

In 1998, the fleet of 115 yachts was hit by a south-westerly storm as it entered Bass Strait on 27 December. Winds gusting at times to over 70 knots combined with heavy seas over a strong flowing East Australian Current to exact the biggest toll ever on the race. Six lives lost, five boats sunk and a further 66 boats retired from the race. The severe and fast developing storm caught the fleet entering Bass Strait waters and resulted in the biggest maritime rescue operation ever in Australian waters with 55 rescued in an operation involving some 25 aircraft, six vessels and approximately 1000 personnel.

2.2 The 1998 Race

In 1998, a fleet of 115 yachts contested the event. Four percent were overseas entries and the remainder Australian, including 55% from NSW, 6% from QLD, 5% from SA, 16% from VIC, 10% from TAS, with the remainder from WA and ACT.

The race was contested in three handicap formulae, IMS, CHS and PHS. Fifty eight boats contested the IMS divisions, 12 CHS and 45 PHS.

The race began in a light north-easterly sea breeze that slowly freshened during the course of the afternoon. By late evening the wind had increased to around 25 to 30 knots and moved slowly to the north west. The wind strength increased further to as much as 40 knots.

Under these conditions, the fleet enjoyed a record pace spinnaker ride down the NSW coast and by the 0300 hours Radio Sked on 27 December the leaders were even with the position achieved by Morning Glory when setting the race record in 1996.

During the early hours of the morning the wind continued to move to the west and spinnakers were replaced by headsails, providing fast two-sail reaching. Crews could observe extensive lightening on the southern horizon and the wind continued to shift southwards. By first light, the fleet had a predominantly south-westerly air flow with wind strengths at times approaching 35 plus knots.

By mid-day the barometer dropped rapidly to 982 Mb in the race area. Winds continued to increase during the afternoon and were reaching 60 knots regularly by 1600 hours south of latitude 37°. The high winds built seas to six metres with waves occasionally double that size.

Up until midnight the fleet between latitudes 37° and 38°30' south experienced wind gusts of up to 80 knots. Those further south or north experienced wind gusts of up to 60 knots. However, these yachts did not experience the strengths felt closer to the north western flank of the low pressure system which had formed at a position of approximately 40°05'S, 145°30'E, around 250 nautical miles from the fleet.

Prior to the 1400 hours Sked on 27 December five yachts had retired, all from incidents or damage sustained during the spinnaker run. However, within a few hours of the Sked, conditions deteriorated as the low-pressure system deepened. A number of yachts sought shelter and the first of many incidents was reported to both the Race and Search and Rescue (SAR) authorities. At 1700 hours the Australian Maritime Safety Authority (AMSA) declared a Mayday for the general area due to multiple incidents, including distress and urgency calls and the deployment of a number of EPIRBs.

By Sked four at 0300 hours on 28 December there were 42 retirements, with several more yachts advising that they were seeking shelter with the intention to continue racing when the storm abated. A number of yachts had not reported in, some due to on board communication problems and others because they were experiencing varying levels of distress resulting from the conditions. Major SAR actions had been mounted and continued for the next 36 hours.

By the time the low pressure system started to move away from the vicinity of the fleet, 71 yachts had retired. Twelve yachts required SAR intervention - 55 crew were rescued, six yachts abandoned, five boats sunk and six lives lost.

By late afternoon on 28 December those still racing were encountering 6 to 8 metre seas and winds that had eased to less than 40 knots. Conditions improved rapidly and within 24 hours of the front crossing the fleet, most yachts were experiencing light winds and calms down the Tasmanian coast. Light to moderate conditions prevailed for the remainder of the race, although some of the later finishers encountered head winds of up to 25 knots across Storm Bay.

Sayonara, the first yacht to finish, crossed the line in Hobart at 0800 hours on 29 December with the last boat, Misty finishing in position 44, crossing at approximately 1830 hours on 1 January.

2.3 Racing Rules, CYCA Regulations and Eligibility

In 1875 the Yacht Racing Association (now known as RYA – Royal Yachting Association) was formed in Britain to establish rules for yacht racing. In 1907 the International Yacht Racing Union (IYRU) was formed with a charter to consolidate the variety of national bodies.

In 1950 the IYRU and the North American Yacht Racing Union (later to become US Sailing) finally began the task of combining their rules into a consistent international set of rules. By 1959 the Yacht Racing Rules became universal.

The rules are revised every 4 years (the year after the Olympic year) by an international specialist team. For the past 18 years this team has included an Australian (Tony Mooney).

The international administration body for sailing, the ISAF, consists of a number of national organisations, including the AYF. The AYF, in turn, consists of a number of state associations (such as the Yachting Association of NSW). A chart of Sailing Management hierarchy appears in Appendix 4.

Only clubs affiliated with a state association are allowed to conduct racing under the auspices of the ISAF and AYF. These clubs are bound by their affiliation to conduct the races in accordance with the published Racing Rules of Sailing (RRS).

Within certain strict guidelines, the host club is allowed to alter the published rules, provided they are approved by the AYF in advance. This is normally done to provide for local conditions or requirements. These alterations, plus other pertinent information, are published in documents known as the Notice of Race (NOR) and the Sailing Instructions (SI). The information contained in these documents, plus the RRS, form the rules under which this race is conducted. These documents governing ocean racing appear in the following appendices:

- Racing Rules of Sailing (Appendix 5)
- Notice of Race (Appendix 6)
- Sailing Instructions (Appendix 7)

  IMS Rules and Regulations (Appendix 8)

Notwithstanding the presence of these rules, all boats are always required to observe the International Rules for the Prevention of Collisions at Sea (ColRegs) when racing at night. ColRegs are the internationally prescribed 'rules of the road' for all shipping.

The RRS define five fundamental rules. These fundamental rules override all others and cannot be altered by the AYF or a host club. They cover:

1. Safety. Competitors are required to render all possible assistance to any person or vessel in danger. They shall carry adequate life saving equipment as required by the rules.
2. Fair Sailing. They shall compete in a sportsmanlike manner.
3. Rules. They will sail by the rules and accept the penalties imposed therein.
4. Decision to Race. A boat is solely responsible for deciding whether or not to start or to continue racing.
5. Drugs. Performance enhancing drugs are banned.

Sailing is a "self policing" sport. This means that, unlike football, there are no umpires or referees close at hand penalising competitors for breaches of the rules. There is an obligation on the competitors to play within the rules. When these are broken there is a protest procedure available, with action initiated by competitors or the Race Committee, for dispute resolution. If by some means a yacht breaks the rules, that yacht must lodge a declaration detailing the breech, to be dealt with by the Race Committee.

2.3.1 Eligibility

A set of eligibility requirements is established through the RRS for Category 1 races (with modifications as approved by the National Authority) and incorporated in the requirements for the event. Eligibility applies to both boats and crews and covers such things as:

- yacht eligibility – IMS and CHS certification, ABS (American Bureau of Shipping) compliance (where applicable), stability,
- crew experience, and
- safety.

2.3.2 Yacht Eligibility

Yachts competing in the IMS category are required to undergo comprehensive measurement procedures to gain certification and to determine each yacht's handicap. The measurement process also produces data that enable the calculation of the yacht's stability. Stability in its own right forms part of the race's eligibility requirements.

CHS yachts undergo a less comprehensive measurement process, and PHS yachts are not required to be measured. PHS yachts derive their handicap by arbitrary means, based on previous racing performances.

2.3.3 Stability

For IMS yachts, Cat 1 races call for a Limit of Positive Stability (LPS) or a Stability Index of 115° or greater. (Stability is dealt with in detail in section 6.2 of this report). In layman's terms, the LPS is the angle of heel where a yacht will tip upside down rather than returning to its upright position, taking into account the forces of wind and waves.

Most of the PHS fleet competing in 1998 had competed in previous SHYR and demonstrated stability compliance through earlier IMS or IOR certification. Nonetheless, PHS yachts may demonstrate compliance by either:

- IOR Certificate (may be lapsed)
- IMS Certificate (may be lapsed)
- Letter or other certification from the designer
- Documentation from any other national or international authority used for this purpose
- Different yachts from the same mould or class or type will be accepted on the basis of one yacht of that mould, class or type meeting one of these requirements.

CHS yachts were required to certify stability by the same methods applying to PHS yachts.

The race organisers "grandfathered" yachts with an LPS or a Stability Index of not less than 110°, provided and only provided, that a particular boat had competed in a previous SHYR (as detailed in the Notice of Race Item 6.1.7).

2.3.4 Construction

From 1 January 1986 yachts competing in Category 1 ocean races had to be built in accordance with American Bureau of Shipping (ABS) approved plans, under the ABS guide for Building and Classing Offshore Boats. The IMS Certificate is endorsed by the National Authority (AYF) to confirm ABS approval. The ABS has kept the contents of the guide under continuous review and accepts submissions from interested parties with a view to maintaining a continuous improvement process.

Since 1995, the ABS has declined to process racing yachts under 24 metres, but designers and builders have continued to design, declare and build to the ABS standards, until such times as a replacement code is developed. This self-regulating process has been accepted by the AYF for IMS certificates until such times as a replacement code is established.

Construction standards are not prescribed for PHS boats. To date, and as was the case in 1998, the bulk of the PHS fleet has previously raced in the event under the IMS, and have conformed to the IMS/ABS requirements as a result. New boats or boats new to the race, that were not previously racing under IMS, were not required to provide evidence of construction standards.

2.3.5 Safety Equipment

Each yacht must have a Category 1 Safety Certificate (Appendix 9), issued following mandatory inspection by a certified AYF Safety Inspector.

Safety Regulations specify not only what equipment will be kept on board but also what compliance standards must be met. As the safety scheme is conducted under the auspices of the national authority (AYF), the CYCA accepts safety certificates issued through other yacht clubs, particularly those from interstate. For the 1998 SHYR, the CYCA carried out random "spot checks" at their own resolve on yachts from interstate or other clubs.

As a part of the particular safety requirements for the 1998 SHYR, all yachts had to provide the following:

- current annual life raft survey certificates,
- HF radio certificate,
- currency dates on flares (spot checked), and
  currency dates on fire extinguishers (spot checked).

In addition, yachts had to provide proof of $10 million cover for public liability insurance.

2.3.6 Crew Experience

Crews are subject to personal eligibility in two respects. The first is their eligibility under the RRS. This includes such issues as professional status, drugs policy etc. Secondly and more importantly, the RRS requires crews to be suitably experienced. The Application for Entry (Appendix 10), as part of the Eligibility Requirements, stipulates that each yacht must supply full details on the relevant sailing experience of three crew members. This is in turn reviewed by Sailing Office Management or may be referred to

the Sailing Committee (or a Sub-Committee of it) for review and approval. Appropriate experience for various race categories is specified in the RRS.

The blend of experience in the crew of a boat will range from seasoned veteran to novice. It is not inappropriate for a novice to compete, as long as the balance of crew experience meets eligibility requirements.

There is no stipulation on age limits with respect to crew eligibility. Children and juveniles have been eligible to compete in the event when the overall crew competence of the yacht has been considered. In 1998, ten crew under the age of 18 competed in the event.

2.4 Responsibilities of Organisers and Owners/Skippers

2.4.1 Organisers' Responsibilities

The responsibilities of the organising authorities are set forth in the NOR and are prescribed under the ISAF Race Management Manual Section A (Edition 4/97)(see Appendix 11 for details).

The responsibilities of the organisers centre around the requirements to provide a race management structure to:

a) ensure all competitors comply with the NOR handicapping, and safety eligibility requirements,
b) provide technical expertise to deal with calculation and provision of results and deal with related infringements, including a race jury,
c) provide on and off race course support to meet the needs of the event (in the case of the SHYR, this includes the provision of a radio relay vessel, weather forecasting, position reporting), and
d) provide adequate safety measures and precautions, consistent with the nature and scope of the event.

2.4.2 Owner's/Skipper's Responsibilities

The Owner's responsibility is clearly set out in the "Racing Rules of Sailing for 1997-2000" published by the AYF. Particular detail is set out in the Special Regulations Addendum, Section 1.2 Owner's Responsibility (p.143) and is quoted in full hereunder:

"(a) The safety of a boat and her crew is the sole and inescapable responsibility of the owner, or owner's representative who must do their best to ensure that the boat is fully found, thoroughly seaworthy and manned by an experienced crew who are physically fit to face bad weather. They must be satisfied as to the soundness of hull, spars, rigging, sails and all gear. They must ensure that all safety equipment is properly maintained and stowed and that the crew know where it is kept and how it is to be used.

(b) Neither the establishment of these Special Regulations, their use by race organisers, nor the inspection of a boat under these Regulations in any way limits or reduces the complete and unlimited responsibility of the owner or owner's representative.

(c) *A boat is solely responsible for deciding whether or not to start or continue racing.*

RRS 78.1 states *"A boat's owner and any other person in charge shall ensure that the boat is maintained to comply with her class rules and that her measurement or rating certificate, remains valid.*

Additionally, owner's/skipper's responsibility includes ensuring compliance with the NOR and the SI. At a number of points, the Owner/Skipper or Owner's Representative, signs various documents to acknowledge that the requirements have been met. These are:

Application for Entry,

Entry Form,

- Safety Certificate, and
- IMS/CHS Certificate.

In signing the Safety Certificate and the IMS/CHS Certificates, the Owner/Skipper/Representative accepts responsibility for various aspects of compliance. For example, in signing the Safety Certificate after the safety inspection, the signatory is not only signing for the completion of a safety inspection, but also, that the said inspected equipment will be on board for the duration of the event. On the IMS Certificate, the signatory acknowledges "I certify that I understand my responsibilities under the IMS rule". (Refer to pp.23-25 of the IMS Measurement System in Appendix 8).

2.5 Briefings of Competitors and Third Parties

Over the course of the year between events, a number of formal and informal briefings occurs between race officials, competitors and third parties.

Briefings of Competitors

Notice of Race (formal)

The NOR was the first formal briefing document available. The NOR details the rules under which the event is run, including eligibility and any applicable special regulations. The NOR is a legally binding contract that race officials are unable to modify from the original specification, as it allows competitors to prepare racing, handicap and safety equipment to a fixed set of parameters. The NOR was available for the SHYR in July 1998.

Sailing Instructions (formal)

The SI detail rules and regulations that apply while racing. These include details of penalties that may be applied in respect to various infringements and in particular, detail radio operations and procedures.

Compulsory Race Briefing (formal)

A compulsory Race Briefing was held on 24 December for skippers and navigators (or their designated representatives). At this briefing, specific items from the SI were reviewed by the Sailing Manager (along with the Radio Instructions).

Additionally, a representative from the Weather Bureau, Mr Ken Batt for the 1998 Race, presented a prognosis for the period of the Race. The weather forecast included a review of the status of the East Australian Current. In addition, an AMSA Liaison Officer, Mr Anthony Hughes, gave a presentation on SAR techniques, in particular covering the deployment of life rafts from aircraft.

Other inputs at the Race Briefing included arrangements for finishing and berthing in Hobart. In some years, a commentary on the frequency of whale sightings over the course has been included.

Included in the 250 people (approximately) attending the briefing in 1998 were the representatives of each yacht, the Commodores CYCA and Royal Yacht Club of Tasmania (RYCT), the immediate past Commodore RYCT, the Vice Commodore CYCA, the Sailing Manager CYCA, the General Manager CYCA, a Weather Bureau Representative, an AMSA Liaison Officer, the skipper of the Radio Relay Vessel (RRV) Young Endeavour and the RRV Radio Operator, the Race Management Team and the Race Jury.

Race Day Weather Package (formal)

The Bureau of Meteorology (BOM) prepared an up-to-date weather forecast package that was distributed outside the Sailing Office at the CYCA from 0900 hours on Boxing Day, 26 December. Additionally, BOM representatives were available to discuss the prognosis.

Contact with Race Management (informal)

A number of less formal "briefings" may occur between competitors and the CYCA, usually through the Sailing Office staff. These include the Safety Inspection for each yacht, completed by AYF Certified Inspectors who will not only "inspect" the yachts' equipment but will also provide advice on various matters with respect to compliance.

Typically other discussions are held, which relate in the main to ratings, handicapping and safety.

"Offshore"/ "Onshore" Magazines (informal)

The Club's two publications "Offshore" (bimonthly) and "Onshore" (monthly) are also sources of race information.

2.5.2 Third Parties

A series of meetings is held between April to December with RYCT as well as with various authorities to discuss race organisation. The latter meetings were held particularly to cover the start and coverage of the fleet down the NSW coast.

CYCA Management met four times in 1998 with representatives of the following groups: Waterways, NSW Water Police, Sydney Harbour Master, Civil Aviation Safety Authority (CASA), Volunteer Coast Guard and Royal Volunteer Coastal Patrol and the National Parks and Wildlife

Service. The main focus of the meetings was the Boxing Day start, harbour and crowd management.

Since 1994 AMSA has been included as an integral part of the running of the event. A liaison officer works alongside the management team from the Race Briefing on 24 December and stays with the Race Management team in Hobart for the duration of the event. Through this association, AMSA is appraised of the details of race and fleet, starting with the issue of the NOR. In this way, AMSA receives all competitor details, crew lists etc. The liaison officer for the past five years has been Mr Anthony Hughes, who has developed a close working relationship with Race Management and a good understanding of procedures.

Royal Volunteer Costal Patrol (RVCP) and Volunteer Coast Guard Stations are faxed a list of race entries and Radio Sked sheets a few days prior to 26 December. However, poor administrative records for 1998 prevent an accurate assessment of precisely which stations received this information. Sailing Office Management advised RVCP Eden, the Sydney Water Police and Penta Comstat (subscription Coastal Radio Station for pleasure craft) received copies in 1998.

3.0 CHRONOLOGY OF EVENTS

The following chronology was established using a number of sources, including the RRV Radio Log, notes from the CYCA situation room in Sydney and Hobart and encompasses the time period 26 December (1300 hours) until 29 December 1998 (1700 hours).

Details in this chronology have been prepared as a guide only, some times and events may not be completely accurate.

DATE	TIME	EVENT
26/12/98	1300	Race start
	2000	**Sked 1**
	2126	ABN Amro reports rudder damage, retires
	2236	Sledgehammer reports broken steering cable, retires
	2330	Challenge Again Man Overboard (MOB)
	2337	Sydney reports rudder damage, retires
	2346	Challenge Again retrieved MOB, all ok
	2348	Alexander of Creswell offers assistance re ABN, is advised all under control
27/12/98	**0300**	**Sked 2**
	0515	King Billy taking water, retires
	0532	Innkeeper lost life raft overboard
	0602	Allusive reports problem keel, heading towards land for repair
	0615	Wild Thing rig damage, retires
	0650	Marchioness rig damage, retires
	1000	Team Jaguar dismasted, motoring back to Eden
	1013	Assassin via Allusive retires
	1035	Tartan heading to Eden for shelter
	1102	Red Jacket retires
	1141	Innkeeper sail damage, retires
	1235	Doctel Rager reports severe weather ahead, winds 50-60 knots, gusts 70+knots

DATE	TIME	EVENT
27/12/98	1250	Secret Mens Business, Wild One & She's Apples II also advise of severe weather
	1329	Secret Mens Business heading to Eden for shelter
	1332	Wild One heading to Eden for shelter
	1334	Henry Kendall heading to Eden for shelter
	1335	Sea Jay heading to Eden for shelter
	1336	She's Apples II heading to Eden for shelter
	1346	Indian Pacific heading to Eden for shelter
	1400	**Sked 3**; Sword of Orion advises fleet of extreme winds of 50-70 knots, gusting up to 80 knots ahead; Elysion Blue, Maglieri Wines, Wide Load, Kickatinalong retire; Team Jaguar's engine disabled (rope around propeller) after knockdown; Polaris & Bobsled seeking shelter
	1415	VC Offshore Stand Aside (VCOS) rolls 360°, Miintinta retires for Eden
	1515 (approx.)	Siena hears VCOS' Mayday via ABC helicopter and stands by VCOS
	1525	AMSA records 3 EPIRBs (Team Jaguar, merchant ship & trawler)
	1527	Dixie Chicken going to stand by Outlaw
	1530	Cyclone retires
	1535	Rapscallion heading to Eden, not retiring
	1600	Solo Globe Challenger (SGC) knockdown & dismasted; helicopter lifts injured crewmen off VCOS; Team Jaguar requesting assistance, crew ok
	1623	Pippin reports SGC knocked down and dismasted, crew ok, standing by
	1635	Canon Maris retires, heading to Sydney
	1638	Challenge Again heading to Gabo Island

DATE	TIME	EVENT
27/12/98	1640	Not Negotiable heading to Eden for shelter
	1644	Sword of Orion heading to Eden, 38°18'S,150°17'E
	1650	Sword of Orion roll-over 360°, dismasted, MOB, May Day, EPIRB activated on deck, lost sight of MOB 5-7 minutes later
	1655	RRV broadcasts reminder to the skippers that the responsibility/decision to continue racing rests with them.
	1700	AMSA declares May Day for general area, winds of 60 knots and multiple incidents; Team Jaguar advised commercial tow available through "Moira Elizabeth" ETA 6 hrs; Winston Churchill knockdown, hull damage, sinking
	1702	Chutzpah heading to Eden, all ok
	1711	Bin Rouge retires, heading north
	1712	Impeccable heading to Eden, not retiring, all ok
	1713	Inner Circle seeking shelter Gabo Island
	1720	Business Post Naiad (BPN) rolled 360° and dismasted, 5 crew on deck washed overboard and recovered, deck breached, engine started and course set in northerly direction, May Day sent & EPIRB activated; Hawk V retires, 2 injured crewmen
	1721	Winston Churchill May Day, boat taking water, 9 crew are getting into life raft, yacht sinks minutes later
	1737	Hi Flyer heading to Eden, injured crew member, not retiring
	1738	Midnight Special heading to Gabo Island
	1745	Forzado retires
	1746	Unipro retires to Eden
	1748	Loki reports smashed window, takes on water
	1749	Yendys advises of May Day from BPN, message that BPN

DATE	TIME	EVENT
27/12/98	1749	(contd.) had rolled over with major hull damage, its position 38°05'S,150°32'E, was attempting to steer 174°
	1755	Southerly heading to Sydney, all ok
	1800	Siena relieved of rendering assistance to VCOS by SAR authorities and retires due to injured crew member; Ruff N Tumble retires; Zeus II dismasted, retires
	1810	Adagio retires, heading to Bermagui
	1815	BPN 43 miles from Disaster Bay, 38°03'S,150°32'E, steering 300°, 5.4 knots; Sword of Orion sights yacht, fires flares
	1820	Relish IV retires, all ok; crew of VCOS airlifted; Antipodes heading to Eden, not retiring
	1825	Jack Guy heading to Jervis Bay or Sydney
	1830	Kingurra reports May Day, MOB (John Campbell) no life jacket, 38°00'S,150°47'E, deployed EPIRB, boat was knocked down
	1907	Liquid Asset returning to Eden, not retiring, all ok
	1910	Kingurra MOB recovered by police en route Malacoota: Pippin released from rendering assistance to SGC and continues racing; Outlaw structural damage, Dixie Chicken standing by; Secret Mens Business crew injury, drop off at Eden and continue racing; Trust Bank Hummingbird retires to Eden
	1915	BPN via Yendys, BPN at 37°59'S,150°31'E steering 299°, 6 knots
	1920	B52 rolled 360° and dismasted, activated EPIRB; Sword of Orion MOB, helicopter en route, 38°14'S,150°24'E; Margaret Rintoul II, 38°15'S,150.°22'E reports red flare sighted at 1845 hours

DATE	TIME	EVENT
27/12/98	1930	Sagacious & Hummingbird retire
	1940	Zeus II via emergency aerial heading to Eden
	1958	Tilting at Windmills advises BPN steering 295° at 5 knots, 37°56'S, 150°31'E
	2000	Midnight Special rolled 360° and dismasted, EPIRB deployed; Solandra dismasted, reported by merchant ship "Patsy Ann", 37°45'S,150°38'E motoring to Eden; Hi Flyer retires; Sword of Orion hears SAR aircraft overhead
	2006	Jubilation sheltering in Eden, not retiring
	2010	Rapscallion dropping off injured crew in Eden; Loki no motor 38°02'S,150°37'E, steering 075°
	2015	Gundy Grey knock down, life raft inflated & washed away, injured crew, retires to Eden
	2016	Dixie Chicken retires
	2030	Ocean Design retires
	2045	BPN concerned about fuel contamination; Sword of Orion heard SAR helicopter, gives position, EPIRB placed in water
	2049	Miintinta's engine overeheats and stops
	2055	Bright Morning Star retires to Eden
	2106	Terra Firma retires to Eden
	2112	Team Jaguar asked to release flares so "Moira Elizabeth" can identify
	2119	Inner Circle reports position of red flare 37°37'S,150°33'E
	2130	Alexander of Creswell & Solandra (lost rig) retire; Challenge Again & Inner Circle sheltering at Gabo Island; merchant ship "Patsy Ann" departing to area of Winston Churchill
	2136	Kendell, Southerly, Wild Thing & Impeccable report sighting of red flares
	2200	Miintinta taking water, trawler from Eden to rescue

DATE	TIME	EVENT
27/12/98	2201	Ocean Road sheltering in Eden
	2210	Team Jaguar 37°41'S,150°32'E activates red flare for "Moira Elizabeth"; Sea King helicopter returning to site of Sword of Orion
	2218	"Moira Elizabeth" activates red flare for Team Jaguar
	2224	"Moira Elizabeth" was offered to be released by RRV, takes decision to stay
	2235	Hawk V retires
	2300	Midnight Special activates EPIRB
	2300	BPN rolled through 360° for second time, inverted for 4-6 minutes
	2302	Team Jaguar sees 2 red flares at 280°, distance one mile; "Moira Elizabeth" about 9 miles away, sees nothing, expects rendezvous 2 hours
	2310	Miintinta last report, 36°56'S,150°37'E, flooding
	2322	Bacardi reports helicopter in company with Sword of Orion; Sword of Orion taking water, another helicopter searching area for MOB
	2325	RRV in search pattern for Winston Churchill
	2356	Team Jaguar activates red flare for "Moira Elizabeth" 37°31'S,150°43'E
	2359	Inner Circle reports sighting of red flare
28/12/98	0000	Helicopter dispatched to search for Winston Churchill
	0003	Tenacious 37°34'S,150°18'E knockdown, no motor, all ok, heading to Eden
	0005	Boomaroo sheltering near Eden, continuing race
	0036	Impeccable retires, anchored in Eden
	0050	"Moira Elizabeth" fires red flare for Team Jaguar to sight, flare sighted

DATE	TIME	EVENT
28/12/98	0109	"Moira Elizabeth" 4 miles from Team Jaguar
	0215	"Moira Elizabeth" preparing to take Team Jaguar under tow
	0250	Sword of Orion hears SAR helicopter, gives position, EPIRB placed in water
	0300	**Sked 4**
	0305	Vessels asked to deactivate beacons if not in imminent danger by RRV
	0315	3 people winched off Sword of Orion, balance will be picked up by daylight; Midnight Special fires flares
	0500	Miintinta towed by fishing boat "Josephine Jean", still taking water; Sword of Orion, 6 remaining crew being lifted; Midnight Special rolled 360° again during helicopter rescue, 5 crew airlifted en route Merimbula
	0555	Team Jaguar under tow, 43 miles to Eden, all ok
	0557	Miintinta crew transfers to trawler via life raft
	0600	4 crew airlifted off Midnight Special en route Malacoota, boat abandoned
	0610	RCC - confirmation 6 crew airlifted from Sword of Orion
	0645	Adagio motoring to Bermagui
	0705	Outlaw 36°52'S,151°42'E damaged, engine problems, heading to Eden, crew ok, requesting stand by
	0710	Zeus II dismasted 36°45'S,151°23'E, engine problems, jury rig to conserve fuel
	0738	Miintinta, tow line broke, yacht abandoned
	0800	She's Apples II damaged steering, returns to Eden for repairs; 3 crew airlifted off SGC
	0841	BPN 7 crew winched off, 2 dead crew remaining on boat, BPN 37°22'S,150°42'E
	0846	97 no steering 37°58'S,151°02'E

DATE	TIME	EVENT
28/12/98	0859	"Moira Elizabeth" towing Team Jaguar, 37°06'S,150°21'E, ETA 1230-1300 hours in Eden
	0924	Antuka retires, motoring to Eden
	1000	Atara sends distress email accidently
	1005	Veto instructed by RRV to light flare following 2 missed Skeds
	1017	Relish entering Eden, injured crewman, requests ambulance
	1020	Sea Jay retires to Eden
	1030	Fudge relays Atara's message to RRV, apologises for mishap
	1039	She's Apples II departing Eden to Hobart – racing
	1049	Kendell departing Eden to Hobart – racing
	1050	SGC no communications, adrift 151°53'E, Navy asked to attend scene
	1103	Lady Penrhyn retires in Eden
	1106	Chutzpah retires to Eden
	1115	Search pattern for Winston Churchill established by AMSA
	1118	Wild Thing ETA Eden 0600 hours
	1203	Loki retires to Bermagui, no motor
	1215	Challenge Again departing Eden to Hobart - racing
	1243	Breakaway departing Eden to Hobart – racing
	1245	Bin Rouge departing Eden to Hobart – racing
	1246	Tenacious retires to Eden
	1324	She II departing Eden to Hobart - racing
	1335	Vagrant entering Eden, retired, one injured crew
	1400	**Sked 5**
	1645	"Tug Rubicon" departs Eden to tow SGC
	1825	Bin Rouge rudder problems
	2130	Search terminated for MOB for Sword of Orion, search for Winston Churchill's crew ongoing

DATE	TIME	EVENT
28/12/98	2230	Helicopter finds 2 crew from Winston Churchill, advised 3 others swept from life raft at 0500 hours
	2325	Bin Rouge retired in Eden
29/12/98	0125	New Horizons 37°01'S,151°07'E, no engine, no radio, 4 crew injured
	0156	Securité/PAN PAN from Race Control Centre for yachts to look out for 3 MOB from Winston Churchill 37°18'S,150°40'E
	0201	Waitangi II via Avanti lost radio, everything ok
	0305	Veto missed Sked 3 (and Sked 2), asked to activate EPIRB by RRV
	0400	P3 aircraft dispatched to search area for Veto, "Tug Rubicon" and "HMAS Newcastle" searching area for SGC
	0810	Tartan departing Eden to Hobart - racing
	0830	Phone call from owner of Veto, dismasted, no radio, all ok, at Batemans Bay
	0859	Mike Bannister's body (Winston Churchill's MOB) found
	1000	SGC 2 crew taken on board of "HMAS Newcastle", 3 crew remaining on board of SGC, motoring to Bermagui
	1700	Search for Winston Churchill's 2 missing MOB abandoned

4.0 WEATHER

The Bureau of Meteorology (BOM) has prepared a document, "Preliminary Report on Meteorological Aspects of the 1998 SHYR, February 1999" (Appendix 12). The following weather analyses rely heavily on this BOM report (Sections 3 & 4).

Extracts from the BOM Preliminary Report are indented and italicised for easy identification.

In addition meteorologist Roger Badham who provided a subscription weather service to a number of the fleet (Appendix 13), completed his own Post-Race Review. Excerpts are also taken from his Post-Race Report (Appendix 14).

4.1 The History of the Weather

While examination of the data of the 54 SHYR demonstrates that there is little regularity in the weather patterns, it is possible to describe what might constitute a "typical" race:

A typical SHYR will begin in a light to moderate north-easterly sea breeze providing running conditions down the NSW Coast. The breeze will build to around 25 knots or more and swing rapidly through the north-west and eventually to the south to consolidate a strong SE to SW air flow of 25 to 35 knots gusting to 45 knots. With the winds, seas will build to around 5 metres or more.

Off the NSW coast, the East Australian Current runs at between one and four knots. In years when the current is stronger, it has the effect of standing the seas up and producing waves with no backs, making conditions particularly tough on crews and equipment. In these years, retirements due to damage and seasickness are higher than normal.

The southerly winds remain for up to 48 hours, slowly abating and often being replaced by long periods of calms. It is not unusual for a second front, almost always a south- westerly, to hit the fleet in Bass Strait or off the Tasmanian coast. More often than not, the south-westerlies in Bass Strait are stronger than those

experienced off the NSW coast. These winds are usually coupled with bigger seas. This is a function of winds being funnelled between Tasmania and the mainland and the fact that the waters in the Strait shallow to less than 20% of the water depth on either side of the Strait.

It is not unusual for the race to end with yachts becalmed in the Derwent River, taking many hours to finish the last miles of the Race.

Strong southerly winds are a feature of the Race and only one event in the Race's history has failed to produce any such conditions. Stronger than average winds with accompanying big seas have hit the fleet on a number of occasions. Some veterans talk of a seven-year cycle of "tough" races and each of these has rightly earned its reputation.

1946: on the second day the fleet was hit by a 65 knot SSW change and eight metre seas

1956: started in a hard southerly, followed by a 50 knot south-westerly in Bass Strait and a southerly gale in Storm Bay with winds up to 86 knots

1963: after a light northerly start, followed by a strong south-westerly in Bass Strait and down the Tasmanian coast and over 70 knots in Storm Bay

1970: two days of fresh north-easterlies was followed by two days of 40 to 50 plus knot south-westerlies

1977: an easterly moved to the south-east with wind speeds between 30 and 50 knots, a later south-west change at 35 knots with an 85 knot squall hitting the tail enders

1984: started with a strong southerly change that built to a solid 40 to 45 knots over a hard flowing East Australian current making the waves particularly vicious

1993: an early south-east change hit the fleet on the first afternoon building to 50 knots and gusts in the mid 70 knot range with 10 metre seas.

4.2 Forecasts and communication to competitors

Weather information was available to the fleet through a number of avenues:

a) BOM briefings at the compulsory briefing on 24 December

b) BOM package on 26 December

c) BOM services by fax/Internet

d) Roger Badham Sydney Hobart Forecast by subscription

e) By HF Radio on board yachts through:

- Penta Comstat
- VIS, VIM, VIH

f) AM/FM commercial radio stations down the NSW coast

g) RRV ("Telstra Control") providing BOM reports with Skeds

4.2.1 The BOM's Role in Marine Weather Services

"The Bureau has a responsibility under the Meteorology Act 1955, to issue routine forecasts and warnings of weather conditions for, inter alia, the purposes of navigation and shipping. The Bureau provides a suite of routine weather products in the public domain. These products include coastal waters (out to 60 nautical miles from the coast) and high seas forecasts.

A wind warning service is also provided and, for coastal waters, this covers strong winds (mean winds averaging 25 to 33 knots), gale-force winds (mean winds averaging 34 to 47 knots) and storm-force winds (mean winds averaging in excess of 47 knots). For high seas forecasts, warnings are issued for gale-force, storm-force and hurricane-force winds (mean winds averaging over 63 knots – in serve tropical cyclones only)".
(BOM Preliminary Report, p.11)

Services provided to the CYCA

"For many years, BOM has provided a pre-race briefing and a special race forecast service to all competitors in the SHYR through the CYCA. The special service has always been provided by the NSW/Tasmanian Regional Forecasting Centres (RFCs) of the Bureau with the NSW RFC delivering the pre-race briefing as well as the outlooks leading up to the race. During the event, these offices liaise together and with Victorian RFC which is responsible for routine forecasts in Eastern Bass Strait, forecasts for the high seas in the Tasman Sea and for high seas warnings south of latitude 38 degrees south. For the race, the NSW office prepares race forecasts from Sydney to 38 degrees south and the Tasmanian south of 38 degrees south. The schedule of forecasts is shown in the following table:

NSW RFC		
Date	***Time of Issue***	***Area Covered***
Dec 26th	*0500, 1000, 1300*	*Sydney to Jervis Bay*
Dec 27th	*0200, 1300*	*Jervis Bay to Gabo Island*
Dec 28th	*0200, 1300*	*Jervis Bay to Gabo Island*
TAS RFC		
Dec 27th	*1300*	*Bass Strait*
Dec 28th	*0200, 1300*	*Bass Strait and Tas East Coast*
Dec 29th	*0200, 1300*	*Bass Strait and Tas East Coast*
Dec 30th	*0200, 1300*	*Bass Strait and Tas East Coast*
Dec 31st	*0200, 1300*	*Bass Strait and Tas East Coast*

The forecasts were distributed to the CYCA, the Royal Yacht Club of Tasmania and made available generally through the Bureau's weather-by-Fax and Internet services. These forecasts were also relayed to the competitors via the Radio Relay Vessel, the Young Endeavour, during the regular radio schedules." (BOM Preliminary Report, p.11-12)

"Relevant services provided by the BOM in the period leading up to and encompassing the yacht race included routine marine products (coastal waters and high seas forecasts and warnings, coastal weather reports, etc.) and specific services for the CYCA. The routine services broadcast on marine radio are twice per day for highs seas forecast and two or three times per day for coastal weather forecasts. Warnings are broadcast on receipt and repeated every two hours while the warning is current. The specific services for the CYCA were provided on a cost-recoverable (sic) *basis (ie the incremental cost to the BOM of providing the service was recovered from the CYCA) and included pre-race briefings by Bureau staff for the competitors and organisers and special access arrangements for race officials to contact the Bureau's Senior Forecaster any time.*
(BOM Preliminary Report, p.12)

4.2.3 Meteorological Services Leading up to the SHYR

"Meteorological services for the CYCA, leading up to and including the SHYR, commenced on Tuesday 15 December 1998 with a general weather briefing delivered by a meteorologist from the NSW Regional Forecasting Centre to all competitors in the Telstra Cup event. (This event is the lead-up series to the SHYR). The majority of yachts that participate in these series also takes part in the SHYR.

The briefing consisted of a general information session that included possible weather problems around the Sydney area as well as information on where and how competitors could obtain weather information.

Competitors were also made aware of a number of web sites, including that of the Bureau, and the Bureau's Weather-by-Fax service where they could obtain the full suite of marine products produced by the Bureau."
(BOM Preliminary Report, p.12)

Data from the Questionnaire responses clearly show that the fleet used multiple sources to get weather information both before and during the race.
Apart from the CYCA Race briefing, 85% of yachts received the BOM Boxing Day Package, 20% subscribed to Roger Badham's source, and 33% used other publicly available information, Internet, poll fax and newspapers.

4.2.4 Outlooks for the SHYR

"The first formal outlook for the SHYR was prepared at 10.20am on 23 December 1998. This was issued primarily for media purposes and covered the period from Saturday 26 December to Tuesday 29 December. It was based heavily on the Bureau's computer generated products. The outlook was issued with a qualifier that it was based on limited data and needed to be fine-tuned."
(BOM Preliminary Report, p.12-13)

4.2.5 Pre-race Briefing for the 1998 SHYR

"The official pre-race briefing, held at 9am on 24 December 1998 at the CYCA, Rushcutters Bay, Sydney, was attended by approximately 250 people. A Bureau meteorologist provided general meteorological and oceanographic information as well as the latest information on likely weather conditions for the race.

A race weather outlook was also presented. This outlook was issued at 8.30am on 24 December and covered the period 26 to 29 December. It

was based on the latest computer generated prognoses but the various computer models available to NSW forecasters at the time were not conclusive regarding the evolution of weather patterns for the race. The outlook also contained the qualifier that 'this outlook is based on limited data and will need to be fine-tuned'.

It was added verbally at this briefing that at least one other computer model, namely the European Centre for Medium Range Weather Forecasts computer model, which was run the day before the briefing, was showing signs of a low pressure system forming to the south east of Gabo Island. Competitors were told to keep an eye on this, especially since there was a trend towards low pressure development in the northern Tasman Sea.
(BOM Preliminary Report, p.13)

"Competitors' attention was also drawn to possible 'wind opposing current' problems. This was in light of the forecast strong southerly change coupled with 3 to 4 knots East Australian Current generally setting south. In such conditions, steep breaking seas can develop very quickly."
(BOM Preliminary Report, p.14)

Badham reports (Appendix 14): "I attended the briefing (as I usually do) and I have to say that on this occasion the standard of the briefing from the Bureau's representative was very poor. For an approximately 20 minute period nearly every weather feature that could possibly develop along the various sections of the race track was discussed. Most of this was quite superfluous to the task and only in the last few minutes were the actual forecast conditions addressed and then the Bureau's representative stated that as the models were presently disagreeing with outcome, he would only give the briefest of outlooks and that everyone would have to wait

until the morning of the race. While the uncertain statement is true, there had been some consistency over the days leading up to the morning of the briefing. In my opinion it would have been much more beneficial for the audience had he focused on the 3 most likely outcomes as indicated by the models." (Roger Badham, Post-Race Review, p.1-2)

4.2.6 Forecasts and Warnings for the 1998 SHYR

"On Boxing Day, 26 December, the first special race weather forecast was issued at 4.29am. This was the first issue of the special forecasts that were faxed to the CYCA as well as to the Radio Relay Vessel.

During the morning of Boxing Day, before the race commencement at 1pm, the Bureau has traditionally maintained a race weather briefing service outside the sailing office of the CYCA. Competitors can avail themselves of the latest race weather and oceanographic information and have the opportunity to talk to Bureau forecasters for any elaboration or explanation that they may require. Approximately 75% of competitors in the 1998 race availed themselves of this service. Crews that approached the stand were handed the latest (9.04am) issue of the special race forecast as well as a comprehensive briefing pack. Three meteorologists provided this service on the Bureau's behalf.

The 9.04am issue of the race forecast updated the 4.29am issue by including a gale warning for waters south from Broken Bay. The warning, based on computer model output, was forecasting south to south west winds with mean speeds in the 30 to 35 knots range with stronger gusts. Competitors were also warned that the strong to gale force SW/W winds would persist south of Jervis Bay over Sunday and would start to moderate over Monday evening."
(BOM Preliminary Report, p.14)

Badham states on the timing of the BOM's meteorology forecast:
"I believe that the timing of the official race forecasts is particularly pertinent. The BOM scheduled their race forecasts to be issued at 2am and 2pm during the race period. On most occasions the forecast was actually issued at around 0000 to 0100 hours and 1200 to 1300 hours local time. This a particularly poor time for a number of reasons.
Firstly, the numerical product that the forecasters use as a guidance is run twice daily at the BOM; namely at 0000Z and 1200UTC or 1100 and 2300 hours local time. That is the time that the models are actually initialised and run; the product from these models becomes available at around 0130Z or 1330Z (ie 1220-1300 and 0030-0100 hours local time). As such, it seems to me to be impossible that any of those forecasts could have used the latest available numerical guidance. There are no significant observations made at midnight (local time) so that detailed MSL analysis is done at 2100 and 0300 hours local time. This means that the forecast issued at 0200 hours is prepared on old observations and old analysis chart and old numerical guidance."
(Roger Badham, Post-Race Review, p.7)

4.2.7 Issue of First Storm Warnings

"At about 1pm on 26 December, meteorologists in both the NSW and Victorian RFCs received the latest computer generated prognoses (based on data input at 10am on 26 December 1998) which showed the development of a strong low pressure system in Bass Strait. The computer prognosis indicated mean winds of 45 to 55 knots were likely to occur over that area, especially in Eastern Bass Strait. After consultation between the respective senior forecasters, both offices issued a storm warning. The Victorian warning issued just before 2pm, covered waters east of Wilson's Promontory and the NSW warning, issued about fifteen minutes later, covered waters south from Merimbula.

Upon issuing the storm warning through the normal channels, the Bureau's NSW office also contacted the following:

AMSA (it was understood that they would contact other authorities, including the Navy)

Eden Royal Volunteer Coastal Patrol

Sydney to Hobart Race Media Centre

The NSW RFC then issued an updated special race forecast at 2.50pm on 26 December 1998. The updated forecast, which included advice that a storm warning was current south of Merimbula, was sent to the Young Endeavour which was responsible for relaying forecasts and warnings to the competitors during official radio schedules. According to the limited number of reports from crews that have been received so far, it appears that in addition to the radio schedules some yachts received the details of the warning from other means (ie coastal radio broadcast)."
(BOM Preliminary Report, p.14-15)

4.2.8 Outputs from Operational Computer Forecast Model

Forecasters use a variety of computer models enabling them to interrogate the atmospheric conditions. Models are routinely assessed and evaluated, forecast against actual. The Committee has been advised that, apart from the models, virtually no data are available from sources in the area, as it is remote and expensive to deploy assets. A number of assets, like Deal Island has been closed in the last few years, yielding ever less forecasting information, and virtually no real-time data.

"The computer weather forecast model output shows that on Wednesday 23 December, three days before the start of the race, the different computer models were forecasting different possible evolutions of the weather patterns. The ECMWF model was forecasting a ridge of high

pressure and moderate to fresh north easterly winds over the waters around Gabo Island for Sunday. Other models were suggesting that a low would develop somewhere between Gabo Island and the southern Tasman Sea with south easterly to south westerly winds of about 25 to 40 knots likely to affect the race.

By Thursday 24 December, the models were generally on different tracks with the ECMWF model indicating the formation of a low to the east of Tasmanian, implying south westerly winds at about 30 knots for the Gabo Island area for Sunday evening. Some other models, including the Bureau's GASP model, were forecasting a high pressure system very close to Gabo Island for Sunday evening, implying light and variable winds.

On Friday 25 December, the models were starting to agree on the development of a low pressure system over the Tasman Sea, though they differed in its exact location. However, the Bureau's GASP model and the UKMO model both forecast a ridge of high pressure just off Mt Gambier, near western Bass Strait, and the US aviation model persisted with a centre of high pressure over Gabo Island. Taken as a group, the models were firming, on a prediction of southerly or south westerly winds near Gabo Island by Sunday, with strengths probably between 15 and 30 knots, but there were still significant differences between them.

By Friday evening, the GASP and UKMO models were predicting stronger southerly or south westerly winds, up to 35 or perhaps 45 knots, for the Gabo Island area for Sunday. The limited area (but very accurate) LAPS model available at about 1am on Saturday morning was, however, only forecasting wind speeds near Gabo Island of about 25 knots."
(BOM Preliminary Report, p.19-20)

4.2.9 Computer Model Forecasts

"Real consensus between the models did not occur until about noon on Saturday 26 December. The global models (ECWMF, JMA, GASP, UKMO and US) became available during Saturday morning and were all forecasting the development of a deep low which would be about 220 nautical miles south east of Gabo Island by Sunday night. They were forecasting south westerly winds of around 45 knots, near the high end of the gale force range. Shortly after, the LAPS model output became available and forecast the low to develop much closer to Gabo Island which would mean stronger (about 50 knots) winds. At about 1pm the same day, the much higher resolution "MesoLAPS" model predicted a deeper low of 985hPa central pressure only about 80 nautical miles off Gabo Island with westerly winds of 55 knots. The Bureau's wave model display, using the winds modelled by "MesoLAPS", became available about 2.30pm and forecast waves just over 8 metres high in Eastern Bass Strait on Sunday night."

(BOM Preliminary Report, p.20)

"Later runs of the GASP and UKMO models available Saturday evening 26 December maintained forecasts of 50 knots winds, slightly lighter than the earlier "MesoLAPS" model output. It is considered that this slightly apparent decrease of forecast wind was most likely a consequence of the GASP and UKMO models' slightly coarser resolution, rather than any change in the predicted severity of the event.

The next run of the "MesoLAPS" model, available at about 1am on Sunday 27 December continued to forecast a low developing over Eastern Bass Strait and moving eastwards over the Tasman Sea but predicted a less deep central pressure (990 hPa) and slight (45 knots) winds over the area south of Gabo Island by Sunday night.

On Sunday morning, the real time observational data plotted on manually analysed charts provided the most useful basis for the forecasting of an event that was nearing peak intensity. From this point on, the weather forecast models were useful mainly as an aid for predicting the general abatement of conditions."
(BOM Preliminary Report, p.20)

Roger Badham states on the meteorological situation and model guidance for the race: "The general development and situation was well forecast by the numerical models, but until the 26th, there was a great deal of uncertainty about the actual location of the low pressure system. With hindsight, the USA models (MRF) picked it the best and earliest, with the Australian model (GASP) varying somewhat but being particularly good on the morning of the start, while the ECMWF was probably the least accurate of that group. It needs to be pointed out that the numerical models do not provide the forecast. They supply guidance to the forecaster and it is the forecaster's task to pick and choose the information at hand and construct the forecast accordingly. The models never forecast extreme events with good accuracy nor will they simulate the extreme sharp horizontal wind boundaries that have been observed around intense low pressure systems."
(Roger Badham, Post-Race Review, p.1)

4.2.10 Storm Warnings Issued by the BOM

"Storm warnings for both coastal waters and high seas referred to mean winds of up to 45 to 55 knots. It is known that wind gusts will cause temporary fluctuations about this mean and that maximum gusts of up to 40% above the forecast mean wind may be observed. Therefore with a forecast of 45 to 55 knots regular gusts of around 70 knots were likely.

Storm warnings for the coastal waters referred to waves of 4 to 7 metres significant waves height (average height of the highest one third of all waves). Storm warnings for the high seas referred to rough (2.5 to 4 metres) to very rough (4 to 6 metres) seas and moderate (2 to 4 metres) to heavy (greater then 4 metres) swell which would result in a combined significant wave height of at least 7 metres. It should be noted that while forecasts and observations of waves are for the significant wave height, individual waves approaching twice that size can be expected to occur.'
(BOM Preliminary Report, p.21)

Roger Badham comments on the BOM's warnings that "the correct warning – a storm warning- was in place at all times. A storm warning is an open ended wind warning for ex tropical waters, where the wind is observed, or forecast, to average in excess of 48 knots. It corresponds to force 10 and above on the old Beaufort Scale. It would appear that the people's and sailor's awareness and understanding of the storm warning is perhaps not as good as it should be:

a. some are not aware of the storm warning behind a wind warning,
b. that it is an open ended warning, and
c. it was probably doubly confused by the term 'storm' and that there was severe electrical thunderstorm activity associated with the front/trough on the night preceding the development of the low pressure system.

It should also be noted here that at all times, the official race forecast (from the BOM ed.) was for 40 to 50 knots, so that at all times, the referenced forecast wind speeds never truly reflected the storm warning that was in place. It seems a very thin connection to forecast 40 to 50 knots of wind with a warning that references winds of 48 knots or more."(p. 6)]...["I believe that there is probably room for better communication between the Race organisers and the BOM. It would also

be better if the BOM provided a small team of dedicated forecasters, where there can be direct open communication of conditions etc., if necessary to the Race organisers or the Radio Relay Vessel. I found that when I was forecasting for the race, it was in the days, when I either had to call direct the RRV and relay the forecast directly to Lew Carter, or HF fax them, in the early days of satellite fax. I spoke often directly with the RRV, and any emphasis or detail or coastal station report that I thought was important could be brought to the attention of the actual person talking to the fleet at Sked time.

The BOM has no marine weather station, though they have been proposing such a section for at least 10 to 15 years. The quality of the BOM marine forecasts suffers as a result, for it comes down to the individual that is on the shift... and I frequently read coastal waters forecasts that are either wrong, poor and often at odds with their other forecasts. It is an area that requires addressing within the BOM to improve their product for sailors all around Australia."
(Roger Badham, Post-Race Review, p.8-9)

4.3 Forecasts versus Actual Wind and Sea Conditions

Seventy-four percent of the fleet sought weather information from sources other than the three daily RRV Skeds. More than half of the fleet used HF radios to listen to Sydney Radio (VIS) and Melbourne Radio (VIM), and Penta Comstat. Twenty percent listened to local AM/FM radio stations and 11% had on board weather faxes.

Nine percent of the fleet sought additional weather information from these sources at least once a day with 55.5% seeking information more than twice and up to five times per day.

The BOM's "Preliminary Report on Meteorological for the 1998 Sydney to Hobart Yacht Race" (p. 21) quotes that: "...*It is known that wind gusts will cause temporary fluctuations about this mean and that maximum gusts of up to 40% above the forecast mean wind may be observed. Therefore with a forecast of 45 to 55 knots regular gusts of around 70 knots were likely.*" And later with respect to wave heights "...*It should be noted that while forecasts and observations of waves are for the significant wave height, individual waves approaching twice that size can be expected to occur.*"

From the Questionnaire, it is absolutely clear that yachts did not know or understand this aspect of weather forecasting practice with respect to either wind strengths or wave heights and did not interpret the forecast this way as a result.

Seventy eight percent of yachts had a dedicated navigator on board, trained in forecasting techniques, none of whom claim knowledge of this "convention". In fact 90% of yachts reported that they inferred wind and sea conditions would be between "slightly stronger or slightly less strong than forecast" with only 10% expecting "much stronger than forecast".

At 1235 hours on 27 December, Doctel Rager reported winds of 50 to 60 knots, gusting up to 70 knots. One and a half hours later, Sword of Orion reported during the 1400 Sked that they were experiencing extreme winds over 70 knots with gusts up to 80 knots.

The average true wind speed recorded on yachts at the height of the storm was 54 knots from a mean direction of 250° magnetic. The average strongest gusts reported were 68 knots with a range of 55 to 72 knots being statistically significant. Thirty five percent of the fleet reported the average wind speed as being greater than 60 knots. Twelve yachts reported gusts of 80 knots or more.

Most yachts will have recorded apparent wind speeds on board up to about eight knots faster than the true wind speed due to the effect of the speed of the yacht. Thus, average observed wind speeds would have been 60-62 knots, with gusts in the low 70 knot range.

Reports of wave heights from competitors may be suspect because it is extremely difficult to estimate wave heights from on board yachts at sea. In addition, an individual's judgement may be subjective.

It is clear, however, from observations of television footage and the descriptions of individual incidents from competitors that seas of at least 15 metres were common and waves of 20 metres were encountered with considerable regularity. Several yachts reported that the height of the wave responsible for their demise was 25 metres or more.

Competitors also reported that waves had no backs to them, indicating that there was some current effect. This is consistent with satellite pictures of the East Australian Current that shows it eddying north of the storm centre track. The biggest waves were steep and usually breaking at the top, making safe manoeuvring extremely difficult and hazardous.

Crews described the seas as large, steep and breaking, often with several metres of white water on top of the swells. The waves were irregular in height and direction. The winds were unrelenting and blew the tops off waves creating white out conditions.

The average wave height reported by the fleet was 9.4 metres with the average maximum wave height being 14 metres. Approximately 15% (16 yachts) claim to have experienced waves between 15 and 19 metres, 13.6% (15 yachts) between 20 and 24 metres, and 5.4% (6 yachts) 25 metres or more. The seas came from an average direction of 240° magnetic.

Reports from the fleet vary on just how long they endured the most severe conditions, ranging from three hours (12%) to more than ten hours (13%). The bulk of the fleet (57%) claimed to be in the most severe conditions for between four and eight hours.

From interviews with yacht crews and open-ended questions in the Questionnaire the conditions were described as:

- "ugly, big and wet",
  "horrendous",
  very large swells with breaking waves... sea completely white with foam. very poor visibility wave crest blown off",
  "treacherous- due to extremely large waves breaking frequently",
  "large breaking waves threatened to overwhelm the boat – they would stand up on the quarter – sometimes dropping on us...",
- "the sea was sheet white from the wind with white outs coming through the gusts",
- "waves were breaking over the yacht washing crew along the deck and knocking the yacht down to approximately 80°. One washed the boat sideways on its beam where the mast nearly hit the water."
- "(wind) howling, screaming",
  "it looked like the 'gates of hell' and building the greatest bitch of a sea you could ever design.'

The actual weather forecasts by the BOM for the 1998 SHYR were as follows:

DATE	TIME	WINDS	OFFICE
26/12	0448 hours	S/SE 15/25	NSW Regional Office
26/12	0904 hours	W/SW 30/40	NSW Regional Office
26/12	1209 hours	W/SW 30/40	NSW Regional Office
26/12	1450 hours	W 40/50	NSW Regional Office
27/12	0213 hours	W/SW 40/50	NSW Regional Office
27/12	1209 hours	W/SW 40/50	NSW Regional Office
27/12	1236 hours	W/SW 40/50	TAS Regional Office
28/12	0205 hours	W/SW 35/45	TAS Regional Office

BOM warnings for the 1998 SHYR were as follows:

Issued by the New South Wales Regional Office:

DATE	TIME	WARNING	AREA	WINDS
26/12	0926 hours	GALE	south of Broken Bay	S/SW 30/40
26/12	1023 hours	GALE	NE of 38/150	SW/S 30/40
26/12	1414 hours	STORM	south of Merimbula	W/SW 45/55
26/12	0415 hours	STORM	NE of 38/150	W/NW 45/55
26/12	2051 hours	STORM	NE of 38/150	SW/NW 45/55
26/12	2059 hours	STORM	south of Merimbula	W 45/55
27/12	0253 hours	STORM	south of Merimbula	S/SW 40/50
27/12	0253 hours	STORM	NE of 38/150	W/SW 40/50
27/12	0904 hours	STORM	south of Merimbula	W/SW 40/50
27/12	0905 hours	STORM	NE of 38/150	SW/NW 40/50
27/12	1500 hours	STORM	south of Merimbula	W/SW 40/50
27/12	1500 hours	STORM	NE of 38/150	W 40/50

Issued by the Victorian Regional Office:

DATE	TIME	WARNING	AREA	WINDS
26/12	1124 hours	STRONG	east of Wilsons Prom.	W/SW 20/30
26/12	1358 hours	STORM	east of Wilsons Prom.	W/SW 45/55
26/12	1700 hours	STORM	low + NE of 40/150	W/SW 40/50
26/12	1626 hours	STORM	east of Wilsons Prom.	W/SW 45/55
26/12	2316 hours	STORM	east of Wilsons Prom.	W/SW 45/55
26/12	2300 hours	STORM	low + NE of 40/150	W/SW 40/50
27/12	0449 hours	STORM	east of Wilsons Prom.	W/SW 45/55
27/12	0400 hours	STORM	low + E of 40/150	W/SW 40/50
27/12	1102 hours	STORM	east of Wilsons Prom.	W/SW 45/55
27/12	1100 hours	STORM	low + SE of 38/150	Cyclonic45/55
27/12	1700 hours	STORM	low	Cyclonic45/55

4.4 The Geography of the Storm

4.4.1 Evolution of Weather Conditions

"After a very warm Christmas Day with a north to north easterly airflow over much of south eastern Australia, the surface weather pattern for 9pm on 25 December 1998 showed a significant cold front crossing the Great Australian Bight towards Tasmania. A prefrontal trough was already located over western Victoria. These features combined during the next day (Boxing Day) and the resultant system intensified as it moved eastwards across Victoria. The surface weather pattern at 9am on 26

December, four hours before the start of the race, showed it would commence in conditions conducive to a fast race with a favouring current, reportedly running at 4 knots, and north to north east winds of generally 25 to 35 knots prevailing off the NSW southern coast.

By early morning on 27 December 1998, an upper air jet stream and a substantial cold air mass had moved rapidly northwards over Victoria producing unseasonable snow falls on the Australian Alps in the wake of the surface cold front. In association with this injection of a deep layer of cold air over Victoria, a new small-scale low had begun to form and intensify over Bass Strait to the south of Wilsons Promontory. This was occurring at the boundary of the interacting very cold and warm air masses which, with the positioning of a strongly curving jet stream in the upper atmosphere, had become a favourable location for the formation of a rapidly intensifying low.

The central pressures in the low, which formed to the south of Wilsons Promontory, dropped rapidly to near 980 hPa. The low initially moved northeastwards (sic) *but shifted to a more easterly path at a speed near 25 knots by late on the morning of Sunday 27 December. At midday, the low passed to the south of Gabo Island, maintaining its intensity.*

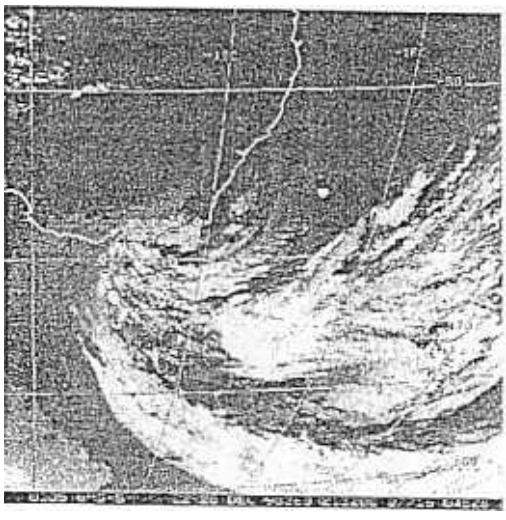
In association with the low pressure development, west to south west winds with mean speeds reaching storm force developed and extended over Eastern Bass Strait and southern NSW coastal waters.

By 9am the following day, 28 December, the surface analysis showed the low moving rapidly away towards the south west of New Zealand and winds and seas were beginning to moderate for the continuing search and rescue operations."
(BOM Preliminary Report, p.ii-iii)

A sequence of twelve satellite photographs illustrates the tight spiral structure and development of the low pressure system (Figure 1). The track of the storm centre is shown in Figure 2. Mean wind speeds and wave heights recorded at ESSO Kingfisher B oil rig, approximately 90 nautical miles from the fleet are shown in Figures 3 and 4 respectively (all figures from BOM, Preliminary Report).

Figure 1

Satellite pictures courtesy of Japan Meteorological Agency.

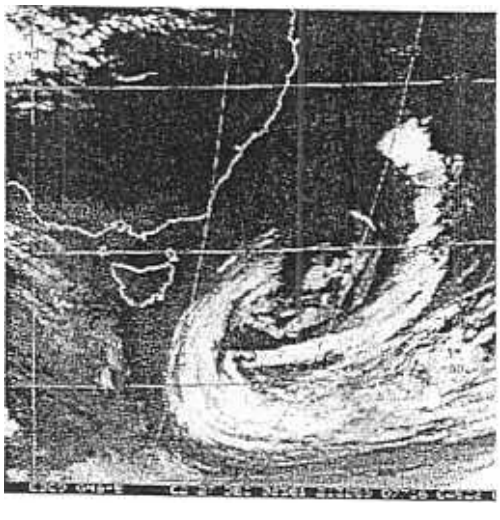


9am 27 December 1998

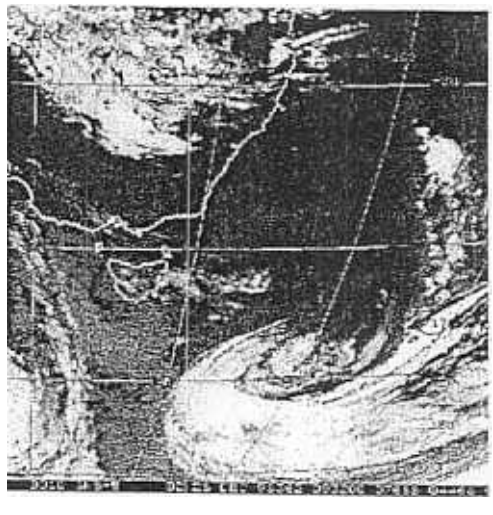
Midday 27 December 1998

3pm 27 December 1998

9pm 27 December 1998



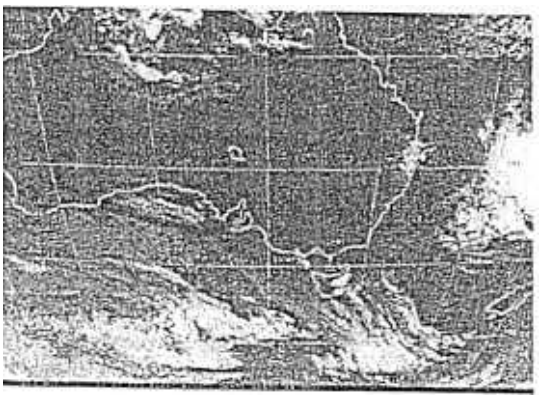
9am 28 December 1998



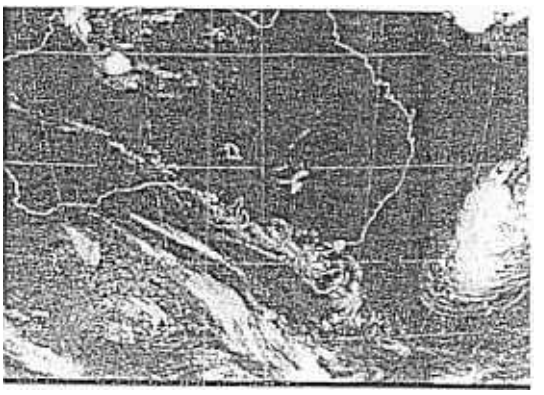
9pm 28 December 1998

Figure 1

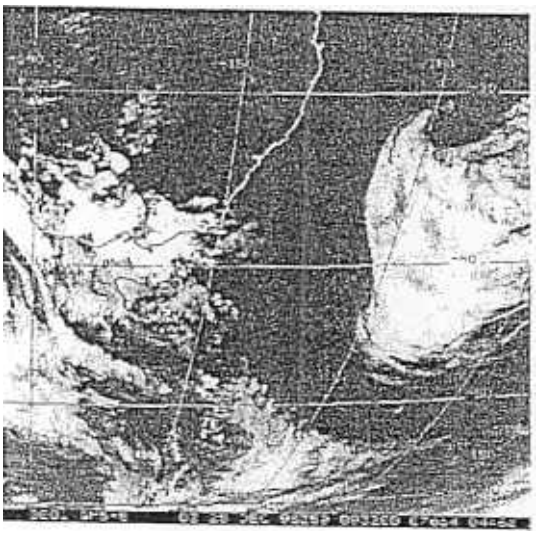
Satellite pictures courtesy of Japan Meteorological Agency.



9am 24 December 1998

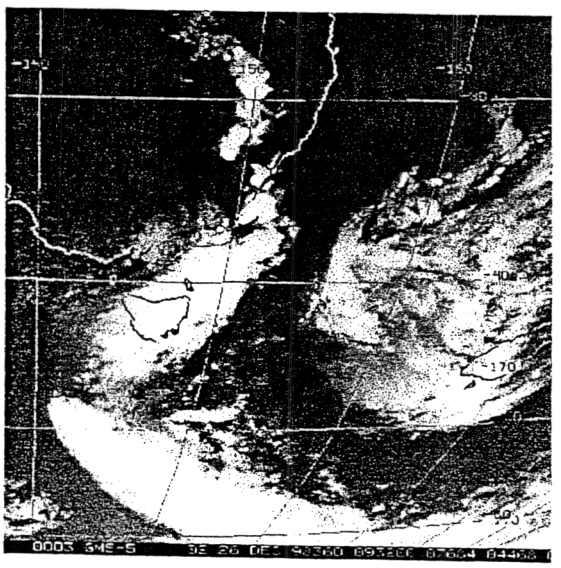


9am 25 December 1998

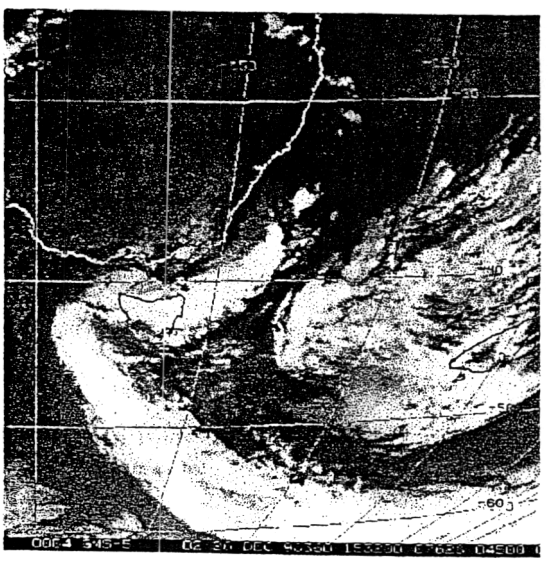


9pm 25 December 1998

9am 26 December 1998

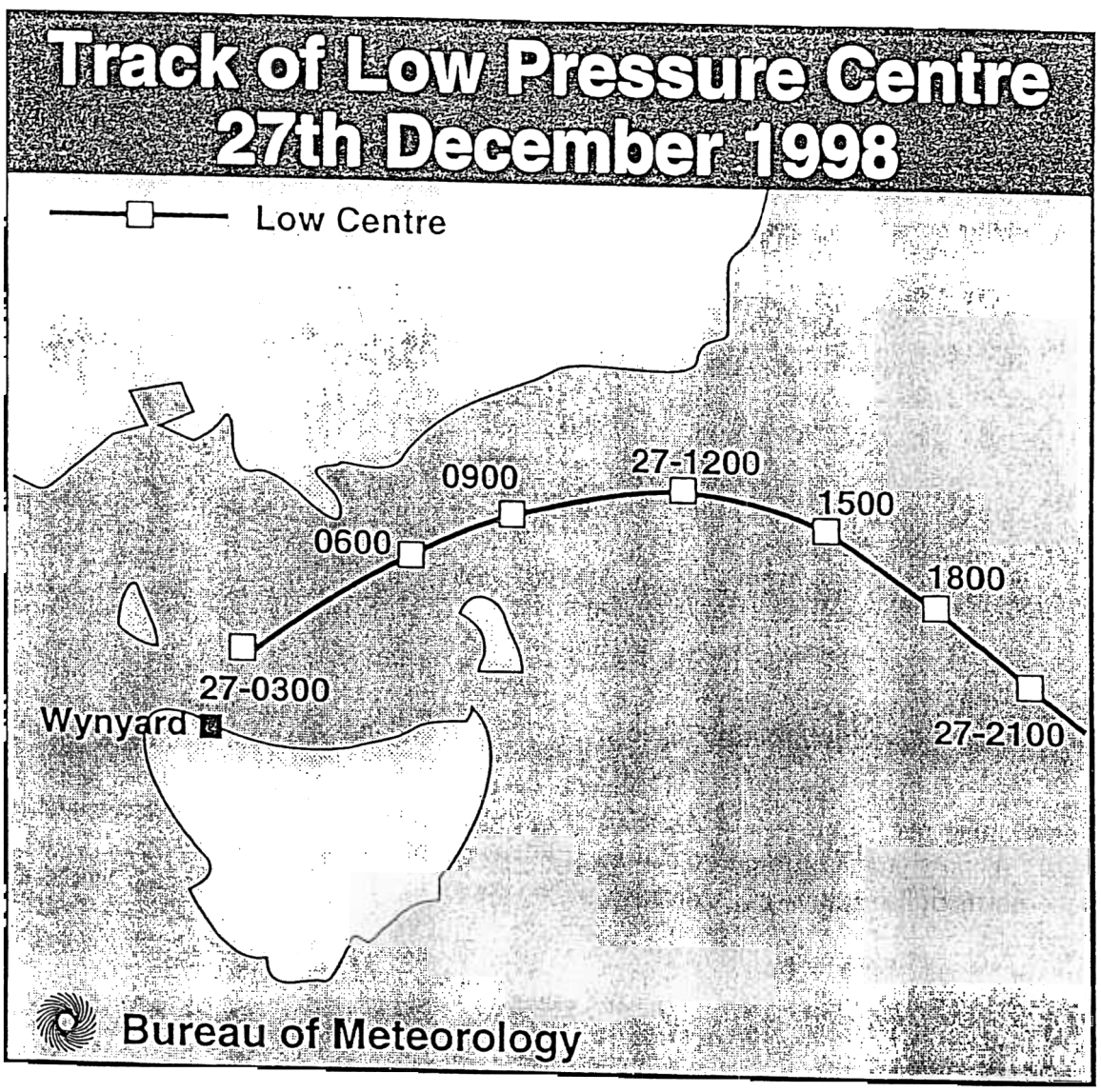


9pm 26 December 1998



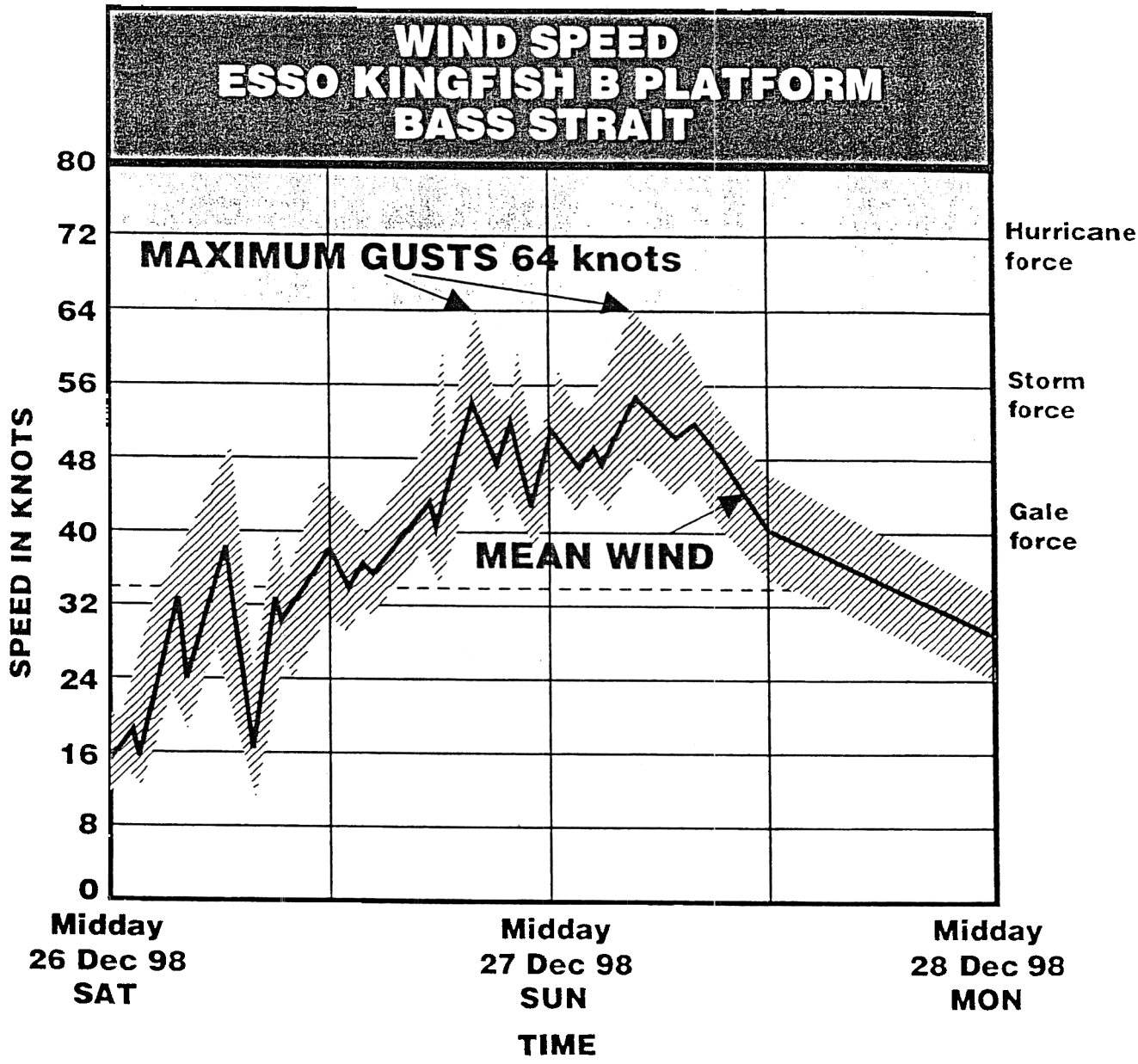
3am 27 December 1998

Figure 2



The track of the low pressure system which developed on 27 December 1998 in eastern Bass Strait. Times indicated are in Eastern Daylight Saving Time (EDST) using the 24 hour clock.

Figure 3



The 10 minute mean winds, and envelope of gusts observed at the Esso Kingfish B platform in eastern Bass Strait (location as given in fig. 1).

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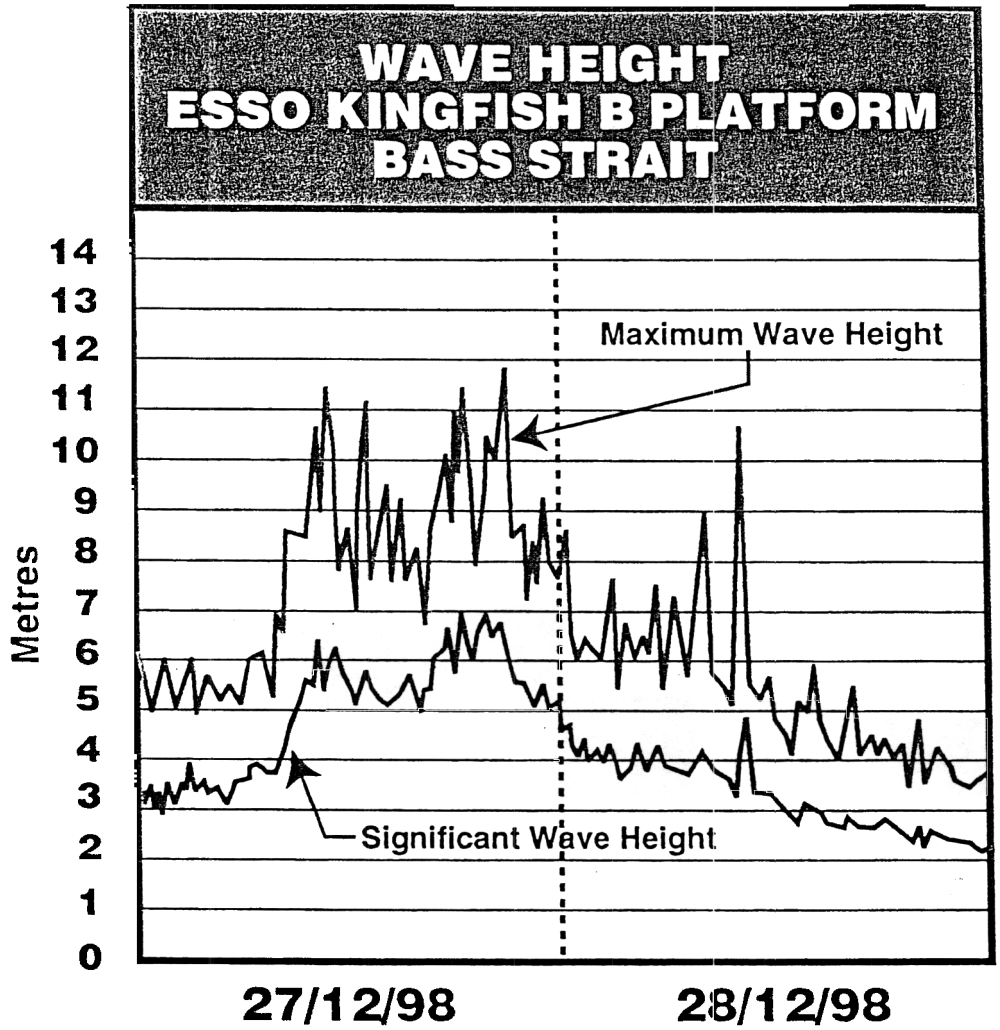
Figure 4



Significant and Maximum Wave Heights (metres) recorded at Esso Kingfish B Platform, Bass Strait 27 - 28 December 1998

Roger Badham reports: "As the low pressure system deepened and shifted east on the 27th, the strongest winds were not near the centre of the low, but rather on its western flank in the cyclonic circulation. At 6am through to midday, the most severe winds lay in a narrow band across Bass Strait from the NW tip of Tasmania to Wilsons Promontory. This band of extreme winds generated the large seas that were to hit the fleet later that afternoon and evening. An average wind speed of 50 to 60 knots for a period of 6 to 8 hours is capable of generating seas with a maximum wave height of 12 metres and an average wave height of 6 to 8 metres. Until mid afternoon, the low was west or close to the rhumb line and as such the nastiest winds and seas never hit the leading yachts. Those nastiest winds and seas appear to have reached the 'corner' and the rhumb line from mid afternoon and they continued through the evening and night.

After midnight, the low pressure system began to pick up speed and pull away to the SE-SSE and as a consequence, the pressures rose rapidly and the winds gradually abated. Undoubtedly, the serious damage occurred on the evening and night of the 27th when a band of storm force winds and extremely large waves with shallow backs moved in across the rhumb line and that coincided with the bulk of the mid to smaller size yachts heading out into Bass Strait. At 9 am that morning, Wilsons Promontory reported an average wind of 79 knots from 250°, gusting to 92 knots. The storm force winds that swept the fleet were not that strong, but it does appear that a narrow band of 55 to 70 knot winds did operate for a time. The Bureau's storm warning is the correct warning for those conditions, but the referenced winds in their forecasts were generally 40 to 50 knots and at most 45 to 55 knot winds – substantially down on what was observed. As well, the forecast sea heights appear to have been substantially underestimated."

(Roger Badham, Post-Race Review, p.10)

4.4.2 Wave Heights

"Significant wave heights of 6 to 7 metres with a few reaching maximum heights of 11 to 12 metres were recorded during Sunday at ESSO Kingfisher B Platform. The Young Endeavour reported seas of 5.5 metres and a swell of 6 metres (combined effect 8 metres) while located approximately 30 nautical miles east of Gabo Island at 11pm on 27 December 1998."
(BOM Preliminary Report, p.iv)

Roger Badham states "it is normal in seas state forecasts to differentiate between seas and swell. however around the intense circulation of a low pressure system, it is somewhat misleading to separate the sea states. Technically, it is sea not swell, inside such a rapidly developing low where the winds are rising to 50 knots or more. This is even more pertinent for the shallow waters of Bass Strait. As well, the band of strongest winds shifted eastwards at approximately the same speed as the developing sea. This makes for a really nasty 'Bass Strait type sea' develop, where large waves trains or sets of 5 to 10 minute periods develop. This point was examined in the recent Fastnet reanalysis by Pedgley, 1997. The extra complication undoubtedly occurred where the large waves met the confluence of currents (around the cold eddy) and this must have assisted in standing the waves up- a feature described by nearly all the foundering yachts. The Victorian Office has considerable experience forecasting in Bass Strait with ESSO. At all times their forecasts for eastern Bass Strait were superior to those supplied to the race, even though the Victorian forecasts were also less than what was actually observed.

I would suggest that the race forecasts for sea state were ultra conservative given the wind forecasts. A wind speed of about 50 knots for 9 hours can theoretically produce a significant wave height of at least 9 to 10 metres, without taking into account shallowness, the 'in phase' development or the

opposing currents. However, using the old trusted nomograms for calculating a developing sea under certain fetch and time constraints show that 10 metre seas should have been expected in Bass Strait. It would seem perhaps obvious, that in future race forecasts, that the role of forecasting Bass Strait section of the race be given to the Victorian Office."
(Roger Badham, Post-Race Review, p.8)

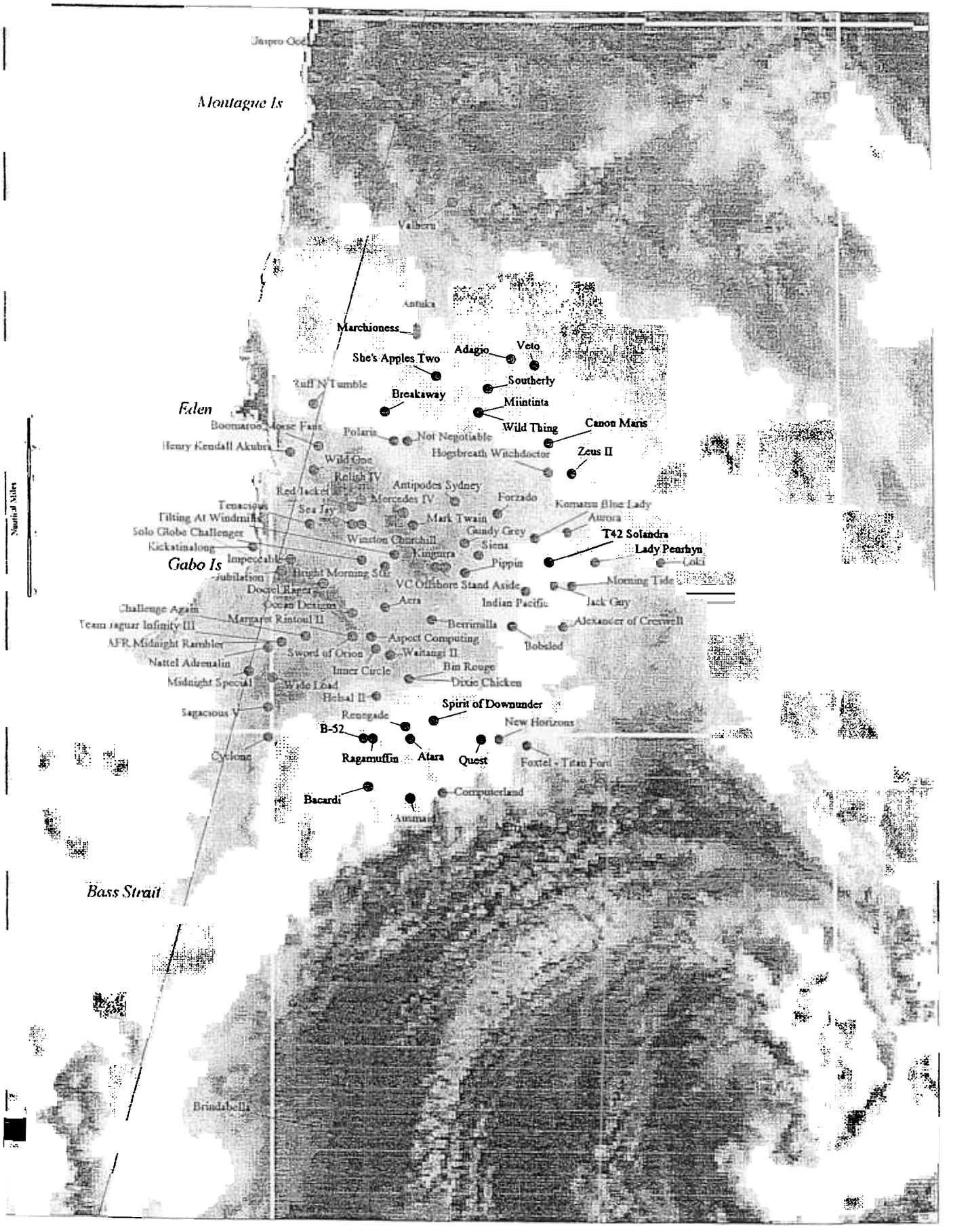
4.4.3 Maps

The Questionnaire asked skippers to provide their position at the time the storm front hit their yacht. The following six maps plot each yacht's latitude and longitude at the time each yacht prescribed.

Maps 1-3 show the positions of the entire fleet (Map 1), yachts that finished (Map 2) and yachts that retired (Map 3) over a satellite photograph of the storm.

Map 4-6 show the positions of the entire fleet (Map 4), yachts that finished (Map 5) and yachts that retired (Map 6) over surface sea temperatures, showing the eddying East Australian Current.

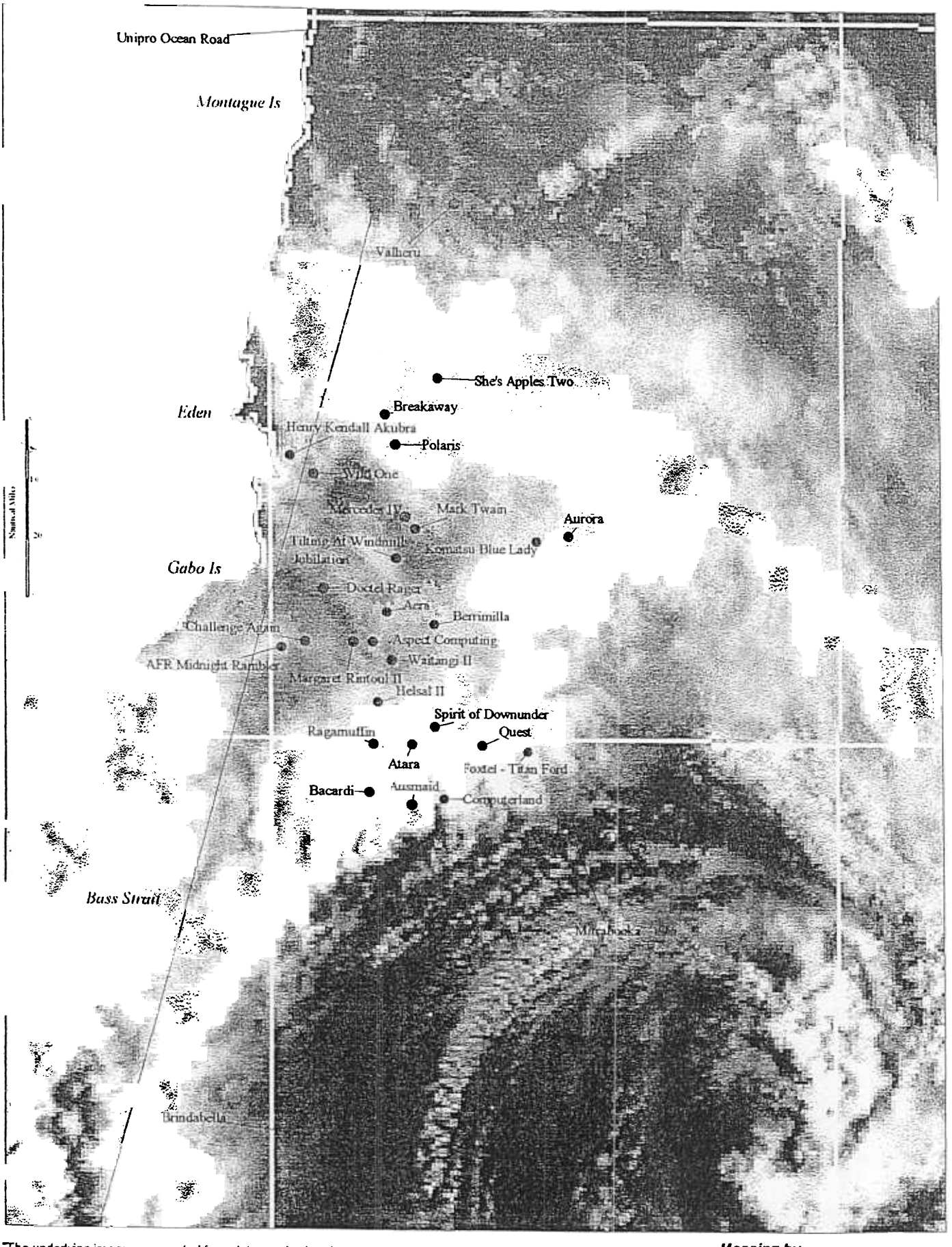
Map - Position of fleet when the storm front hit (over cloud conditions for 1604 hours on the 27th December 1998)



"The underlying image was created from data received and processed by CSIRO Marine Research at Hobart from the Advanced Very High Resolution Radiometer (AVHRR) instrument from onboard the USA's National Oceanographic and Atmospheric Administration (NOAA)

"The image uses NOAA-14 AVHRR BAND4 infra-red (thermal) data to describe cloud top conditions for 1604 hours on the 27th of December, 1998 (AEDST)."

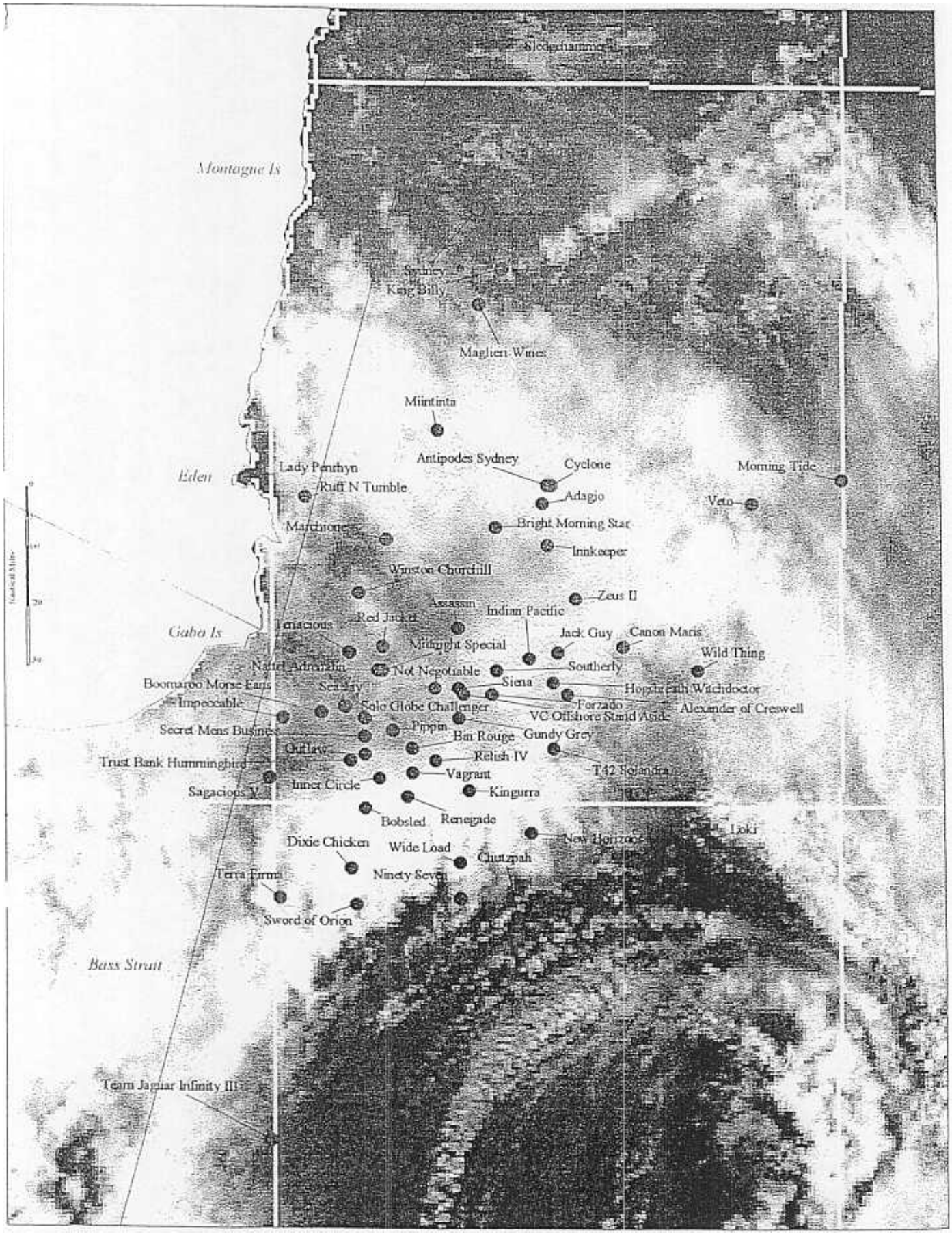
Map 2 - Position of yachts that finished, when the storm front hit (over cloud conditions for 1604 hours on the 27th December 1998)



"The underlying image was created from data received and processed by CSIRO Marine Research at Hobart from the Advanced Very High Resolution Radiometer (AVHRR) instrument from onboard the USA's National Oceanographic and Atmospheric Administration (NOAA)

"The image uses NOAA-14 AVHRR BAND4 infra-red (thermal) data to describe cloud top conditions for 1604 hours on the 27th of December, 1998 (AEDST)."

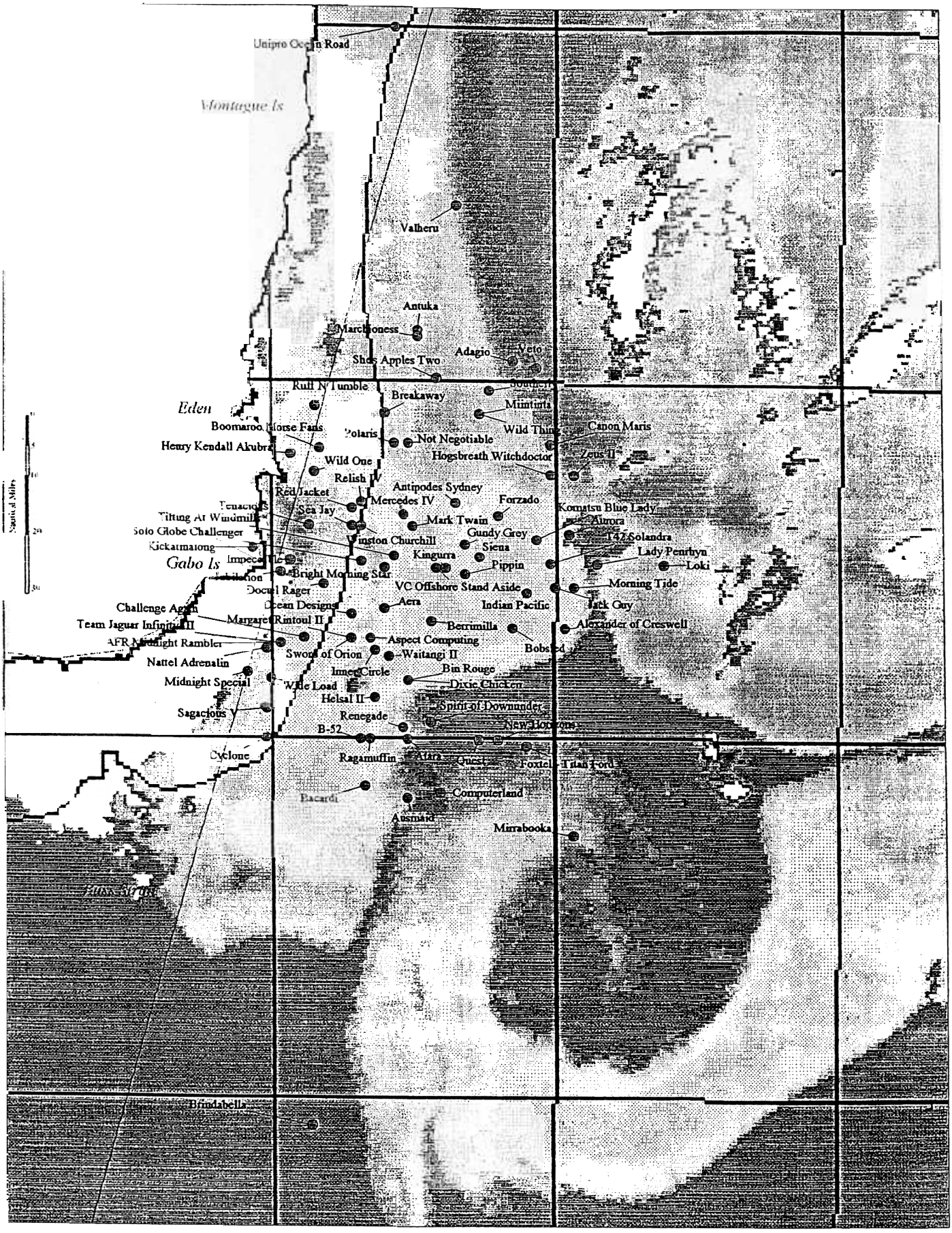
Map 3 - Position of yachts that retired, when the storm front hit (over cloud conditions for 1604 hours on the 27th December 1998)



"The underlying image was created from data received and processed by CSIRO Marine Research at Hobart from the Advanced Very High Resolution Radiometer (AVHRR) instrument from onboard the USA's National Oceanographic and Atmospheric Administration (NOAA)

"The image uses NOAA-14 AVHRR BAND4 infra-red (thermal) data to describe cloud top conditions for 1604 hours on the 27th of December, 1998 (AEDST)."

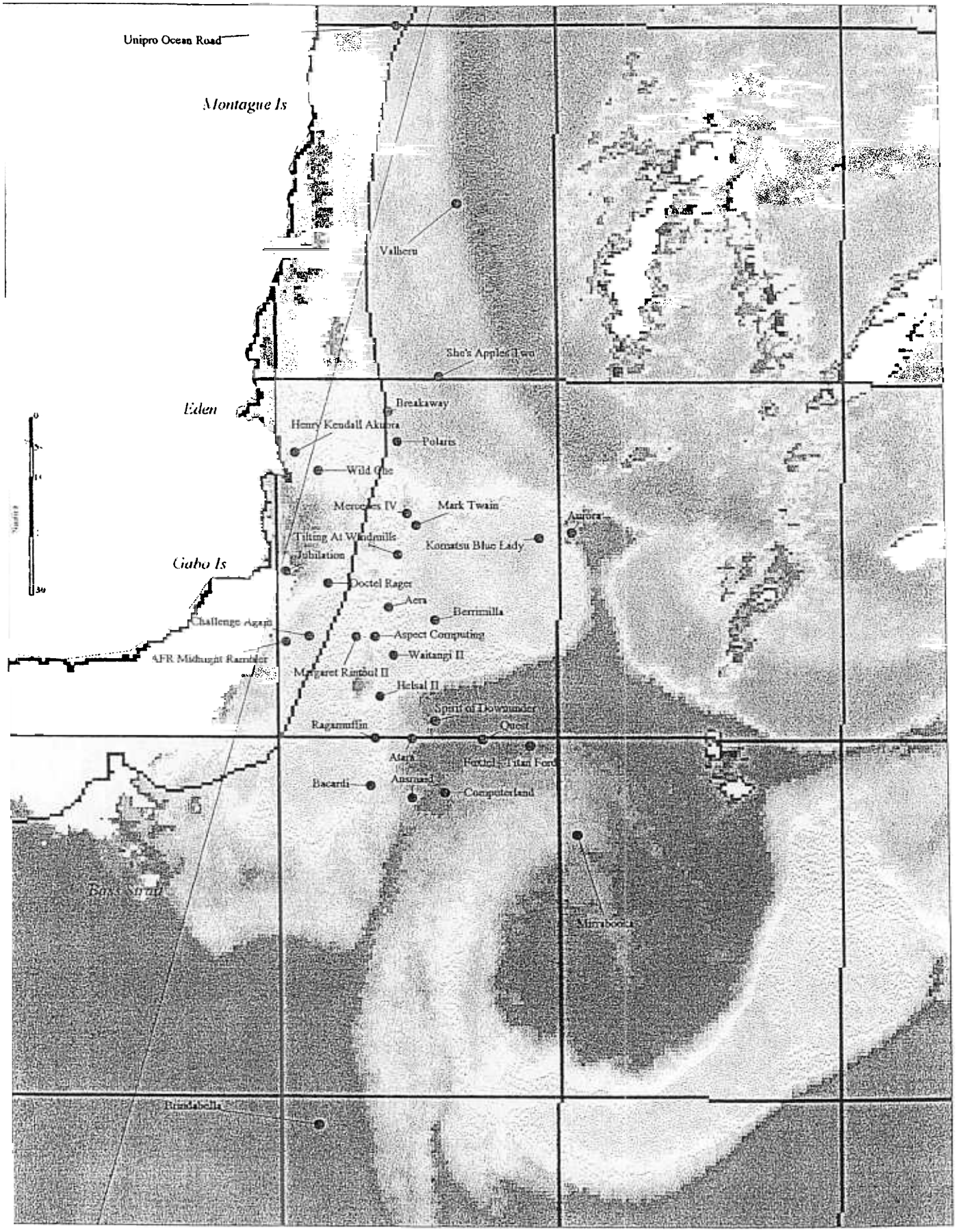
Map 4 – Position of fleet when the storm front hit
(over sea surface conditions at 2116 hours on the 23rd December 1998)



"The underlying image was created from data received and processed by CSIRO Marine Research at Hobart from the Advanced Very High Resolution Radiometer (AVHRR) instrument from onboard the USA's National Oceanographic and Atmospheric Administration (NOAA)

"The image uses NOAA12 AVHRR BAND4 and BAND5 infra-red (thermal) data to describe sea surface temperature conditions for 2116 hours on the 23rd of December, 1998 (AEDST)."

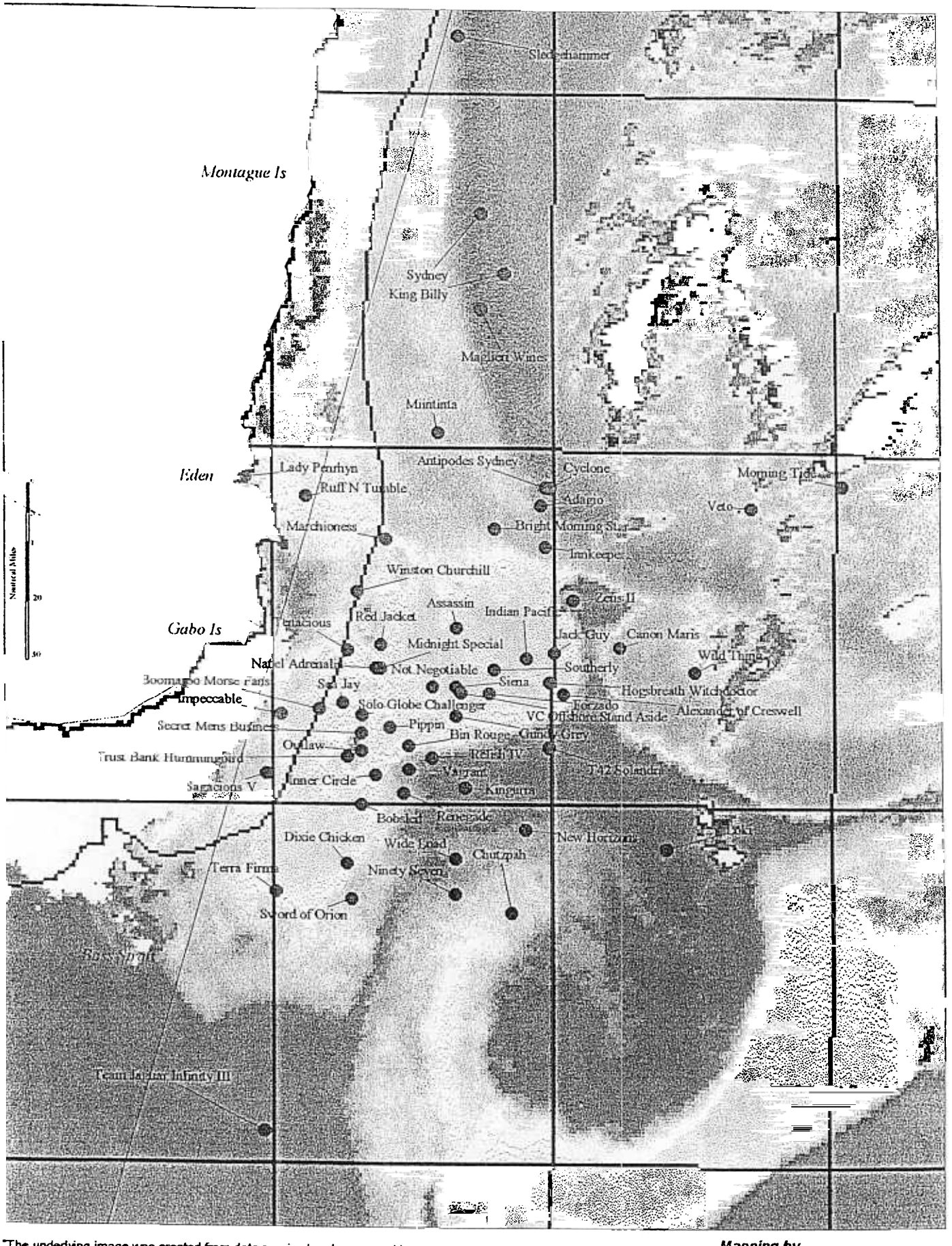
Map 5 - Position of yachts that finished, when the storm front hit (over sea surface conditions for 2116 hours on the 23rd December 1998)



"The underlying image was created from data received and processed by CSIRO Marine Research at Hobart from the Advanced Very High Resolution Radiometer (AVHRR) instrument from onboard the USA's National Oceanographic and Atmospheric Administration (NOAA)

"The image uses NOAA12 AVHRR BAND4 and BAND5 infra-red (thermal) data to describe sea surface temperature conditions for 2116 hours on the 23rd of December, 1998 (AEDST)."

Map 6 - Position of yachts that retired, when the storm front hit (over sea surface conditions for 2116 hours on the 23rd December 1998)



"The underlying image was created from data received and processed by CSIRO Marine Research at Hobart from the Advanced Very High Resolution Radiometer (AVHRR) instrument from onboard the USA's National Oceanographic and Atmospheric Administration (NOAA)

"The image uses NOAA12 AVHRR BAND4 and BAND5 infra-red (thermal) data to describe sea surface temperature conditions for 2116 hours on the 23rd of December, 1998 (AEDST)."

5.0 INFORMATION AND COMMUNICATIONS

5.1 CYCA Race Management – Internal (CYCA Sydney, Race Centre Hobart, Radio Relay Vessel, Fleet)

5.1.1 Summary of Administrative Procedures Relating to Entry and Eligibility of Yachts

The NOR, the document that details the event's rules and regulations is assembled soon after the preceding year's race. The document is compiled by the Sailing Office staff, amended as necessary on the basis of issues arising out of the previous event and accommodates changes necessary to meet the needs of the following one.

The NOR is then reviewed by the Yachting Association of NSW Racing Rules Committee for technical accuracy and circulated through the Sailing Committee and selected delegates of the Race Jury. Once approved, it is sent for printing.

Around mid-year the NOR is sent to major Australian and selected overseas yacht clubs, competitors from the previous two races and any individuals who have made an inquiry or requested a copy. From the NOR, the Sailing Office receives Applications for Entry from individual yachts. This process continues for the period from issue up to the closing date (2 November in the case of the 1998 event). The Application prescribes under Item 6.0 to 6.2.4 that specific information on eligibility be provided, including crew experience, IMS Certificates (for IMS measured boats) that detail stability and scantlings requirements, as well as alerting potential entrants of safety requirements.

Applications are reviewed by the Sailing Office staff with particular reference to crew experience, stability and the IMS Certificate. If regarded as acceptable, the applications are approved. Approved applicants are forwarded an Entry Form. An estimated 60% plus of the fleet were regular

competitors with the same boats and crews, sometimes new boats with same crews. In these cases, approval is regarded as a relatively straight forward process. For "unknown" yachts or crew the review is more intense and is usually referred to the Sailing Manager or possibly the Chairman of the Sailing Committee. On some occasions, a matter will be referred to the Sailing Committee for a decision.

In 1998 some 8-10 applicants were asked for more information or asked to provide additional crew with more experience, prior to being sent an Entry Form. Three applications were referred to the Sailing Committee, one due to lack of sailing experience of the crew, the other two (Jarkan and Noumea) for issues relating to eligibility.

Entry Forms are then completed and returned to the Sailing Office. Attached to that form should be:

- Cat 1 Safety Certificate
- Radio Check Certificate
  A photo of the Yacht
- Entry Fee
- Insurance Certification

They are also advised of deadlines when these and other information are required at the Sailing Office.

No records are kept of when information is received and staff was unclear as to the timeliness of the receipt of data. Their estimate is that about 80% are lodged on time with the remainder requiring follow up. Lodgement of IMS Certificates is the biggest problem due to finetuning of boats and the re-measurement process. Late lodgement compounded by a build up of other activity associated with the Race creates additional workload for the

Sailing Office and places considerable pressure on the administrative process. In 1998 this was exacerbated by the frequent absence of one staff member on duties outside the Sailing Office.

Receipt of final forms is logged on a grid in the Sailing Office by authorised individuals. For example, only the Chief Safety Officer can log the receipt of a completed safety check. This system is regarded by management as efficient and effective and not open to abuse.

Information is accumulated in folders of common subjects (Safety Certificates, IMS Certificates etc) and is not cross-referenced. Additionally, information received is not cross-referenced with earlier data from the Application for Entry. For example the Race Application Form requires information to qualify that at least 3 crew members to have the necessary experience to meet the eligibility requirements of the race. There is no cross check on the crew list submitted later to confirm that any or all of these people are on the boat at the time of the race. In one instance, the same crew person was in fact found in multiple applications.

Prescribed paperwork for competing yachts was mostly present and correct. These were IMS and CHS Certificates, Safety Certificates, Insurance and crew lists. Some PHS information was missing.

PHS boats must comply with Notice of Race Item 6.1.5, 6.1.6, 6.1.7 and 6.1.8. These Items specify the eligibility of the yacht with respect to construction and stability. There were 22 instances where proof of stability was not supplied. Sailing Office practice has been to accept yachts that previously competed in the SHYR on the basis of their previous acceptance, given that currency of information is not required for PHS yachts, as it is under the IMS Rule. Examination of the CYCA files

showed that all certification for these yachts was on file, but not in the 1998 Race data files.

Crew lists, with names, addresses and contact numbers for NOK are lodged with the Sailing Office. A process exists to change crew at any time through the submission of a different coloured form. This latter process appears to work efficiently.

The accuracy of the information on crew lists, whilst the responsibility of the skipper (or his representative) to supply, was found to be inaccurate when relatives needed to be contacted. Additionally, contacts were often not at the numbers/addresses listed because of the holiday period.

Race Management Structure

The RRS requires that the Organising Authority appoint a Race Committee. The Race Committee has the responsibilities detailed in the ISAF Race Management Manual and the RRS. As the SHYR is an annual event, run over the same course and therefore has the same requirements each year, the CYCA delegates much of the administrative preparation that would normally be done by a Race Committee to the Club's Sailing Management.

The Race Committee has the power to shorten or change the course, delay the start or abandon the race entirely.

The CYCA also appointed a Race Management Team. This team was primarily responsible for the activities directly associated with the race, management of the start, communications with the RRV, collection of position reports, calculation of results and search and rescue coordination. It also had post-race management responsibilities including calculation and publication of final results and post-race reviews.

In 1998 this team included two CYCA Sailing Office staff and one volunteer. Two of the team hold formal qualifications in Race Management. The delegate from AMSA is available to the team at all times.

The RYCT also had its own SHYR Committee that organised a Telephone Information Centre, fleet docking logistics, a dockside Race Information Centre and the facilities for the RCC.

The last part of the formal race management structure is a Race Jury, appointed by the Organising Authority. The Jury plays no part in the management of the race as its function is to hear protests related to rule infringements from competitors.

The Sailing Committee approve the SI and in doing so, appoint the Race Committee. Item 3 of the SI noted the following as members of the 1998 Race Committee:

Hans Sommer (CYCA Vice Commodore) - Chairman

- Howard Elliott

Robert Badenach (RYCT Immediate Past Commodore)

David Boyes (RYCT Commodore)

Bruce Rowley (CYCA General Manager)

- Mark Robinson (CYCA Sailing Administrator) and

Phil Thompson (CYCA Sailing Manager).

The responsibilities of this Committee are presented in ISAF Race Management Manual Section 2.3. This manual is more specifically targeted at regatta sailing organisations rather than long offshore racing. The Chairman of the Committee was unsure of the precise responsibilities of the Committee as a result.

The Committee met in Sydney on 24 December to construct the IMS Handicap course. The Committee, or a number of its members, was always present in the Race Control Centre (RCC) at the RYCT in Hobart from 0300 hours on 27 December and reacted to incidents as they occurred. Race Committee members played the major role in liasing with AMSA (Anthony Hughes was also at the RYCT), the RRV and interfacing with relatives/friends of yachts in trouble.

5.1.2 Management of the 1998 Event

Race Management progressively moves from Sydney to Hobart from late on 26 December and formally hands over to be fully operational at its RCC at RYCT from midday on 27 December. The decision to control the race from Hobart was precipitated by the 1993 race, believing it to be a more effective method of managing the race.

The RRV is responsible for conducting position report Skeds. Race Management monitored Skeds from RCC and was in regular contact with the RRV.

Under normal circumstances the role of the RCC is to collate position reports and produce results for the media and friends and relatives of those racing. Typically the Media Director visits the RCC soon after each Sked to get updated information prior to writing press releases or holding press conferences.

The Media Centre for the SHYR was located at the CYCA until late on 26 December, with a token presence up until midday on 27 December. From 26 December it was established in dedicated rooms at the Grand Chancellor Hotel, Hobart, some 10 minutes by car from the RCC.

The SHYR Media Director is employed by the race sponsor. The Media Centre exists primarily for the benefit of the sponsor, to maximise favourable coverage of the event.

Although the CYCA did not have a formal disaster plan, the Race Management infrastructure has been developed and refined over time. It has coped with races with high attrition, notably 1984 and 1993, and complex logistics as was the case in 1994 with 396 entrants in the 50th SHYR.

In addition, the management of the situation did not suffer appreciably, due to the lack of a formal crisis management plan. This was because:

- AMSA takes control of maritime distress calls and is accountable for management of SAR incidents,
  the formal race infrastructure (RRV/RCC) was well equipped to cope, and
  an informal infrastructure of experienced volunteers took control of the additional administrative burden created by the crisis in Sydney and Eden. Although this group performed a valuable service, it did not have a bearing on the on-water management of the incidents.

In Hobart at the RCC, the SHYR Committee had to deal with a number of separate issues. Their primary responsibility was coordination of the on-water incidents with AMSA. These involved:

- coordination/communication AMSA→RRV→fleet and
  fleet→RRV→AMSA,
  working with/advising AMSA on assessing the situation and its potential,
  setting up information flow for NOK, including manning phones,
- notifying (with the Police) NOK of fatalities, and

- contact with the BOM.

Like Sydney and Eden, the RCC was inundated with phone calls and the system was unable to cope with the volume.

Apart from the volume of traffic being dealt with, one other important issue emerged, namely notification of NOK of fatalities. As no procedure was in place, various discussions took place with AMSA, the Tasmanian and NSW police as to who had accountability for formal notification. On this point there was never any clear consensus and Race Management remains unclear of this responsibility.

The time taken to notify Winston Churchill relatives of the fatalities, for example, was unnecessarily long. Death certificates were issued at approximately 1000 hours and relatives in Sydney notified by local police around 1400 hours on 29 December. Despite repeated phone calls from RCC, the NSW Police did not confirm notification to RCC until 1900 hours. This delay caused extreme embarrassment, frustration and unnecessary anguish to many people, both within Race Management as well as without.

The "informal" race infrastructure in Sydney and Eden

From 0230 hours on 27 December Mr Peter Bush, and subsequently a number of volunteers, were on duty at the CYCA. Bush had been appointed to be media spokesperson until such times as the Club's Commodore, Mr Hugo van Kretschmar, completed the race. Bush arrived at the CYCA at 0230 hours in order to hear the 0300 hours Radio Sked to appraise himself of the yachts' positions before talking to the press.

Bush had been monitoring weather reports and was concerned that conditions similar to 1984 – a low pressure system called an East Coast

Low might develop. With this, he anticipated winds of 45 knots and a likely high attrition rate. Although those conditions were still some hours away, Bush decided to stay at the CYCA after the 0300 hours Radio Sked until he was no longer required, expecting a large number of retirements and the need for media comment.

During the course of the afternoon on 27 December Mr Greg Halls, a previous SHYR Race Director and veteran of 13 SHYR, telephoned Bush to advise that he was available to go to Eden on the NSW south coast, the likely retirement destination for the fleet. Halls was following the race through the media and his own HF radio set. He also assumed that the forecast of 45+ knots would produce a high attrition rate.

After discussion, Bush and Halls agreed that there was likely to be a need in Eden if conditions developed as forecast and agreed to talk later. Bush phoned Halls some 3 hours later and Halls departed immediately for Eden at around 2100 hours on 27 December.

As incidents developed on the race course, relatives and friends began to seek information with increasing frequency. For many, their first call was made to the CYCA because:

they were not aware of the Race Information Line, or numbers (later, they complained of being unable to get through),

the Internet site was virtually inaccessible and was not, in any case, kept up to date,

they saw the CYCA as the Race Organiser and assumed that the Club would be manned and have the answers they required, and

the bulk of the crews, and therefore relatives, are Sydney-based.

A group of up to 14 volunteers handled a range of inquiries from relatives, friends and the press. Up to 40 media personnel were on site at the CYCA for much of the crisis, having assumed, as friends and relatives did, that the race was being managed out of the CYCA.

Information flowed to/from the team in Sydney from:

direct calls with the RCC in Hobart,

direct calls with the Media Centre in Hobart,

- listening to the race frequency, on a radio set up in the Sailing Office, and as reception was often poor, on a yacht on the marina,
- news reports (often the Situation Room was made aware of an incident from the media, before being advised by AMSA or the RCC), and telephone calls from interested parties.

Halls arrived in Eden at 0220 hours on 28 December and after a briefing with the local police joined the RVCP for the 0300 hours Radio Sked. Halls had also called in at Bega Hospital en route to appraise himself of the available facilities.

Halls assisted police and the RVCP in managing the incidents involving Team Jaguar, Miintinta, Business Post Naiad, Nattel Adrenalin and Renegade medivac.

From the first light he did the rounds of yachts in Eden, advising of the CYCA presence and that assistance was available. Halls also provided briefings for local police, the Water Police, Community Services, Pambula Hospital, air operators in Pambula, the ABC helicopter, plus liasing with the CYCA in Sydney and the RCC in Hobart. Halls was frustrated by his inability to contact race officials in Hobart, particularly their failure to respond to his messages.

Halls set up an "Operations Centre" at the Public Works/Harbour Masters Office in Eden. He continued the liaison between local authorities, the CYCA and the RVCP, particularly helping with yacht identification, crew lists and advice to NOK.

Halls was also confronted by between 30 and 40 media personnel, whom he reported as being better informed on the incidents than SAR and government authorities.

Other issues that created management difficulties were:

- the volume of calls from the crews' NOK,
  the absence/lack of documentation available locally on yachts and crews from the CYCA,
- the lack of resources, resulting in a lack of sleep affecting Halls' efficiency and effectiveness, and
- SAR authorities' poor internal communications and non-overlapping of essential services, creating additional but unnecessary work.

Communication between the CYCA-RYCT-Eden and the Media Centre was often difficult. There was no overall control point for information and personnel would rotate without people in the other locations knowing. In addition, mobile phones were diverted or turned off.

Information from the fleet is, in practice, limited to the twice-daily mandatory position report Skeds at 0300 and 1400 hours. Ad-hoc information is reported to the RRV in case of an incident or retirement. Many people making inquiries about yachts were extremely frustrated that they could not get more current information as they did not know about the twice-daily Sked procedure. They clearly expected the CYCA, RCC etc. to have current accurate information.

The volume of calls was also an issue. Multiple callers made inquiries about individual crew members. In Sydney media inquiries demanded a dedicated person, full-time. Neither Sydney nor Eden was well appraised of developments and as a result, was only able to pass on limited information.

5.1.3 Radio Communications

The primary method of communications between the fleet, the RRV and RCC is High Frequency (HF) radio. Very High Frequency (VHF) radio is also used as a secondary source.

Both HF and VHF equipment are prescribed under the Cat 1 Safety. The major difference between HF and VHF is the distance over which effective communication can be maintained. HF is still a major radio communications method for maritime and aeronautical use, primarily because of its range. The 4 kHz band is used, with the primary race frequency of 4483 kHz. The 6 kHz band is designated as the second race frequency. 4483 kHz is recognised as being a good "working" frequency for the race, offering good local as well as medium distance communication capabilities.

The RRV uses a standard marine HF radio, transmitting with a power of 150 watts, with an antenna system similar to that used by the fleet. The installation and commissioning of the radio on the RRV is critical and results in a higher quality signal which can be heard by the whole fleet as well as the RCC and the CYCA. Only a few yachts exhibited similar signal qualities.

In addition to the HF, the RRV was also equipped with VHF, SatCom C and an analogue mobile phone. Mobile phone coverage is accessible during less than half of the race.

SatCom C provides an "email-like" capability to exchange of text messages and a facsimile service. SatCom C communications have been used sparingly since trials in the 1997 SHYR identified very high costs associated with it (6 exchanges cost almost $1000). SatCom C is a "store and forward" communications method, representing not real time and consequently unsuitable for emergency use.

The quality and reliability of communications between RCC, the RRV and competitors were not as good as it could have been, with some intermittent and low quality transmissions taking place.

The HF installation on the RRV was inadequate as was evidenced by its inability to provide continuous high quality HF communications. The RRV had some difficulty hearing and being heard at various times by parts of the fleet. In addition, the RRV had to have an emergency installation during the first few hours of the race. While this did not impact on the race, if the problem had emerged later, it could have been disastrous.

It should be acknowledged that the average yacht's HF installation will always be less than optimum. At the very least the antenna systems used by most yachts (backstay antenna or deck mounted whip) are not efficient. The physical length of these antennae is significantly shorter than the required electrical length. The optimum length for a half wave antenna for 4483 kHz is approximately 32m. Any other length results in transmitted power being directed through the earth system that is effectively lost. If, in addition to this, the effect of the antenna being inclined (as the boat heels), a poor power system (due to low battery power or poor connections) and a poor earth system, are taken into consideration the result is reduced transmitted power – ie reduced signal.

Another problem that surfaced in the 1998 SHYR was the inability of the RRV to efficiently utilise an additional channel for distress management. It became apparent very quickly, that the load on the 4483 kHz channel was far too great. In hindsight, some traffic could have been redirected to another channel and normal race communications continued on 4483 kHz. This would only have worked if:

(a) the RRV had a second HF transceiver installed, and

(b) the RRV had a second radio crew to manage traffic.

Finally, the RRV did not have the capability to communicate directly with many of the SAR aircraft, particularly fixed wing aircraft. Aircrafts are not normally fitted with Marine VHF Channel 16 which operates on 141.3 MHz, and use Aviation frequencies 121.5 MHz (distress) and 123.1 MHz (search and rescue).

RCC-Fleet

Prior to 1990, RCC used the HF facility at the CYCA and the RYCT to communicate with the RRV. This installation was also intended as back up for fleet communications in the event of a failure on the RRV. Since 1990, RCC has made use of a product from Telstra called Yachtcoms. Yachtcoms is basically remote access to the Telstra Maritime HF transceivers using a normal telephone line.

Prior to 1996, Telstra operated maritime HF facilities in Sydney, Hobart, Melbourne and Brisbane. These facilities have now been consolidated into facilities in Melbourne and Brisbane.

For the SHYR, the Yachtcoms facility is linked to the Brisbane HF installation. This means that the RCC is transmitting and receiving via Brisbane throughout the race. In practice, this results in reasonable communications in the early part of the race (when the fleet is north of

Gabo Island), poor communications across Bass Strait and almost zero communication as the fleet moves down the Tasmanian coast. To overcome this, the RCC uses the HF installation at the RYCT as the fleet moves closer to Tasmania and while the fleet is moving down the Tasmanian coast.

Yachtcoms provide a reasonably good received signal from the RRV for about two thirds of the race in good weather conditions. In adverse weather conditions and for the latter part of the race the RRV is often out of range.

The Yachtcoms service has three major drawbacks:

(a) there is only one remaining handset available. Telstra has already provided notice to discontinue this service when the current handset dies,

(b) the antenna farm is located in Brisbane which makes it difficult to communicate with the RRV in the conditions noted above, and impossible to communicate with the fleet as a whole after about the first day of the race, and

(c) Yachtcoms are totally controlled by Telstra, that is, the RCC cannot have the system operate continuously, nor can it change frequencies during operation.

These three issues make it impossible to provide completely reliable communications facility between the RCC and the fleet.

The existing RRV-fleet communications strategy does not cover two important cases:

(a) a failure in RRV communications, and

(b) excessive load on the RRV as seen in the 1998 SHYR.

5.1.4 Review of Recommendations Stemming from the 1993 SHYR

In 1993, 104 yachts started the SHYR and after enduring winds of up to 75 knots, 66 yachts had retired, 44 of which were voluntary and 22 for involuntary reasons.

The CYCA sent a questionnaire to competing yachts and received 78 responses (75%). The findings from this Review were (for full details refer to Appendix 15):

- the mandatory safety equipment carried on board of yachts was more than adequate for the gale force conditions encountered (76% of respondents finding equipment adequate, plus 8% with no comment),
- skippers also endorsed the RRS Part 1, Fundamental Rules 4 stating that " a boat is solely responsible for deciding whether or not to *stop* or *continue* racing", and
  response to the questionnaire highlighted a number of problem areas but there "appeared no need for further regulation."

Recommendations from the Sailing Committee included (quoted verbatim):

- "educational seminars for competitors in heavy weather boat handling techniques necessary to conserve yachts under such conditions, together with education and training of crew in safety equipment and safety procedures as part of an essential requirement for acceptance in the SHYR,
  closer scrutiny of crew experience before long ocean races to ensure that each yacht competing has experienced sailors aboard,
  development of more "user friendly" safety equipment to encourage crews to wear safety harnesses and life jackets when on deck, especially at night,

- encourage the use of safety equipment including the carrying of personal strobe lights,
- development of an inflatable life jacket with crutch strap, lifting eye and pocket for light, bleeper and safety line,
- annual checks by yacht owners of all webbing and stitching on safety harnesses against salt water deterioration,
  refinement of radio communications and improved radio protocol by yacht operators, including special courses during the year,
- compulsory 24-hour listening watches by all yachts if and when directed by the RRV to broaden the Club's race safety net."

As a direct result of the review of the 1993 SHYR the following actions were taken:

- introduction of the Application for Entry, giving the Sailing Committee the ability to assess the sea going qualities and crew experience of each yacht,
  relocation of Race Management to Hobart,
  introduction of a "Radio Certificate" (radio check by qualified person) as part of the Safety Requirements, and
- inclusion of AMSA as advisers to the Race Management Team.

Each of these changes had a positive impact on the overall safety net provided for the event, as documented by the results gathered by the 1998 Questionnaire.

The CYCA did not pursue the recommendations on:

- educational seminars on heavy weather sailing and crew training in safety equipment,
- the development of more user friendly safety equipment,

the encouragement in the use of personal safety equipment and its use at night,

- the development of an inflatable life jacket of the type described above,

  annual inspection of harness webbing, and

  compulsory 24-hour radio listening watches.

An inflatable life jacket/harness similar to the device described is commercially available and was on board a number of yachts. However, these other issues that emerged during the course of the investigations into the 1993 event are still relevant and have emerged again in 1998. The CYCA is remiss in not pursuing and implementing the 1993 Sailing Committee's recommendations more rigorously.

5.2 Media – Publication of Intercepted Information

The SHYR has historically been covered by local, interstate and international "yachting" journalists. These journalists are well "educated" on the sport and fully conversant with the rules, regulations and safety requirements of the event. This group traditionally moves to Hobart soon after the start of the event, and is appraised of the fleet's progress through random briefings after each Radio Sked.

Soon after it became clear that there were multiple incidents in the race, the news media, as opposed to yachting journalists, became heavily involved in reporting on the event. News media are usually not "yachting literate".

From a situation where race information was largely single source (Media Centre in Hobart), the news media, in their efforts to report, pursued several sources:

- some 40+ were full-time at the CYCA and relied on briefings from the CYCA,

- approximately 30-40 covered the south coast ports, and accessed the RVCP, Coast Guard, police and crews of retired yachts,
  some were aloft in aircraft, and
- some used radio scanners to listen to yachts and SAR officials.

This process resulted in numerous instances of information being reported direct from yachts or SAR aircraft to radio and TV stations and newspapers. This in its own right is not an issue. However, with rapid reporting direct from incidents, information often proved to be erroneous. As messages between the RRV, RCC, yachts and SAR were often "work in progress", relays by one party on behalf of another, they were often incomplete or approximations/estimates rather than absolutes.

The result was that not only was misinformation reported but also relatives, friends and interested parties inundated race authorities in Sydney, Hobart and the NSW Police on the south coast seeking information that those authorities simply did not yet have, and had not been released by AMSA. In some cases families and friends were simply acting on wrong information.

There are at least six instances of journalists reporting incorrect information that led to considerable distress for families and friends. Moreover, the media reported fatalities on board Business Post Naiad and Winston Churchill, long before the issuing of death certificates. Direct reporting, without approvals from AMSA, made it difficult to ensure only correct information went to relatives and the general public.

5.3 Overall Co-ordination and Dissemination of Information

The dissemination of information for the SHYR has been the responsibility of the Media Director and the Media Centre. The centre is established in early November at the CYCA and is relocated to Hobart late on 26 December after the start of the race.

The primary role of the Media Centre is:

- promotion of the event and the sponsor,
  the conduct of media briefings before/during/after the race,
  updating of results, and
  ensuring information passed to the media is accurate and up-to-date.

The Media Director and his team, with the exception of a CYCA employee, Ms Lisa Smith, are retained by the sponsor, and as a result are focused on maximising exposure for the sponsor of the event.

When the crisis developed and multiple information sources emerged, it became apparent that the Media Centre was not able to effectively handle the demand, because:

- their focus remained on "promoting the event" for some time,
- they were not often appraised of the current situation,
- there were too many sources of information, ie Sydney, Eden, Hobart and literally dozens of "experts" introduced by the media.

It is not unreasonable that reporters receive regular accurate briefings, but the fact that the Media Centre was in Hobart precluded this being achieved. In addition, the Media Centre had no concept of the demand being placed on other centres. Finally the Media Centre was by and large dealing with yachting journalists not news media, the latter who, as previously noted, had little understanding of the yachts and the circumstances under which they were racing.

6.0 ABILITY OF YACHTS AND THEIR EQUIPMENT TO WITHSTAND THE CONDITIONS

6.1 Boat Construction, Including Masts and Rigging

From the interviews and Questionnaires, it is clear that the 1998 fleet had to deal with conditions that were by and large different from 1984 and 1993; both races with high attrition

1984 was exceptionally tough on yacht structures and rigs, because of wind over current. Winds were generally 40-45 knots and the current in places was running at up to 4 knots. This created a particularly nasty swell and steep waves with hollow, or no backs, that had the effect of launching boats off the tops, and dropping them into the troughs. The constant slamming inflicted significant damage on hulls and broke masts. In 1993, the fleet faced stronger winds (winds in excess of 50 knots were common) that in turn produced bigger seas. Thus, it was the size of the swell and waves that caused the damage in 1993.

In 1998, the weather front was, compared to 1984 and 1993, short lived. Yachts reported that exceptionally large waves were responsible for virtually all the damage inflicted. Unlike 1984 and 1993 where the seas were very much head on, yachts in 1998 had seas much more on the beam. This was certainly the case with all the yachts that found themselves in serious predicaments. Large breaking waves also meant that decks were constantly awash and water ingress to the cabin created additional problems, particularly for engines, electrical systems and instrumentation including navigation equipment and radios.

The condition of yachts also needs to be reviewed in the context of the normal wear and tear that is inflicted in the course of a SHYR. While this is not recorded each year, experience demonstrates that it is not unreasonable that the following occurs:

minor to moderate sail damage,

- chaffed/broken halyards, sheets and braces,
- damaged (bent/broken) stauncheons and lifelines,
  flat batteries and minor electrical problems,
- broken boom or spinnaker pole and
- one or two yachts will each suffer rudder damage, dismasting and/or minor structural damage.

Profile of the 1998 fleet:

The following is a brief statistical analysis of the 1998 fleet.
Full details appear in Appendix 16.

	Mean
	13.2 metres
	11.7 years
Age of Mast	7.7 years
Age of Rigging	3.3 years
Number of previous SHYR	4.3

Keel type	**Percentage**
Full length	11%
Fin	42%
Fin with Bulb	47%

Construction Material	**Hull (in %)**	**Rudder (in %)**
Timber	15%	12%
Alloy	5%	5%
	60%	62%
Exotic	20%	21%

Mast type	Percentage
Alloy	
Carbon	
Timber	
No answer	1%

Rigging Type	Percentage
Rod	
Dyform (stainless steel)	
1x19 stainless steel wire	
No answer	2%

Examination of the damage at the end of the race for the total fleet, is covered by the following table, ranking the damage from the most common to the least commonly occurring. These data were extracted from the returned Questionnaires (total number of 110).

Damage to yachts in the 1998 SHYR

Extent of Damage	Total	Yachts Retired	Yachts Finished
Total	110	70	40
	100%	64%	36%
Sail Damage	42	23	19
	38%	33%	48%
Rig Damage	23	18	5
	21%	26%	12%
Life Lines Damaged	20	14	6
	18%	2%	15%
Wind Instruments/Log Unserviceable	20	14	6
	18%	2%	15%
Other Structural Damage	18	10	8
	16%	14%	2%
Electrics Unserviceable (Not Flat Batteries)	18	15	3
	16%	21%	8%

Extent of Damage	Total	Yachts Retired	Yachts Finished
No Answer		7	9
	15%	10%	
Other Damage	13	10	3
	12%	14%	8%
Steering Damaged/Broken	12	10	2
	11%	14%	5%
Engine Unserviceable (Flat Batteries)	12	9	3
	11%	13%	8%
Boom Damaged/Broken	11	7	4
	10%	1%	1%
VHF Unserviceable (Flat Batteries)	11		4
	10%	1%	1%
Other Radio Damage	11	9	2
	10%	13%	5%
GPS Unserviceable (Flat Batteries)	11	6	5
	10%	9%	12%
Port Hole/Window Breached	10	10	0
	9%	14%	0%
Dismasted	10	10	0
	9%	15%	0%
HF Unserviceable (Flat Batteries)	9	6	3
	8%	9%	8%
Internal Frames (Hull)	8	7	1
	7%	10%	2%
Internal Frames (Cabin)	8	7	1
	7%	10%	2%
Vessel Abandoned/Sunk	5	5	0
	5%	7%	0%
Torches Unserviceable	6	4	2
	5%	6%	5%
Nil Damage	5	4	1
	5%	6%	2%
Other Engine Damage	5	3	2
	5%	4%	5%
Deck Breached	4	4	0
	4%	6%	0%
Electrics Unserviceable (Flat Batteries)	4	1	3
	4%	1%	8%

Extent of Damage	Total	Yachts Retired	Yachts Finished
Hull Breached	3	3	0
	3%	4%	0%
Keel Damage	3	2	1
	3%	3%	2%
Rudder Damage	2	2	0
	2%	3%	0%

(*NB: multiple responses occurred, percentage figures are rounded)

This damage sustained across the fleet did not necessarily prevent yachts from continuing in the race. There were 71 retirements in the 1998 SHYR (70 of which returned the Questionnaire). Each was asked to give their primary reason for retirement and list contributing factors.

Primary reasons for retirement:

45% - prevailing weather conditions or forecast of continued poor or worsening weather,

38% - yacht or equipment not in condition to continue, and

9% - crew not in condition to continue (mainly seasickness)

Of the 26 yachts that were unable to continue due to "yacht and equipment not in condition to continue'

- 6 - retired before the storm
- 4 - were dismasted
- 4 - had equipment failure
- 4 - had rig damage
- 3 - had hull/structural damage
- 3 - had engine failure
- 2 - retired for other reasons

Five yachts were rolled through 360° after being hit by extreme waves (B52, Business Post Naiad, VC Offshore Stand Aside, Sword of Orion and Midnight Special). Three of these ultimately sunk (VC Offshore Stand Aside, Sword of

Orion and Midnight Special). Each of the five yachts sustained considerable damage to their decks as a result of surface wave action. Each of the yachts that rolled over was also dismasted. Details of each of these incidents appear in Section 7.6 of the report.

Serious damage to yachts, excluding dismastings and roll-overs, is in contrast to 1984 and 1993 a less significant feature in retirements. This is borne out by the Chief Executive Officer of Club Marine (the major insurance company for the fleet) who wrote in the editorial of Club Marine Magazine Vol. 14 No.1 (January 1999): "Final figures are still not available and probably won't be until the CYCA finalises its inquiry, but in my opinion the criticism of yacht designers and mast manufacturers is also not justified. The often quoted 1984 event saw 69% of starters retire, whilst in 1998, 65% retired. Very similar figures, but after analysis, it is shown that 26% of retirements in 1984 were as a direct result of rig failures. So far for 1998, the failure of rigs is around 10%. In 1984, 16% withdrew due to hull failure. Once again, so far for 1998 this figure is looking to be around 5%. So, at this stage, it would appear that the biggest cause for boat withdrawal was sound seamanship and not inadequate hull design or construction. In fact, I am of the belief that the fleet which started the race on Boxing Day, was probably one of the best prepared fleets to ever compete in the event."

6.2 Stability

Stability requirements for the SHYR are stipulated in the NOR Item 6.1.4(c) (for IMS boats) and 6.1.5 9(c) (for PHS boats) and 6.1.7. CHS entrants' requirements are detailed in the "Addendum to NOR CHS Division" Item 6.1.9.

Items 6.1.4.(c), 6.1.5(c) and 6.1.9 require that yachts have a minimum Stability Index or LPS of 115°. Item 6.1.7. allows for yachts that have competed in a previous SHYR to have an SI or LPS of 110 ° or greater.

Mr Andrew Dovell, the Senior Naval Architect with yacht design firm Murray, Burns & Dovell Pty Ltd, has produced a study on the stability of yachts racing in the 1998 SHYR. Extracts from that report follow (a copy of Dovell's study is enclosed in Appendix 17):

"The IMS or International Measurement System, originally drafted in the late 1970's has been the dominant format for offshore yacht racing worldwide for the past 10 years or so. The IMS rule undertakes to assess a yacht's speed potential based on a massive array of design parameters including length, beam, displacement, righting moment, sail area, etc. Each and every boat racing under the IMS must be subject to a lines lift, done on shore and termed the 'hull measurement', and a flotation and righting moment test, termed the 'in water measurement'. One of the outstanding features of the IMS rule is that it provides race organisers with an accurate and objectively determined set of design parameters from which a yacht's general safety levels can be assessed in accordance with the well established standards set down by the ORC in its special regulations (discussed in the next section of this report). In particular the values of displacement, righting moment, and the limit of positive stability are accurately determined as part of the IMS measuring process – critical parameters in determining the seaworthiness of a yacht.

No other racing rule past or present includes this scientific, and objective assessment of stability."(p.1-2)

"For a Category 1 event the ORC Special Regulations specify competing yachts are required to have a limit of positive stability of 115°. The CYCA's Notice of Race modifies this requirement with a grandfathering clause that exempts yachts that have competed in a previous Sydney to Hobart to have an LPS of 110°.

It is of note that the stability requirements specified in the ORC Special Regulations are the result of ongoing study of the subject of intact stability and

have been out in place as a direct result of the research done on the matter in response to the 1979 Fastnet Race tragedy. [This research is documented in the "Final Report of the Directors-Joint Committee on Safety from Capsizing, June 1985". The Joint Committee was the United States Yacht Racing Union (USYRU) and the Society of Naval Architects and Marine Engineers. (ed.)]. *This research has proven a very strong correlation between the LPS and the amount of time a yacht can expect to remain inverted if rolled. This work is based on tank testing experiments and has been verified with experience. It is of note that the boats rolled in the 1998 Sydney to Hobart Race also behaved as predicted in this research."* (p.2)

"An IMS certificate contains an abundance of information about a yacht both in terms of its design and parameters, and its racing data for every wind direction and strength. Hidden amongst all of this is the yacht's length, displacement, and LPS." (p.3)

"The relative lightness or heaviness of a yacht is best defined by its displacement to length ratio. This is typically calculated as displacement in cubic metres divided by length cubed and multiplied by 1000 to make the number of reasonable magnitude. The value of length used in this study is an average of the IMS calculated length and length overall. Typical values for purpose built racing yachts designed in the last 5 years are indicated and form a cluster in the lower third of the graph indicating that these yachts are indeed lighter than their predecessors. Older yachts and heavier displacement cruising yachts have higher displacement/length values, a few noteworthy examples have been pointed out. Those yachts reported being rolled and those that were severely knocked down were individually identified.

[The analysis graphed (ed.)] *the limit of positive stability as a function of length for the fleet, and those yachts that were rolled or severely knocked down are noted. A cross section of the modern racing boats have been pointed out; several*

examples of older heavier designs were highlighted as well. Unlike the trend]...[*for the modern boats to show as a cluster, in the case of the limit of positive stability the modern boats are scattered fairly evenly through the fleet.*

[From the analysis of yachts in the SHYR (ed.)] *it is clear that there is no correlation between a yacht's relative lightness and its susceptibility to being rolled or severely knocked down in extreme conditions. In fact the boats rolled or severely knocked down have displacement to length ratios scattered right across the range of this variable from the extreme of light to the extreme of heavy.*

[It is also (ed.)] *clear that there is no correlation between a yacht's LPS and its susceptibility to being rolled or severely knocked down in extreme conditions. It is noteworthy that the time spent inverted by each of the yachts rolled was in line with the correlation established by USYRU in 1989, and none of the boats report being kept upside down for more than 4 minutes* (up to 6 minutes were reported ed.), *which is the expected value for a yacht with an LPS of 115°.*

About the only correlation that can be formed from [the analysis (ed.) of] *displacement to length and LPS is that most of the trouble was experienced by boats between 11 and 13m in length. I would suggest that this is due primarily to the weather pattern, which hit part of the fleet hardest."* (p.3)

In addition to Dovell's report, a number of yachts was selected to be interviewed on the basis that they were at the higher or lower end of the stability indices. These selections were made without the knowledge of the owner or crews. During these interviews, the interviewer subjectively ascertained whether the performance of the yacht in the conditions varied in any way from each other. Yachts chosen for interviews with a lower limit were Indian Pacific and Wild One, and yachts with an upper limit were Margaret Rintoul II and Ausmaid.

From the interview process, no conclusion could be drawn from the behaviour of higher versus lower stability yachts, with respect to their ability to handle the conditions.

If we consider the 5 yachts that were rolled through 360° and those that got into difficulty through severe knockdowns, there was a range of stability indices, as illustrated by the following table:

Stability of yachts involved in incidents

Yacht	Stability Index	LPS
Solo Globe Challenger	143.1	135.3
Winston Churchill	135.3	123.6
Team Jaguar	133.0	123.6
Kingurra	132.2	125.3
Sword of Orion	127.7	128.8
Midnight Special	122.5	123.5
B52	121.7	119.0
VC Offshore Stand Aside	n/a*	116.0
Miintinta	SV –1.286**	
Business Post Naiad	102.8	104.7

(* earlier IMS Certificates did not calculate a stability index)
(** Miintinta's stability is derived from its IOR Certificate where the SV value –0.25 equates to 115°. At –1.286 Miintinta is significantly over 115°)

Two yachts, Business Post Naiad and Midnight Special, were rolled through 360° twice, the second time after having been dismasted. Their likelihood of being rolled increased after being dismasted. Yacht Designer Scott Jutson explains the role the mast plays in stability: "The mast plays a more important role in the scheme of things when you look at its role in preventing capsize. This revolves around the concept of roll moment of inertia or rotational inertia. This loosely translates into a boat's resistance to being rolled. Most of a boat's rotational inertia is supplied by the mast, so strange but true, a heavier mast will impose more resistance to capsize. Following from this is the fact that a dismasted vessel is much more vulnerable to rolling over and over."

No conclusion can be drawn, because of the diversity of the yachts and their key variables, that anything other than extreme waves and the "luck" of being struck or not, determined the fate of individual yachts.

Details of yachts involved in incidents

Yacht	LOA in metres	No of SHYR	Age in years	Construction	Displacement	Type	Keel	Mast	Rigging
Solo Globe Challenger	13.27	1	14	GRP	Heavy	Cole 43	Full	Alloy	Wire
Winston Churchill	15.5	17	46	Timber	Heavy	Cover-dale 51	Full	Alloy	Wire
Team Jaguar	19.7	6	9	GRP	Medium	Farr	Fin/ Bulb	Alloy	Rod
Kingurra	13.1	14	26	GRP	Heavy	Joubert	Full	Alloy	Wire
Sword of Orion	13.16	3	5	GRP	Light/Medium	Reichel Pugh 43	Fin/ Bulb	Alloy	Rod
Midnight Special	12.17	0	3	GRP	Medium	Jarkan 40	Fin	Alloy	Dyform
B52	12.47	1	3	GRP	Light/Medium	Bashford 41	Fin/ Bulb	Carbon	Rod
VC Offshore Stand Aside	12.5	0	8	GRP	Light/Medium	Young 12	Fin/ Bulb	Alloy	Rod
Miintinta	12.95	1	22	GRP	Heavy	Swanson 42	Full	Alloy	Wire
Business Post Naiad	11.09	2	14	GRP	Medium	Farr 40	Fin	Alloy	Wire

Of these yachts, 5 were continuing in the race and 5 were retired or seeking shelter when they were hit, specifically:

Yacht	Status
Solo Globe Challenger	Racing under bare poles
Winston Churchill	Racing
Team Jaguar	Retired, after dismasting, motoring to Eden
Kingurra	Racing
Sword of Orion	Retired, returning to Eden
Midnight Special	Heading for shelter
B52	Racing
VC Offshore Stand Aside	Heading for shelter
Miintinta	Retired, heading to Eden and took on water from unknown source, possibly delamination midships after being hit by a succession of waves
Business Post Naiad	"Racing" under bare poles, rolled through 360° and dismasted. Rolled through 360° again 5 ½ hours later, while motoring on northerly course

6.3 Serviceability of Engines and Electrical Systems

Several yachts reported the loss of electrical equipment during the race. Eleven percent of yachts claimed their engines were unserviceable due to flat batteries, with a further 4.5% suffering other engine problems, usually fuel blockages.

Sixteen percent reported electrical problems not related to batteries, including failures of GPS, HF and VHF radios. A further 18% reported the loss of wind instruments and logs.

Reasons for electrical failure were not investigated in great detail, as the outcome of the 1979 Fastnet Race showed them to be less important than other factors. From the interviews, water ingress because of big and breaking waves was felt in some instances to have been able to penetrate electrical systems and cause problems.

One additional problem was encountered. At least two yachts that rolled through 360° and spent some time inverted, reported spilling battery acid into the boat. This created an additional health and safety hazard.

6.4 Safety Equipment, Including Life Rafts, Life Jackets, Safety Harnesses, Pyrotechnics, Radio Equipment, EPIRBs

6.4.1 Life Rafts

In the 1998 SHYR, three yachts, Winston Churchill (2), Miintinta (1) and VC Offshore Stand Aside (2), deployed life rafts voluntarily to evacuate crew from vessels in distress. Two yachts, Gundy Grey (1) and Innkeeper (1), reported life rafts washed overboard. Innkeeper's raft canister was washed over intact. Business Post Naiad, deployed its life rafts (2) following their capsize.

Gundy Grey:

At approximately 1900 hours on the Sunday night 27 December, Gundy

Grey was struck by a large wave which laid them on their port side. Both crew were in the cockpit at the time. Both were knocked down by the weight of water for about 15 seconds and when they untangled themselves from the sheets in the cockpit they saw that the raft had gone over the port side and had started to inflate. When the helmsman, Shayne Russell Smith saw the raft he estimated that it was no more than 5 metres from the boat (his comment was "I could only see the colour black, there was no roof".)

Less than 10 seconds later the raft had parted from the tether and was starting to drift away "even then I could only see black, the roof had not inflated" said Smith. There was no speculation at that stage that the raft may still be upside down. The painter was still attached to the strong point on the boat and the raft end of the tether had the plastic plug attached.

The RFD raft canister was secured on a factory base on the deck behind the centre cockpit. It had 3 pad eye strong points, two forward and one aft; each through bolted with four bolts. One-inch webbing straps were sewn round the forward pad eyes, went over the canister and joined to form a loop to which two lengths of venetian blind cord were attached. This venetian blind cord was then looped around a pelican clip attached to one inch webbing, in turn sewn around the aft pad eye to complete the tie down.

The crew was convinced the raft failed to do the job expected of it at that stage to stay tethered to the craft. There was very little forward way by the boat and there were no huge waves at the time to increase the drag on the raft.

The loss of the raft was reported to Race Control on race frequency 4483 kHz. This report included the position and the serial number of the raft.

Business Post Naiad:

Following the second roll-over the crew deployed a life raft which inflated correctly and was tethered astern, where it kept flipping over. Some time later the crew believing, that the yacht was in imminent danger of sinking, prepared the second life raft for deployment. As they were man-handling it through the companionway the life raft inflated. (The crew thought the painter tangled below and triggered the inflation device – ed.). The life raft was eventually deployed and tethered over the side of the yacht successfully. Both life rafts were later carried away after being struck by a rogue wave.

Miintinta:

The crew deployed the yachts' 8 man 'ME Petrel' life raft to carry out a crew transfer from the stricken yacht to the rescue trawler "Josephine Jean". Following deployment of the life raft, which inflated correctly, it was tethered alongside the yacht. The crew then jumped into it from the yacht and awaited retrieval by the rescue trawler. The crew was not aware of any deficiencies with respect to the raft in the entire event.

VC Offshore Stand Aside:

Following the yacht's capsize, two RFD life rafts were deployed, one a 6 man 'ProSaver' valise, the other a 6 man "Pacific" canister type (purchased new November 98). The valise was difficult to get from the cabin to the deck because of its weight and bulk in a confined space. The canister' raft failed to inflate and the crew attempted to recover the canister to manually inflate it. Due to the weight of the canister and the wearied state of the crew, they were unable to recover the raft. The raft and canister tended to hold the vessel beam on to the seaway, creating a hazardous situation. As the other life raft had inflated correctly, the crew decided to cut the tether and release the un-inflated life raft/canister, which separated from the yacht.