The Chairman
Sydney Hobart (RYCT) Committee
Royal Yacht Club of Tasmania
Marieville Esplanade
Sandy Bay
Tasmania 7005

Thursday, February 18, 1999

Dear Mr R Badenach,
1998 Sydney-Hobart Yacht Race

The Radio Communications Committee of the RYCT, having received a number of statements, and observations from Radio Operators who were on duty during the Sydney-Hobart Race, wish to place the following points on record for your consideration and submission to the Review Committee as you see fit.

The Sailing Instructions and Rules published in the Notice of Race are lacking in detail concerning radiocommunication equipment and procedures. Total reliance is placed on the AYF Rules, which are also sadly lacking in this area.

Many yachts suffered radio equipment and battery failure. Reports from a radio surveyor, David Hughes, who was called to repair radio installations after the race, indicate that the radio equipment installation on those yachts was not of an acceptable standard. Reliance on the Australian Yachting Federation (AYF) Rules which states that: "Radio transceivers should be checked annually", is questionable. There is no "standard" to which pleasure craft are surveyed. The AYF set standards in many areas, but sadly, in the case of radio communication installations, the requirements are woefully inadequate. Radio equipment, compared to other items of yacht equipment, is given scant attention in the Australian Yachting Federation Rules.

The reference, under Rules, to "the prescriptions and safety regulations of the Australian Yachting Federation (AYF)", and that "A yacht shall comply with Addendum A AYF Special Regulations Category 1." has little significance when Addendum A states only that:

Marine transceivers shall be fitted with the frequencies/channels specified....

An HF transceiver (shall be) permanently installed.

A marine (VHF) radio transceiver should be provided with a masthead antenna and co-axial feeder with not more than 40% power loss.

An emergency antenna shall be provided when the regular antenna depends upon the mast.

Radio transceivers shall be checked annually.

A proposed "standard" which addresses radio equipment installation, inspection, testing and survey is attached as Appendix A.

Although practiced in navigation and boat handling, few yacht skippers have been actively involved in Distress communication procedures. Many yacht skippers and crewmen who gained their "R/T Certificates" some years ago, have not kept up to date with the changes that have taken place in the last ten years in marine radio communication, and have not undertaken any refresher education and training in this area.

It was observed that a great many Distress calls and messages were transmitted on 4483 kHz which were handled by Young Endeavour, "Telstra Control", to the point that the radio operators became overloaded with work and consequently delays occurred in alerting the shore authorities. Why did the yachts not use the international Distress frequencies of 2,182, 4,125, 6,215 or 8,291 kHz and communicate directly with Melbourne or Sydney Radio? This would seem to indicate a fundamental lack of knowledge with respect to Distress communication procedures. The attached "Guide for Operators of Radiotelephone Stations in Small Vessels" should be displayed near the radio equipment on every boat. (deleted from this Email 22-11-99)

The Radio Instructions must provide clear guidance for yachts as to the procedures to be adopted in the event of Emergency and Distress situations. The directions that are given in the Radio Instructions are inappropriate and out of place (see Radio Instructions para 39.2).

The word "Distress" does not appear in the Contents page of the Sailing Instructions.

Yachts who called Hobart Race Check on CH 81 and were unable to hear the reply from the repeater probably had USA (simplex) mode selected. Many users of marine VHF are not aware of the technical difference between the International channel arrangement and that of the USA.

A great deal of concern was expressed over the action of Telstra Control stating the names of possibly missing or deceased crewmen over HF radio which is monitored by the press and others thus making those names public knowledge. The nature of such information is extremely sensitive and should have been passed over secure communications via Inmarsat to the shore authorities.

Advice given to Team Jaguar by Telstra Control to activate her EPIRB so that her position could be determined was inappropriate, as Team Jaguar was not in immediate danger. Comment has been received that professional Radio Operators (ex Telstra Coast Station) should be employed on Young Endeavour.

It is felt that the role of the Race Support Vessel should be reviewed, and consideration should be given as to whether the Young Endeavour is the most appropriate vessel for that role.

A view was held that all yachts competing in ocean races should carry a 406 MHz EPIRB, especially, since the cost for these EPIRBs has reduced substantially in the last few years. Yachts should also carry large identification letters on their hulls for better visual identification to avoid confusion in circumstances where a number of yachts, in the same area, are in difficulties.

Finally, standards for life rafts need to be established and enforced. It was reported that one of the life rafts was black in colour!

Yours faithfully

Michael Collinson
Chairman, Radio Communications Committee

Appendix A
Radio Installation Survey

Inspection Form

Yacht name
Date
Yacht Sail Number
Location

Tick box to confirm item checked

Items 10 and 18: put N/R if not required

Radio Batteries	Radio Batteries isolated from engine starting batteries
Batteries in suitable location	
	Batteries can be charged by main engine
Electrolyte Level	Electrolyte level in all cells correct
On Load Voltage Test	Battery terminal voltage did not fall below 11.4 v when on load (HF Tx on full power)
Hydrometer	A working hydrometer is kept on board
Battery Terminals	Terminals are tight and well greased
Battery cabling is in good condition	
HF Radio	Installed in a position protected from the ingress of moisture
Frequencies fitted	2182 4125 6215 8291
	2524 4483
Radio Test	ATU effectively tunes HF antenna
Transmission signal reports are satisfactory.	
	Radio Station used for tests

HF Antenna HF antenna in sound mechanical condition

Spare HF Antenna Spare HF Antenna is kept on board and is easily erected

(Spare Antenna is only required if HF Antenna supported by mast.)

Insulators Insulators on HF antenna of good quality and free from defects

Co-axial cable feeder Feeder is sound and of low loss quality with good connections

Radio Earth Radio Earth system is sound and effective–antenna tunes well

Radio Earth Connection Connection to ATU and Transceiver is 50 mm wide copper strip

VHF Radio Installed in a position protected from the ingress of moisture

Channels 16, 67, 6,and 81 fitted. 25 Watt transmit power

VHF Antenna VHF antenna in sound mechanical condition

VHF antenna installed at masthead

Co-axial cable feeder Feeder is sound and of low loss quality with good connections

Spare VHF Antenna Spare VHF Antenna is kept on board

Spare VHF Antenna easily erected and connected

(Spare Antenna only required if VHF Antenna supported by mast.)

VHF Hand Held Radio Channels 16, 67 and 6 fitted. 5 Watt transmit power

VHF Hand Held Radio is Waterproof

Radio Surveyor: Print Name in full:

Signature

The Chairman

R+++qdJ8RšR ®®JJJJq +j+aŋT, š R.$"K-4¿®®Õ"õ The Chairman
Sydney Hobart (RYCT) Committee
Royal Yacht Club of Tasmania
Marieville Esplanade
Sandy Bay
Tasmania 7005

Thursday, February 18, 1999

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An emergency antenna shall be provided when the regular antenna depends

Radio transceivers shall be checked annually.

A proposed ôstandardõ which addresses radio equipment installation, ins attached as Appendix A.

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Yours faithfully

Michael Collinson
Chairman, Radio Communications Committee

Appendix A
Radio Installation Survey

Inspection Form

Yacht name
Yacht Sail Number
Location
confirm item checked

Date

Tick box to

N/R if not required

Items 10 and 18: put

Radio Batteries	Radio Batteries isolated from engine starting batte Batteries in suitable location Batteries can be charged by main engine
Electrolyte Level	Electrolyte level in all cells correct
On Load Voltage	Battery terminal voltage did not fall below 11.4 v when on load (HF Tx on full power)
Hydrometer	A working hydrometer is kept on board
Battery Terminals	Terminals are tight and well greased Battery cabling is in good condition
HF Radio	Installed in a position protected from the ingress
Frequencies fitted	2182 4125 6215 8291 2524 4483
Radio Test	ATU effectively tunes HF antenna Transmission signal reports are satisfactory. Radio Station used for tests
HF Antenna	HF antenna in sound mechanical condition
Spare HF Antenna	Spare HF Antenna is kept on board and is easily ere (Spare Antenna is only required if HF Antenna supported by mast.)
Insulators	Insulators on HF antenna of good quality and free f
Co-axial cable	Feeder is sound and of low loss quality with good connec
Radio Earth	Radio Earth system is sound and effective
Radio Earth Connection	Connection to ATU and Transceiver is 50 mm wide cop
VHF Radio	Installed in a position protected from the ingress Channels 16, 67, 6, and 81 fitted 25 watt transmit power
VHF Antenna	VHF antenna in sound mechanical condition VHF antenna installed at masthead
Co-axial cable	Feeder is sound and of low loss quality with good connec
Spare VHF Antenna	Spare VHF Antenna is kept on board

Spare VHF Antenna easily erected and connecte
(Spare Antenna only required if VHF Antenna supported by mast.)

VHF Hand Held Radio channels 16, 67 and 6 fitted 5 Watt transmit power
VHF Hand Held Radio is Waterproof

Radio Surveyor: Print Name in full:

Signature

The Chairman

Radio Installation Survey and Inspection Form

Yacht Name: _____ Call Sign: _____

Radio Surveyor: _____ Location: _____
(Print Name and Sign)

Owner / Representative: _____ Date: _____

1. Radio Batteries	Radio Batteries isolated from engine starting batteries	☐
	One Battery is Closed or Gel Cell	☐
	Batteries can be charged by main engine	☐
2. Electrolyte Level	Correct Electrolyte level in all cells	☐
3. SG Readings	SG readings of all cells above 1.23	☐
4. On Load Voltage Test	Battery terminal voltage did not fall below 11.4v when On-load Battery Tester applied	☐
5. Hydrometer	A working hydrometer is kept on board	☐
6. Battery Terminals	Terminals are tight and well greased	☐
	Battery cabling is in good condition	☐
7. HF Radio	Installed in a position protected from the ingress of moisture	☐
8. Frequencies Fitted	2182 ☐ 4125 ☐ 6215 ☐ 6227 ☐ 2524 ☐ 4483 ☐ 4603.5 ☐	
9. Radio Test	Transmission signal reports are satisfactory on all frequencies	☐
	Radio Station used for tests	☐
10. ATU	ATU effectively tunes HF antenna on all frequencies fitted	☐
11. HF Antenna	HF Antenna in sound mechanical condition	☐
12. Spare HF Antenna	Spare HF Antenna is kept on board and is easily erected and connected to the ATU	☐
13. Insulators	Insulators on HF antenna of good quality and free from defects	☐
14. Co-axial cable feeder	Feeder is sound and of low loss quality with good connections	☐
15. Radio Earth	Radio Earth system is sound and effective-antenna tunes well	☐
16. Radio Earth Connection	Connection to ATU and Transceiver	☐
17. VHF Radio	Installed in a position protected from the ingress of moisture	☐
	Channels 16, 67, 72, 81 and 80 fitted ☐ 25 Watt transmit power	
18. VHF Antenna	VHF Antenna in sound mechanical condition	☐
19. Co-axial cable feeder	Feeder is sound and of low loss quality with good connections	☐
20. VHF Hand Held Radio	Channels 16, 67, 80 and 81 ☐ 5 Watt transmit power	☐
	VHF Hand Held Radio is Waterproof	
21. Documents	Marine Radio Operators Handbook is kept on board	☐
	Distress Procedure; Guide for operators is visible	☐

Radio Installation Survey and Inspection Form

Yacht name: _____ **Date:** _____
Call Sign: _____ **Location:** _____

Owners Representative: _____

tick box to confirm item checked, or write in the reading obtained.

1. **Radio Batteries**	Radio Batteries isolated from engine starting batteries ..... ☐ Batteries in suitable location ..... ☐ Batteries can be charged by main engine ..... ☐
2. **Electrolyte Level**	Correct Electrolyte level in all cells ..... ☐
3. **SG Readings**	SG readings of all cells above 1.23 ..... ☐
4. **On Load Voltage Test**	Battery terminal voltage did not fall below 11.4 v when On-load Battery Tester applied ..... ☐
5. **Hydrometer**	A working hydrometer is kept on board ..... ☐
6. **Battery Terminals**	Terminals are tight and well greased ..... ☐ Battery cabling is in good condition ..... ☐
7. **HF Radio**	Installed in a position protected from the ingress of moisture..... ☐
8. **Frequencies fitted**	2182 ☐ 4125 ☐ 6215 ☐ 8291 ☐ 2524 ☐ 4483 ☐
9. **Radio Test**	Transmission signal reports are satisfactory on all frequencies ..... ☐ Radio Station used for tests *PENTA COMSTAT* ☐
10. **ATU**	ATU effectively tunes HF antenna on all frequencies fitted..... ☐
11. **HF Antenna**	HF antenna in sound mechanical condition ..... ☐
12. **Spare HF Antenna**	Spare HF Antenna is kept on board and is easily erected and connected to the ATU ..... ☐
13. **Insulators**	Insulators on HF antenna of good quality and free from defects ☐
14. **Co-axial cable feeder**	Feeder is sound and of low loss quality with good connections ☐
15. **Radio Earth**	Radio Earth system is sound and effective–antenna tunes well ☐
16. **Radio Earth Connection**	Connection to ATU and Transceiver is 50 mm wide copper strip ☐
17. **VHF Radio**	Installed in a position protected from the ingress of moisture..... ☐ Channels 16, 67, 81,and 6 fitted ☐ 25 Watt transmit power ☐
18. **VHF Antenna**	VHF antenna in sound mechanical condition ..... ☐ VHF antenna installed at masthead ..... ☐
19. **Co-axial cable feeder**	Feeder is sound and of low loss quality with good connections ☐
20. **Spare VHF Antenna**	Spare VHF Antenna is kept on board ..... ☐ Spare VHF Antenna easily erected and connected ..... ☐
21. **VHF Hand Held Radio**	Channels 16, 67 and 6 fitted ☐ 5 Watt transmit power... ☐ VHF Hand Held Radio is Waterproof ..... ☐
22. **Documents**	Marine Radio Operators Handbook is kept on board ..... ☐ Distress Procedure; Guide for Operators, is visible ..... ☐

Radio Surveyor:

Print Name in full: _____

Signature _____

Radio Installation Survey & Inspection Form

Yacht Name: _____ **Call Sign:** _____

Radio Surveyor: _____ **Location:** _____
(Print Name and Sign)

Owner / Representative: _____ **Date:** _____

1. **Radio Batteries**	Radio Batteries isolated from engine starting batteries *(Batteries in suitable location)* One Battery is Closed or Gel Cell Batteries can be charged by main engine	☐ ☐ ☐
2. **Electrolyte Level**	Correct Electrolyte level in all cells	☐
3. **SG Readings**	SG readings of all cells above 1.23	☐
4. **On Load Voltage Test**	Battery terminal voltage did not fall below 11.4 v when On-load Battery Tester applied	☐
5. **Hydrometer**	A working hydrometer is kept on board	☐
6. **Battery Terminals**	Terminals are tight and well greased Battery cabling is in good condition	☐ ☐
7. **HF Radio**	Installed in a position protected from the ingress of moisture	☐
8. **Frequencies fitted**	2182 ☐ 4125 ☐ 6215 ☐ 6227 ☐ 2524 ☐ 4483 ☐ 4603.6 ☐ *8291* ☐	
9. **Radio Test**	Transmission signal reports are satisfactory on all frequencies Radio Station used for tests	☐ ☐
10. **ATU**	ATU effectively tunes HF antenna on all frequencies fitted	☐
11. **HF Antenna**	HF antenna in sound mechanical condition	☐
12. **Spare HF Antenna**	Spare HF Antenna is kept on board and is easily erected and connected to the ATU	☐
13. **Insulators**	Insulators on HF antenna of good quality and free from defects	☐
14. **Co-axial cable feeder**	Feeder is sound and of low loss quality with good connections	☐
15. **Radio Earth**	Radio Earth system is sound and effective–antenna tunes well	☐
16. **Radio Earth Connection**	Connection to ATU and Transceiver *(50 mm wide copper strip)*	☐
17. **VHF Radio**	Installed in a position protected from the ingress of moisture Channels 16, 67, 72, 81,and 80 fitted ☐ 25 Watt transmit power *6 fitted*	☐ ☐
18. **VHF Antenna**	VHF antenna in sound mechanical condition *(VHF antenna installed at masthead)*	☐ ☐
19. **Co-axial cable feeder**	Feeder is sound and of low loss quality with good connections	☐
20. Spare VHF Antenna	*Spare VHF Antenna is kept on board* *Spare VHF Antenna easily erected and connected*	☐ ☐
21. **VHF Hand Held Radio**	Channels 16, 67, 80 and 81 fitted ☐ 5 Watt transmit power *6 fitted* VHF Hand Held Radio is Waterproof	☐ ☐
22. **Documents**	Marine Radio Operators Handbook is kept on board Distress Procedure; Guide for Operators, is visible	☐ ☐

Doc: 3

Mr John Abernethy
State Coroner's Court
44-46 Parramatta Road
Glebe
NSW 2037

Michael Collinson
PO Box 31
New Town
TAS 7008

16th July 1999

Dear Sir,

I have enclosed a Briefing Paper on the Report of the 1998 Sydney-Hobart Race Review Committee. This Briefing Paper is a modified version of one that I prepared for the Radio Communications Committee of the Royal Yacht Club of Tasmania, which I chair. I coordinated the radio communication facilities at the RYCT for the 1998 Sydney-Hobart Race, and am a member of the RYCT Sydney-Hobart Race Committee.

I started my career in 1965 as a Marine Radio Officer in the British Merchant navy, serving with British Petroleum and later worked as a Communications Engineer with Ferranti (Scotland Ltd). In 1975 I took up a teaching post at Leith Nautical College Edinburgh.

For 17 years, from 1979 to 1996, I was Senior Lecturer in Marine Radio Communication at the Australian Maritime College, Launceston, specialising in COSPAS/SARSAT, the Global Maritime Distress and Safety System, and maritime Search and Rescue communications. I am currently Communications Officer at the Australian Antarctic Division, Kingston.

I have been teaching radiotelephone communications to small boat owners since 1975, and am authorised by the Australian Communications Authority to act as an invigilator for the Radio Operators Certificate of Proficiency examinations.

I hope the enclosed Briefing Paper may be of some assistance to you.

If I can be of any further service, I will be in Sydney on the 29th of July.

Yours faithfully,

M Collinson

Michael Collinson

E-mail:mcollins@tassie.net.au
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Phone: 03 62 32 3299 (BH)
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Mobile: 0418 143 843
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Report

of the

1998 Sydney-Hobart Race Review Committee

Briefing Paper

Introduction

This Briefing Paper has been written on the basis that you may not have had the opportunity to read the Report of the Review Committee, or may not be in a position to determine the accuracy, or otherwise, of many of the technical comments concerning radio communication.

The Briefing Paper is intended to highlight certain points, concerning marine radio communication, mentioned in the Report, and to provide comment, and corrections where technical errors have occurred. It is an attempt to provide information with respect to the findings of the Review Committee, and their recommendations in relation to:

a) the education of those sailing in future Sydney-Hobart, and other yacht races,
b) the planning necessary on the part of those organising such races, and
c) the radio communication infrastructure required to provide safety coverage for the competitors in such events.

In Section A, I have listed, in dot point format, some of the technical aspects in the Report, which deal with Radiocommunication matters, that give me cause for concern.

There are a number of technical errors, and inconsistencies, with poor technical terminology, and lack of attention to detail, in relation to:

i) technical aspects of radio equipment,
ii) radio propagation, and
iii) operational procedures concerning marine radiocommunication.

Section B outlines those major issues on which I believe further recommendation should be made, particularly with regard to:

a) education and training of crews, and
b) the radio installation on board yachts, sailing in the Sydney-Hobart Race.

Section C covers the recommendations stemming from the Report that directly affect the radio installation at the RYCT.

Section A

- page 6 **"Six lives lost, five boats sunk and a further 66 boats retired from the race." ..."..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."**

- page 8 "Twelve yachts required SAR intervention -....."

- page 2 " many crews, despite having high levels of ocean racing experience, were poorly informed on aspects of safety equipment use and Search and Rescue techniques."

- page 5 "Consistently around 10% of the fleet retires for a variety of reasons, ...Some typical causes for retirement include.....electrical problems, ..."

Comment: This figure of 10% appears to be an acceptable figure, as far as the CYCA is concerned, given that no effort has been made to investigate the reasons for the "electrical problems" that arise, and no effort made to improve the "safety checks" that could possible eliminate some of the causes. (see later statement on page 65, that it is expected the "average yacht" will have "low battery power" or "poor (battery) connections".)

- page 13 "Section 2.3.5 Safety Equipment
As a part of the particular safety requirements for the 1998 SHYR, all yachts had to provide the following:
HF radio certificate.."

- page 54 "Section 5.0 Information and Communications
Entry Forms are then completed and returned to the Sailing Office.
Attached to that form should be:
Radio Check Certificate.."

- Page 69 "Section 5.1.4 Review of Recommendations Stemming from the 1993 SHYR
  - " introduction of a "Radio Certificate" (radio check by qualified person)

Comment: The lack of consistency in referring to what in my opinion should be the "Radio Installation Survey Inspection Report Form", *indicates either:*
i) a lack of knowledge, or little command of the particular subject, or
ii) a lack of real interest in the particular subject.

- page 20 "3.0 Chronology of Events

DATE	TIME	EVENT
27/12/98	1650	Sword of Orion...May Day.....EPIRB activated on deck,...
Comment:	*EPIRBs do not radiate effectively to the satellite or aircraft, unless in the water.*	
	2045	Sword of Orion...hears SAR helicopter...EPIRB placed in water.
28/12/98	0250	Sword of Orion...hears SAR helicopter...EPIRB placed in water.
29/12/98	0305	Veto missed Sked 3 (and Sked 2), asked to activate EPIRB by RRV.

Comment: Sked 2 occurred at 0300 hours on 27th December, and Sked 3 occurred at 1400 hours on 27th. This period of 48 hours appears to me to be too long, given the conditions that prevailed, for the Race Organisation to leave a yacht that had not reported before taking any action with regard to it's safety.

Comment: Emphasis was placed on the "deployment of life rafts from aircraft" during the Compulsory Race Briefing, but instruction on how EPIRBs should be correctly operated was obviously not thought to be important. How many life rafts were actually deployed from aircraft during the 1998 Race?

Education on the correct use and operation of EPIRBs must be provided to all yachting crews. The incidents detailed above clearly indicate that there is a significant lack of understanding of the manner in which the signal propagates from the EPIRB to the satellite, or searching aircraft, and the part that the relationship between the antenna and the sea surface plays in the propagation process.

Comment: With the recommendation that all yachts are to carry 406 MHz EPIRBs, comes a greater need for education on particular aspects of their operation.

- page 31 "4.2 Forecasts and communication to competitors
  Weather information was available to the fleet through a number of avenues:

  e) By HF Radio on board yachts through:
  - VIS, VIM, VIH"

- page 166 "Glossary

  VIH Hobart Radio"

Comment: The Telstra Coast Radio Station, Hobart Radio, (call sign VIH) was decommissioned in 1991

page 59 "In Hobart at the RCC, the SHYR Committee had to deal with a number of separate issues.

- Coordination/communication AMSA ⟶ RRV ⟶ fleet, and fleet ⟶ RRV ⟶ AMSA

...the RCC was inundated with phone calls and the system was unable to cope."

- page 63 "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."

Comment: In my opinion, two daily mandatory position reports are quite inadequate for such a race. There should be provision for up to four "Safety Radio Skeds" within a 24 hour period for yachts to register their position and condition with Race Control. (See AMSA's AUSREP Scheme for Small Craft Reporting.)

5.1.3 Radio Communications

- page 64 "Both HF and VHF equipment are prescribed under the Cat 1 Safety. (sic)- .....HF is still a major radio communications method for maritime and aeronautical use, primarily because of its range. .....4483 kHz is recognised as being a good "working" frequency for the race, offering good local as well as medium distance communication capabilities."

Comment: *HF is not a "radio communication method". The range over which communication can be reliably maintained over a 24-hour period will vary with the time of day. (See IPS propagation predictions for December 1998.)*

- page 64 "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 high 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."*

- page 65 "The quality and reliability of communication *between RCC, the RRV and competitors were not as good as it could have been,* with some intermittent and low quality transmission taking place."

Comment: *the expressions "high quality signal" and "low quality transmission" are not technical terms that would be used in describing radio communication signals. Communication engineers deal in signal strength measured in microvolts per metre, measured at a specified distance from the transmitter. The signal quality is more a function of the type of modulation employed.*

- page 65 "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 battery power or poor connections) and a poor earth system, are taken into consideration the result is reduced transmitted power — ie reduced signal."*

Comment: ***I find it difficult to come to terms with this statement. For the Review Committee to ad it that the CYCA accepts that yacht[illegible]going to have poor battery connections and poor earth connections, and further, fails to initiate corrective measures, is to me, quite unacceptable.***

Comment: *The radio operator tunes the antenna to the frequency in use using a manual Antenna Tuning Unit, or the antenna is tuned by the automatic Antenna Tuning Unit which is found with most modern MF/HF transceivers.*

This results in the antenna presenting the correct impedance and radiation resistance to the transmitter, (and the receiver for optimum reception), resulting in the optimum condition for the transmitter to deliver power to the antenna.

- page 66 "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."

Comment: *What "distress management" procedures did the CYCA Race Committee have in place? The word Distress did not appear in the 1998 Notice of Race or Sailing Instructions.*

However, it should be noted that there is a passing reference to distress in the Draft 1999 Sailing Instructions.

Distress radio procedures and Distress radio communication management are still not given the separate section and emphasis that they demand.

- page 66 "Finally, the RRV did not have the capability to communicate directly with many of the SAR aircraft, particularly fixed wing aircraft. Aircrafts (sic) are not normally fitted with Marine VHF Channel 16 which operates on 141.3 MHz, and use aviation frequencies of 121.5 MHz (distress) and 123.1 MHz (search and rescue)."

Comment: *156.8 MHz is the frequency which is designated as VHF Channel 16! 141.3 MHz is not in the VHF Maritime Mobile frequency allocation.*

- page 66 "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."

Comment: *HF receivers and transmitters, with their associated antennas, are still located at Sydney but are operated from Brisbane. Yachts are therefore able to communicate with a Telstra Coast Station physically located at Sydney.*

- page 67 "In adverse weather conditions and for the latter part of the race the RRV is often out of range."

- page 149 "9.10 Communications

  Communication between the RCC RRV-Fleet were unreliable (or had the potential to be) because:

  - geographical remoteness of RCC (Hobart)" (?)

Comment: *" HF radiocommunication, using the appropriate frequency, is capable of providing long range communication over thousands of miles. The lack of direction to the Fleet/RRV/RCC to use appropriate frequencies is again indicative of the lack of understanding of radiofrequency propagation, or of poor race management. (see IPS radio frequency propagation predictions for December 1998 for the optimum HF working frequencies to be used for reliable communication).*

- page 73 "6.0 Ability of yachts and their equipment to withstand the conditions

  While this is not recorded each year, experience demonstrates that it is not unreasonable that the following occurs:

  - flat batteries and minor electrical problems,"

Comment: *I find it difficult again, to come to terms with this statement. I believe that it is unreasonable to accept that yachts will have flat batteries, when the battery is the sole means of powering the radio installation, and further, fail to initiate corrective measures. I find this quite unacceptable.*

- page 75 "Damage to yachts in the 1998 SHYR

Extent of Damage	Total	Yachts Retired	Yachts Finished
Totals	110	70	40
Electrics Unserviceable (Not Flat Batteries)	18	15	3
Electrics Unserviceable (Flat Batteries)	4	1	3
Engine Unserviceable (Flat Batteries)	12	9	3
VHF Unserviceable (Flat Batteries)	11	7	4
Other Radio Damage	11	9	2
GPS Unserviceable (Flat Batteries)	11	6	5
HF Unserviceable (Flat Batteries)	9	6	3

- page 84 "Serviceability of Engines and Electrical systems

  Sixteen percent reported Electrical problems not related to batteries, including failures of GPS, HF and VHF radios."

SAR Communication

Comment: *Between pages 112 and 136, a number of references are made to the inability of yachts to communicate with the SAR aircraft, fixed wing or helicopters. This appears to have been due either to the VHF on board the yacht being unserviceable or the crew not being aware that the SAR aircraft could communicate on marine VHF (using VHF Channel 16, or the On-Scene Search and Rescue channel, Channel 6). The Report covers this aspect on page 148, in the section, 9.9 SAR.*

The Review Committee's recommendation that yachts must carry a water proof hand held marine VHF transceiver is timely. However the recommendation should have also specified that the hand held be fitted with Channel 6, as well as Channel 16, the two on-scene Search and Rescue channels.

Section C The radio installation at the RYCT.

- page 160 "B7. COMMUNICATIONS
  Compulsory

  - RCC-Fleet

    RCC suffers from basic HF/VHF connectivity problems with the fleet. It needs to have an installation at its disposal, that offers very high quality transmit and receive capability.

    The installation needs to be accessible to the primary RCC centre (currently located in Hobart) and, most importantly accessible to the Race Director. The antenna farm needs to be located in an interference free area (outside a metropolitan or built up area). The transceivers need to be high power (400-1000Watt) with RF gain amplifiers capable of detecting weak signals."

- page 161 "Recommended

  - RRV-Fleet

    The RRV installation needs to be above normal power to ensure that the entire fleet, *regardless of the quality of their own installations*, is capable of hearing the RRV in all weather conditions.

    The CYCA should install a linear amplifier for its VHF transceiver, capable of increasing the transmitted output power to 100 PEP."

Comment: *Increasing the power output of the HF and VHF transmitters on board the RRV or at the RYCT will not result in signals being heard by yachts who have: -*

- *" inefficient antenna systems, poor battery connections and poor earth connections" .*

Only by improving the standard of the radio installation on board the yachts, by conducting a proper inspection of the radio installation carried, and setting compulsory standards to be achieved, will such communication problems be overcome.

Comment: *PEP stands for peak envelope power, which is the method by which SSB transmitter power is measured. The system of modulation used in marine VHF transmitters is FM. FM produces constant power output and is not measured in terms of "peak envelope" power.*

Section B — Issues on which further comment or recommendation should be made, particularly with regard to:

a) education and training of crews,
b) the radio installation at the RYCT, and on board the RRV, and
c) the radio installation on board yachts, sailing in the Sydney-Hobart Race.

Education:

i) The COSPAS/SARSAT system,
ii) the propagation characteristics of EPIRBs.
iii) the correct operation and deployment of EPIRBs,
iv) the radiotelephony Alarm Signal,
v) Distress radio communication procedures,
vi) Distress frequencies, and propagation on the HF bands,
vii) SAR radio communication procedures, and
viii) the correct use of the 'on-scene' VHF channel Ch 6.

Radio Installation:

i) the implementation of a formal Radio Installation Survey Inspection and Reporting process.

Section C — The radio installation at the RYCT.

- page 160 "B7. COMMUNICATIONS
Compulsory

  - RCC-Fleet
  RCC suffers from basic HF/VHF connectivity problems with the fleet. It needs to have an installation at its disposal, that offers very high quality transmit and receive capability.

  The installation needs to be accessible to the primary RCC centre (currently located in Hobart) and, most importantly accessible to the Race Director. The antenna farm needs to be located in an interference free area (outside a metropolitan or built up area). The transceivers need to be high power (400-1000Watt) with RF gain amplifiers capable of detecting weak signals."

- page 161 "Recommended

  - RRV-Fleet

  The RRV installation needs to be above normal power to ensure that the entire fleet, regardless of the quality of their own installations, is capable of hearing the RRV in all weather conditions.

  The CYCA should install a linear amplifier for its VHF transceiver, capable of increasing the transmitted output power to 100 PEP."

Comment:

The terms and conditions of the radio licence, issued by the Australian Communications Authority, prevents limited coast stations from using transmitting powers in excess of 400 watts. Therefore the RYCT cannot legally install MF/HF transmitting equipment having a power output above 400 watts. In the case of VHF transmitters, the maximum legal power permitted, for limited coast stations is 50 watts. In the case of the RRV however, the maximum power that may be used is 25 watts!

RF gain amplifiers do not increase the capability of detecting weak signals because they also increase the level of the received noise as well. The demodulator stage in a receiver detects signals. The sensitivity of a receiver (the ability of a receiver to detect signals) is determined by its design and is measured in terms of micro volts of signal at the antenna terminal. The receive antenna should be located in a "quiet" area but the location of the transmitting antenna is not critical as far as "interference" from noise is concerned.

The Board of the RYCT, through the Communications Committee, is currently conducting a total review of the radio installation at the Royal Yacht Club (referred to as the RCC in the Report), with the intention of installing new radio equipment (a 400 watt MF/HF transceiver). At the same time, the antenna performance will also be improved.

However this will not be the answer to the problem of communication with the yachts in the race. This can only be overcome by:

a) improving the standard of radio installation on board the yachts, the RRV, and at the RCC,

b) education of the yacht crews in the use of:

- *i) radio communication equipment,*
- *ii) the appropriate radio frequency, for the range over which communication is required,*
- *iii) EPIRBs, and*
- iv) *SAR radio communication.*

Notes and Comments

on the

Report of the 1998 Sydney Hobart Race Review Committee May 1999

Reference Documents

1.	AYF	Racing Rules of Sailing for 1997 – 2000	"Rules"
2.	CYCA	SHYR Notice of Race 1998	NOR
3.	CYCA	SHYR 1998 Sailing Instructions	SI
4.	ACA	Marine Radio Operators Handbook, December 1998	"Handbook"
5.	ITU	International Radio Regulations –Manual for use by Maritime Mobile-	"Regulations"
6.	CYCA	Report of the 1998 Sydney Hobart Race Review Committee May 1999	"Report"

AYF Racing Rules of Sailing for 1997 - 2000

"Rules"
ADDENDUM A.1
AYF SPECIAL REGULATIONS

page 143: - "1.2 OWNER'S RESPONSIBILITY

The safety of a boat and her crew is the sole and inescapable responsibility of the owner, or the owners representative - - -.

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."

pages 166 and 167: -

3.24.1 MARINE RADIO — Cat 1 2 3 4 5 6 7

Marine transceivers shall be fitted with the frequencies/channels Specified plus any frequencies/channels required by the Organising Authority.

HF SSB transceivers: 2524, 2182, 4125, 6215 kHz

VHF transceivers: Channels 16 and 67

27 Megahertz transceivers: 27.880, 27.860 and 27.940 MHz

An HF transceiver permanently installed

An HF transceiver permanently installed or a VHF transceiver permanently installed where shore based facilities exist for the entire length of the course. — Cat 2

Either an HF or a VHF or a 27MHz transceiver permanently installed. — Cat 3 4 5 R

(a) **A marine radio transceiver.** When this is VHF it shall have a **minimum power of 25W**, and should be provided **with a masthead antenna** and co-axial feeder with not more than 40% power loss. — Cat 1 2 3 4 R R

(b) **A VHF transceiver** should include **Channel 72** (an international ship-ship channel which, by "common use", could become an accepted boat-boat channel for ocean racing boats anywhere in the world). — Cat 1 2 3 4 5

(c) An **emergency antenna** shall be provided when the regular antenna depends upon the mast. — Cat 1 2 3 4 5 R

(d) In addition to (a) a water resistant hand-held VHF transceiver. (Mandatory from 7/2001). — Cat R

(e) **Radio receiver** capable of receiving weather bulletins. — Cat 1 2 3 4 5 R

(f) **Radio transceivers** shall be checked annually. — Cat 1 2

AYF Racing Rules of Sailing for 1997 - 2000

"Rules"
ADDENDUM A.1
AYF SPECIAL REGULATIONS
Page 177

SECTION 4 – PORTABLE EQUIPMENT & SUPPLIES

4.18 EPIRB Cat **1** 2 3 R

(a) Emergency Position Indicating Beacon transmitting on 121.5, 243 or 406 Mhz(sic). Any 406 Mhz(sic) beacon shall be properly registered with the appropriate authority.

Note: - The ACA Handbook for Marine Radio Operators states on page 65, "It is recommended that vessels proceeding more than 30 nautical miles off shore carry a 406 MHz EPIRB.

Comment: - The CYCA should have stipulated that yachts carry a 406 MHz EPIRB for the 1998 SHYR.

Note: - The AYF is the National Authority on matters to do with the Racing Rules of Sailing. The AYF publication sets down "Special Regulations". The conduct of a Race must be according to the "Rules" and "Special Regulations".

Comment: - There are more "Rules" to do with Advertising than to do with Radio and Safety. There is more detail concerning Anchors than there is concerning Radio Equipment.

Comment: - The AYF "Rules" are totally inadequate as far as radio communication matters are concerned. Batteries are not mentioned at all under Marine Radio. The AYF "Rules" do not specify a standard for a Radio Installation Inspection, which should include the antenna – earth system and battery supply, merely stating that "Radio transceivers shall be checked annually".

Comment: - The only reference to "Distress" is in relation to a "Distress Sheet"; a flag! Distress and Search and Rescue procedures are not mentioned.

Comment: - Although a water resistant hand held VHF transceiver is only RECOMMENDED for Cat 1, carriage should have been stipulated for the SHYR in the Sailing Instructions.

Comment: - The AYF "Rules" are sadly lacking in detail. They fail to set performance standards and need totally revising in the Radio section. No reference is made to the Handbook for Marine Radio Operators, published by the ACA.

"Report"

page 13: - "2.3.5 Safety Equipment

Each yacht must have a Category 1 Safety Certificate, 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) - - - "

CYCA Notice of Race 1998

NOR

page 4: - 4.3.1 Entries must be accompanied by a valid Category 1 Safety Certificate and a Radio Inspection Certificate.

page 9: - 12.0 SAFETY EQUIPMENT

12.2 The following requirements for radio compliance apply to the Sydney-Hobart Yacht Race and amend by increasing the requirements of the AYF Safety Regulations.

(a) Both VHF and HF/SSB radios shall be carried.

(b) Shall be capable of transmitting/receiving on additional frequencies: -

VHF Channels	72, 73, 80 and 81
HF/SSB	6227 & 4483

"Report"

page 16: - "The NOR is a legally binding contract - - - .
|
The NOR was available for the SHYR in July 1998."

Comment: - The CYCA should have stipulated that yachts carry a 406 MHz EPIRB for the 1998 SHYR.

Comment: - Although a water resistant hand held VHF transceiver is only RECOMMENDED for Cat 1, carriage should have been stipulated for the SHYR in the Sailing Instructions.

CYCA 1998 Sailing Instructions

RADIO INSTRUCTIONS

SI

39. RADIO RELAY SHIP (Telstra Control)

1.2 Telstra Control will assist yachts in distress by relaying traffic to the appropriate authorities.

Comment: - This is the ONLY mention of anything to do with **Distress** in the Sailing Instructions.

Comment: -

The CYCA are remiss in failing to address Distress Communication Procedures. By implication it is expected that Distress traffic should be conducted on the Race frequency of 4483 kHz which does not comply with internationally recognised procedure.

Comment: - Neither **Distress** nor **EPIRBs** rate a mention in the **Contents** on pages 19 and 20, because they are not referred to in the Sailing Instructions.

SI

41. RADIO TRANSMISSIONS

41.1 The race frequency for all traffic, except recalls SI 20, will be 4483 kHz unless directed otherwise by Telstra Control.

41.3 A yachts(sic) shall maintain a listening watch on 4125kHz or VHF Ch 16 during the silence periods.

42. SAFETY SCHEDULE

1.1 At 2205 hours on the 27th December 1997(sic) and each day thereafter until that time on the 1st of January 1998(sic), Telstra Control will conduct a Safety Radio Schedule on the race frequency.

1.2 All yachts shall maintain a listening watch to receive:

(c) directions for INITIAL SEARCH PROCEDURES.

44.3 A YACHT WHICH FAILS TO REPORT FOR TWO SUCCESSIVE SCHEDULES AND CAN NEITHER RECEIVE NOR TRANSMIT ON HF OR VHF SHALL, AFTER MISSING THE SECOND SUCCESSIVE SKED, IGNITE A WHITE FLARE AT 2215 HOURS.

Comment: - A yacht failing to report at say the 1400 sked on the 26th, and then again failing to report at the 0300 sked on the 27th, is not required to ignite a white flare until 2215 on the 27th. A period of 32 hours having elapsed before any action is taken.

APPENDIX 1

4. SAFETY-SEARCH AND RESCUE (S.A.R.)

3. S.A.R. authorities will not usually express concern or initiate search and rescue proceedings unless a yacht is CLEARLY OVERDUE, that is E.T.A. + 24 hours.

Comment: - The Sailing Instructions fail to give yachts guidance in terms of Distress radio communication procedures to be followed in Emergency situations.

It is questionable whether the radio operators for Telstra control, on board Young Endeavour, were trained in controlling and managing Distress situations. In addition, having only one MF/HF transceiver and one VHF transceiver, and only three operators, placed a severe

limitation on the options available to them. However it is possible that a substantial amount of radio traffic (particularly that involving Team Jaguar) could have been handled using VHF, thus spreading the load and freeing up HF time.

Distress Management Procedure

"Report"
page 59: - "Although the CYCA did not have a formal disaster plan, the Race management infrastructure has been developed and refined over time."

"Report"
page 66: - "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."

Note: - There was no Disaster Plan put in place for the 1998 Race. However, Race Committee representatives met with local Marine Search and Rescue Police in Hobart for the 1999 SHYR. It was reported that they had formulated an "Emergency Plan". This Emergency Plan was not promulgated to any third party including the radio operators at the RYCT.

Comment: - The ACA Handbook for Marine Radio Operators contains instructions for the "Control of Distress Traffic", and specifies the frequencies to be used for Distress communication. The ITU Radio Regulations and ASMA publications also specify the use of "on-scene" Search and Rescue frequencies.

Safety Inspections

Radio Installation Inspection and Report

"Report"
page 11: - "Yachts are required to undergo comprehensive measurement procedures to gain certification and to determine each yacht's handicap."

"Report"
page 13: - "2.3.5 Safety Equipment
Each yacht must have a Category 1 Safety Certificate, 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) - -- -"

Comment: - The AYF "Rules" do not specify, or even mention the need for a Radio Installation Inspection, merely. That: - "**Radio transceivers** shall be checked annually".

Note: - The CYCA introduced a "Radio Certificate" after the 1993 Race. See page 69.

"Report"
page 69: - "As a direct result of the review of the 1993 SHYR the following actions were taken:

- introduction of a "Radio Certificate" (radio check by qualified person) as part of the Safety Requirements, - -"

"Report"
page 97: - "Yachts were required to have their radio installations checked and provide the CYCA with a certificate as part of the mandatory safety requirements."

Comment: - Yachts have to provide a "HF radio certificate", see page 13, referred to as a "Radio Check Certificate" on page 54, and a "Radio Certificate" see page 69. Inconsistent!

Note: - The CYCA introduced a "cut down" version of a "Radio Installation Inspection Report Form" that I prepared and submitted to them for the 1999 SHYR.

The Race Committee or Management Team

"Report"
page 57: - "The Sailing Committee approve the SI and in doing so, appoint the Race Committee. - -
I
I
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 (Race) Committee was unsure of the precise responsibilities of the Committee as a result.
I

Two of the (Race Management) team hold formal qualifications in Race Management."

Technical and other Errors found in the Report

Note: - Errors occurred in the times published in the Sailing Instructions for the Daily Positions Reports and in the dates published in section 43.1, the Safety Schedule.

Comment: - Reference made to "O.T.C. Coast Radio Station" in the Sailing Instructions, page 17, when it should be Telstra Coast Radio Station.

"Report"
page 31 - "Weather information was available to the fleet through a number of avenues: -
- - by HF Radio – through VIH",

"Report"
page 166 - "GLOSSARY - - VIH Hobart Radio"
Comment: - References made to Hobart Radio which no longer exists, having been decommissioned in about 1991.

"Report"
page 66: - "Aircrafts(sic) are not normally fitted with Marine VHF Channel 16 which operates on 141.3 MHz, "
Comment: - Incorrect radio frequency: - Marine VHF Channel 16 "operates on" 156.8 MHz.

"Report"
page 66: - "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 communications as the fleet moves down the Tasmanian coast."
Comment: - The Yachtcoms facility operates through the HF antenna installation at La Perouse, Sydney. It does not communicate through the HF antenna system at Brisbane Radio.

The problem of poor communication is more to do with the choice of Race frequency (4483 kHz) and the lack of understanding on the part of Race Management of the propagation conditions associated with that frequency.

Comment: - Most yachtsmen are ignorant on matters to do with radio propagation, and that is a factor in the management of radio communication for this Race.

"Report"
page 62: - "listening to the race frequency, on a radio set up in the Sailing Office, and as reception was often poor, on a yacht in the marina, - - "
Comment: - How good was the installation of the radio "set up" in the Sailing Office?

Technical and other Errors found in the Report

"Report"

page 160: - "B7. COMMUNICATIONS
Compulsory

- RCC – Fleet:
  RCC (RYCT) suffers from basic HF/VHF connectivity problems with the fleet. It needs to have an installation at its disposal, that offers very high quality transmit and receive capability.
  The installation needs to be accessible to the primary RCC centre (currently) located in Hobart) and, most importantly accessible to the Race Director. The antenna farm needs to be located in an interference free area (outside a metropolitan or built up area). The transceivers need to be high power (400 – 1000Watt) with RF gain amplifiers capable of detecting weak signals."

page 161: - "B7. COMMUNICATIONS
Recommended

- RRV – Fleet:
  The RRV installation needs to be above normal power to ensure that the entire fleet, regardless of the quality of their own installations, is capable of hearing the RRV in all weather conditions.
  |
  |
  The CYCA should install a linear amplifier for its VHF transceiver, capable of increasing the transmitted output power to 100Watts PEP." ;

Comment: - These two sections above contain some fundamentally flawed statements. They indicate a total lack of knowledge relating to: -

- ACA Regulations for Marine Radio Licences
- radio signal propagation
- radio communication theory

Limited Coast Radio Stations are not entitled to use a MF/HF transmitter with a power output greater than 400 watts. To state that the RCC must employ 1000 watts contravenes the ACA Radio Licence Regulations.

Similarly the RRV vessel is not at liberty to employ a VHF transmitter with a power output of 100 watts.

The belief held that by increasing the power of the transmitters at the RCC and RRV, the deficiencies of the radio installations on board the competing yachts will be overcome, is indicative of poor radio communications management.

It is interesting to see that here the CYCA Review Committee are making reference to radio "installations" and stipulating technical conditions, where earlier they were content to have yacht's radios simply "checked".

RF gain amplifiers do not detect weak signals. It is necessary to increase the "signal to noise ratio" in order to improve the reception of weak signals. RF gain amplifiers will also amplify any noise that is received.

PEP (peak envelope power) is a term reserved for SSB signals, not VHF

Technical and other Errors found in the Report

"Report"

page 65: - "It should be acknowledged that the average yacht's HF installation will be always 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."

Comment: -

1. A quarter wave antenna is the correct length, not a half wave: - (see Marconi quarter wave).

$$\lambda_{\text{in m}} = \frac{300}{f_{\text{in Mhz}}} = \frac{300}{4.483} = 66.91_{\text{m}} \quad \text{so} \quad \frac{\lambda}{4} = 16.7_{\text{m}}$$

2. The antenna tuner (manual or automatic) matches the antenna to the correct frequency (4483kHz). This is to achieve the best standing wave ratio, measured by reading the SWR, ~~the~~ "standing wave ratio" (the ratio of reflected to forward voltage or current). In a perfectly matched (tuned) antenna system all the power produced by the transmitter is transferred to the antenna.

3. Reference is made to "Tuning the transmitter" in the Sailing Instructions. This is not a correct description. It is the antenna that is tuned to match the antenna to the frequency being used.

4. If the yacht's radio installation is correctly inspected, they will not have "poor (battery) connections" when entering the Race. Such "faults" would be detected and corrected.

5. If the yacht's radio installation is correctly inspected they will not have a "poor earth system". Such a "fault" would be detected and corrected.

These conditions (3 and 4 above) are considered to be faults by the Australian Communications Authority and should be corrected.

"Handbook"

page 92: - "153.1 Regular inspection and maintenance of the antenna, transceiver and battery power supply will minimise the likelihood of faults occurring at sea.

153.3 Faults can be usually divided into three categories:

- faults occurring on the antenna system;
- faults occurring in the transceiver;
- faults occurring with the battery power supply.

154.5 On vessels equipped with MF/HF equipment, faults occurring on the radio earthing system, although relatively uncommon, may cause transmitting problems. The most likely faults are breaks in the metallic connections at the transceiver, antenna tuning unit (ATU) or at the radio earth plate itself."

~~Comment: Inconsistent reference to: "HF radio certificate" - "Radio Check Certificate" - "Radio Certificate" where the Notice of Race actually states "Radio Inspection Certificate".~~

"Report"

page 5: - "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."

Comment - Tacit acceptance that this is the norm.

"Report"

page 84: - "Eleven percent of yachts claimed their engines were unserviceable due to flat batteries, - - - Sixteen percent reported electrical problems not related to batteries, including failures of GPS, HF and VHF radios." - - - "Reasons for electrical failure were not investigated in great detail, - - - "

Comment: - The engine is required to charge the batteries.
The batteries are necessary to start the engine!

Comment: - Batteries for starting the engine should be of a different type and should be separate to those required to supply navigation lights, radio communication and other electronic equipment. The engine, when running, charges both sets of batteries. Yachts are required to run their engines during the race to charge the batteries. However, this is unpopular with the crew who can find the noise of the engine running disturbs their sleep.

Education and Training of Yacht Crews
in marine radio communication, Distress procedures, and the use of EPIRBs

"Report"
pages 2 & 148: - "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."
Comment: - Expectation that "high levels of ocean racing experience" equates to knowledge of all things.

"Report"
page 15: - "The Owner's responsibility is clearly set out in the "Racing Rules of Sailing for 1997-2000" published by the AYF.

- - 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."

Comment: - Formal re-education and re-training should be an ongoing process for yachts crews.

"Report"
page 68: - "5.1.4 Review of Recommendations Stemming from the 1993 SHYR

Recommendations from the Sailing Committee included (quoted verbatim)

- "educational seminars for the 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 - -"."
- 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."

"Report"
page 69: - "The CYCA did not pursue the recommendations on:

- educational seminars on heavy weather sailing and crew training in safety equipment,

The CYCA is remiss in not pursuing and implementing the 1993 Sailing Committee's recommendations more vigorously."

"Report"
page 131: - "Inspite of most yachts claiming some level of SAR experience or training, evidence from actual search and rescue events demonstrates that crews were not well educated or prepared on the equipment they had at their disposal."

Incorrect use of MAYDAY and operation of EPIRBs

Australian Communications Authority
Marine Radio Operators Handbook December 1998
Chapter 7: Important: - The signal from an EPIRB is regarded by authorities as a signal of distress and is given an appropriate response."

"Report" page 96: - "The following 9 yachts deployed EPIRBs.

• Team Jaguar	dismasted: EPIRB:
• Business Post Naiad	rolled (twice): dismasted: MAYDAY: EPIRB: abandoned: afloat. 7 crew airlifted
• Winston Churchill	knockdown: sinking: MAYDAY: abandoned: sunk. 8 crew airlifted
• Solo Globe Challenger	knockdown: dismasted: 3 crew airlifted
• B52	rolled: dismasted: EPIRB:
• Kingurra	knocked down: MOB: MAYDAY: EPIRB 1 crew airlifted
• Sword of Orion	rolled: MAYDAY: EPIRB activated on deck: MOB: EPIRB placed in water: 10 crew airlifted
• Miintinta	taking water:
• Midnight Special"	rolled: dismasted: EPIRB deployed: 9 crew airlifted

- [VC Offshore Stand Aside did not activate EPIRB? MAYDAY: 12 crew airlifted]

Comment: - RRV asked yacht to activate EPIRB in order to obtain position fix. EPIRBs activated for MOB. This is not justified as MOB is not a Distress situation.

"Report"
page 136: - "AMSA suggested that a protocol for the use of EPIRBs would be helpful."

"Report"
pages 20 and 127: - "Chronology of Events

(27/12/98	1500	VC Offshore Stand Aside transmits MAYDAY [see "Report"page 130)
27/12/98	1650	Sword of Orion [rolled 360 MOB] activated EPIRB on deck
27/12/98	1720	Business Post Naiad rolled 360 MAYDAY sent
27/12/98	1720	Winston Churchill knockdown, MAYDAY 9 crew in life raft, EPIRB deployed
27/12/98	1749	Business Post Naiad activates EPIRB
27/12/98	2300	Business Post Naiad rolls 360 for second time, EPIRB aerial broken
27/12/98	2000	Midnight Special EPIRB deployed
27/12/98	2300	Midnight Special activates EPIRB
27/12/98	2045	Sword of Orion heard SAR helicopter, gives position, EPIRB placed in water
28/12/98	0250	Sword of Orion heard SAR helicopter, gives position, EPIRB placed in water(sic)
28/12/98	0305	Vessels asked to deactivate beacons if not in imminent danger by RRV
28/12/98	1000	Atara sends distress email accidentally.
29/12/98	0305	Veto missed Sked 3 [Sked 3 @ 1400 hrs on 27th] (and Sked 2) [Sked 2 @ 0300 hrs on 27th], asked to activate EPIRB by RRV"

Comment: - Many yacht crews do not understand how the COSPAS/SARSAT system functions and more importantly do not know how the signal propagates from the antenna of the EPIRB to the orbiting satellites or searching aircraft. The fact that the EPIRB must be in the water for the signal to propagate effectively is not known by the majority of the users.

Comment: - Education on the "technical" aspects of EPIRBs, and correct radio Distress and SAR communication procedures is required for all mariners.

Findings

"Report"
page 135: - "SAR crews confirmed that lack of training and, in some cases, the lack of VHFs for communication hampered rescue efforts."

"Report"
page 148: - "Getting SAR assets to stricken vessels quickly was hampered by:

- stricken vessels losing communications and not being able to appraise SAR of their position or condition,
- lack of capability to communicate with SAR aircraft,"

Race Management

"Report"

page 14: - "Responsibilities of Organisers and Owners/Skippers
Organisers' Responsibilities
The responsibilities of the organisers centre around the requirements to provide a race management structure to:-

d) provide adequate safety measures and precautions, consistent with the nature and scope of the event."

"Report"

page 18: - "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."

"Report"

page 57: - "Two of the (Race Management) team hold formal qualifications in Race Management."

page 147: - "The ISAF Race Management Manual is primarily directed at regatta style races and does not provide detailed and sufficiently robust directions for the organisation and management of long offshore races."

"Report"

page 59: - "Although the CYCA did not have a formal disaster plan, the Race management infrastructure has been developed and refined over time."

"Report"

page 98: - "The view of external parties and some yachts however, indicated that the RRV operator should have maintained a much tighter control on traffic, particularly the unauthorised use of the race frequency by competitors and non competitors alike. Their view was that some traffic should have been directed to other HF frequencies, particularly 2524 kHz or to other VHF frequencies."

Comment: - See page 66 of the "Report".

- SAR operations specify the use of "on-scene communications frequencies", control by the "on-scene commander".
- RRV should have used the "Seelonce MAYDAY" signal (see ACA Handbook).

1998 Sydney-Hobart Yacht Race

Report on the transcript of interviews with Mr Lewis Carter, Captain Neil Galletly, and the transcripts of the ten audio-recorded tapes of the proceedings of "Telstra Control" contained in Volume 8 of the brief of evidence provided to me on Friday 24th March 2000.

Reference Documents

1. The International Radio Regulations as embodied in the Marine Radio Operators Handbook, December 1998, published by the Australian Communications Authority. Chapter four Distress, Urgency and Safety Communications using Radiotelephony, and Chapter Seven, which deals with Emergency Position Indicating Radio Beacons.
2. The Notice of Race, for the 1998 Sydney-Hobart Yacht Race, published by the Cruising Yacht Club of Australia
3. The 1998 Sailing Instructions, published by the Cruising Yacht Club of Australia

Preamble

Radio Frequencies

It is noted that the transcript of the radio proceedings contains few references to MF/HF frequencies, or VHF channels, upon which the radio proceedings were conducted.

The Race Frequency

The Sailing Instructions stipulate that radio proceedings will be conducted on 4483 kHz, the Race Frequency, with 6227 kHz and VHF Channel 16 being used to supplement the Race Frequency.

Time Reference

It is also noted that the transcript contains no time reference for any of the radio proceedings. However, comparison has been made with the transcript of the Royal Yacht Club of Tasmania's "Radio Log Book" which covers part of that period from 26th December to 28th December 1998, which does have time references recorded against the events.

"Young Endeavour" maintains all time references in UTC (Zulu), as is the practice internationally with all ships radio stations on vessels over 300 tons. However, all small craft and Limited Coast Radio Stations maintain radio time reference using local time.

Radio Call Signs

No reference is made in the transcript, at any time, to a Radio Call Sign for Telstra Control, which should appear on the Radio Licence issued by the Australian Communications Authority for the Radio Station. No Station at anytime used their Radio Call Sign to identify the station. It is especially important to use call signs in Distress situations. Yachts in distress failed to use call signs, which does not comply with the requirements detailed in the MROCP Handbook.

Telstra Control

"Telstra Control" is the name used by the radio operators, to identify the Radio Station on board "Young Endeavour" when conducting the radio schedules (skeds) with the Sydney-Hobart fleet during the Race.

Mr Lewis Carter is the principal radio operator, assisted by Mr Michael Brown and Mrs Audrey Brown.

Radio Watch Keeping for the Race commenced about midday on the 26th December until Young Endeavour docked in Hobart about midday 31st December 1998, a period of some 120 hours.

From the transcript it would appear that Mr Carter conducted most of the radio proceedings over the period 26th – 31st December.

Assumptions are made regarding the following points that perhaps should be clarified during the inquest.

Two radio transceivers are employed by Telstra Control to provide communication with the "fleet" and to conduct the Skeds at 0305, 1405, with a safety sked at 2305 hrs. each day.

One is a 100 watt MF/HF marine transceiver and the other a 25 watt VHF marine transceiver, typical of the type installed in many small craft.

The MF/HF transceiver is used to monitor and conduct radio communication 4483 kHz. It is capable of monitoring only one frequency at any time, although it can be operated on any marine frequency that has been programmed into the memory.

The VHF transceiver is capable of operating on any of the marine VHF channels and is used to monitor the International Distress, Urgency, Safety and Calling Channel, CH 16. It is likely that a Dual Watch facility will have been available on the VHF transceiver

2182 kHz and VHF Ch 16 are monitored on the navigating bridge of Young Endeavour.

In the event the original MF/HF transceiver had to be replaced when it was found to be faulty after the Race had started.

Further to this, a fuse blew in one of the transceivers. Spare supply fuses were not carried. It was fortunate that a replacement fuse was found on board "Young Endeavour".

Comment

In my view, the availability of only one MF/HF transceiver, and one radio operator, placed a severe limitation on the capability of Telstra Control to provide adequate radio communication and SOLAS Watch Keeping.

The Role of Telstra Control

The Notice of Race and the Sailing Instructions appear to be the only operational documents governing the radiocommunication procedures for the Race.

In the Sailing Instructions, "Young Endeavour" is referred to as the Radio Relay vessel.

Comment

There is no reference made, in either the Notice of Race or the Sailing Instructions, to any radio procedures that should be conducted by Telstra Control in the event of any Distress or emergency situation other than the following statement;

> **"Telstra Control will assist yachts in distress by relaying traffic to the appropriate authorities."**

No guidance is given to yachts, in either the Notice of Race or the Sailing Instructions, in relation to the radio communication procedures they should follow if a distress situation arises.

Although 2182, 4125, 6215, and 8291 kHz amongst others, are designated International Distress, Urgency and Safety frequencies, vessels are able to use any frequency which is available, in order to obtain assistance when in Distress, i.e.4483 kHz.

Comment

I consider that at the very least a statement should have been included in the Sailing Instructions to the effect that yachts should conduct Distress, Urgency, Safety and calling procedures in accordance with the Marine Radio Operators Handbook.

Conduct of "Radio Skeds for position reports.

The Sailing Instructions state that - "Telstra Control" is to monitor the Race Frequency, 4483 kHz and VHF Ch 16, and to conduct radio skeds for position reports and safety schedules, with the fleet at set times.

Telstra Control conducted sked for position reports on 4483 kHz.

Comment

On a number of occasions Telstra Control referred to yachts by the first name of the skipper "Bill" and failed to use the yacht's name.

During the period from approximately 1400 hrs of the 27th December until 0300 hrs on the 28th December, five yachts were recorded by Telstra Control to be in Distress situations.

The choice of 4483 kHz for the Race frequency was not a good one.

Comment
Severe congestion occurred on the Race frequency of 4483 kHz due to the Distress radio traffic, Penta Comstat conducting radio schedules, Limited coast stations of the Royal Volunteer Coastal Patrol broadcasting weather forecasts, and the vessel "Moira Elizabeth" and the yacht Team Jaguar" communicating frequently with Telstra Control. The radio operator of Telstra Control appeared to be having difficulty at times keeping track of the proceedings and failed to maintain control of the frequency.

Comment
Control of Radio Traffic
Telstra Control did not exhibit any control over other stations using 4483 kHz, apart from one occasion, even when it was to the detriment of its own communications in progress. "Telstra Control" apologised to Penta Comstat for causing interference to his radio skeds despite the fact that "Telstra Control" was in the process of conducting Distress traffic on that frequency.

Conduct of Distress Traffic.
It should be noted that the Marine Radio Operators Handbook, which is required to be carried by all Radio Stations on board all vessels under 300 tons, lays down internationally recognised procedures to be followed in the conduct of Distress radio communication.

As "Young Endeavour" is designated the Radio Relay vessel it would appear that much of the Distress traffic was conducted on 4483 kHz through "Telstra Control" However, there appears to be little Distress traffic recorded, relating to "Business Post Naiad", "Sword of Orion" and other vessels reported to be in a distress situation. It is possible that a substantial amount of Distress Traffic took place between yachts and shore based stations on frequencies other than those monitored by "Telstra Control".

Any Distress traffic conducted between yachts and other radio stations, particularly shore based radio stations, on the International Distress frequencies would not have been monitored by the radio operator of Telstra Control.

It would appear from the transcript that radio traffic occurring on VHF Channel 16 was not always monitored and noted by Telstra Control.

Comment
I consider that Telstra Control did not conduct Distress traffic according to the established protocols and procedures as laid down in the Marine Radio Operators Handbook. The operators radio procedures are in general rather informal. The use of correct procedures is essential for the efficient and effective exchange and control of communication during Distress situations.

Also, yachts did not comply with the recognised procedure when transmitting Distress Calls and Messages and time was lost in seeking confirmation of the yachts position and exact nature of the distress situation.

Telstra Control should have set an example by strictly adhering to formal procedures when conducting Distress traffic.

It appears from the transcript that on several occasions Telstra Control did not follow up initial notification of a yacht in Distress and establish more precisely the exact situation.

Relaying of Distress Messages to the authorities
The first priority in a Distress situation is to alert the shore authorities, AusSAR, and have all information passed to them.

Although not obvious from the transcript, it appears that either Michael or Audrey Brown notified the CYC in Hobart or Sam Hughes of AMSA, who was also in Hobart, of the circumstances of each incident.

It is not clear how this was accomplished though it may have been via a mobile phone on the "Young Endeavour".

Comment
Use of Mobile Phones
Normally it is not good practice to conduct Distress traffic using mobile phones. AMSA issued a directive to Mariners to that effect some years ago. It is normally essential that vessels in the vicinity of a Distress situation be kept appraised of the situation via a common Distress frequency. Distress Calls and Messages should always be broadcast, on recognised Distress Frequencies or a frequency where assistance is readily available. The use of a mobile phone precludes that from happening.

However, in the particular circumstances governing these events it was perhaps useful in taking some of the more indirect communication away from the (only available) frequency, 4483 kHz.

Control of a Distress situation
In the case of "Business Post Naiad" I consider that "Telstra Control" did not regularly confirm the status of "Business Post Naiad". However, in mitigation, it is not clear from the transcript that "Telstra Control" was kept appraised of the actual situation, having requested "Yendys" to confirm whether "Business Post Naiad" had in fact declared a MAYDAY situation.

Comment
Use of EPIRBs
Yachts do not appear to be aware that activating and EPIRB is a declaration of a Distress situation. Yachts appear to be ignorant of the exact definition of a Distress situation.

"Telstra Control", at approximately 0305 on 29th December, requested the yacht "Veto" to activate an EPIRB. Earlier, at 0156 that morning "Telstra Control" broadcast an instruction, originating from AusSAR, to all yachts to switch off their EPIRBs where the yacht was not in a Distress situation.

Normally, it is only the skipper or person responsible for the safety of a vessel that has the authority to order an EPIRB transmission to be activated. It needs to be clarified who gave the authority for the transmission by Telstra Control to instruct "Veto" to activate her EPIRB for the purpose of determining her position.

I consider "Telstra Control's" actions questionable in the circumstances.

Use of Red Flares
The use of Red flares is also an indication that the vessel using the Red Flare is in Distress

"Telstra Control" appears to have directed both "Team Jaguar" and "Moira Elizabeth" to set off Red Flares for the purpose of determining the relative positions of the two vessels. This caused some degree of confusion with other yachts in the vicinity believing the Flares to be indicating vessels in distress.

Comment
Team Jaguar / Moira Elizabeth
It is apparent, from the transcript, and the transcript of the RYCT Radio Log Book, that an inordinate amount of radio communication occurred between "Telstra Control", "Team Jaguar" and "Moira Elizabeth" to the point that "Telstra Control" permitted the two stations to interrupt a Position Reporting Sked that was in progress for the purpose of confirming a towing arrangement. Team Jaguar was not in Distress, while a number of other yachts were.

The two stations should have been instructed to use VHF. If that was not possible then they should have been instructed to use 2524 kHz, or some other frequency, to free up 4483 kHz, which at times was carrying Distress traffic.

Although not officially deemed to be the "On-scene Co-ordinator", "Telstra Control" in my view did not properly control the radio traffic on the frequency of 4483 kHz.

Comment
In the case of the PAN PAN broadcasts "Telstra Control" did not broadcast the Urgent Message using the standard procedure and in the recognised format and failed to exhibit the proper conduct of such messages.

Comment

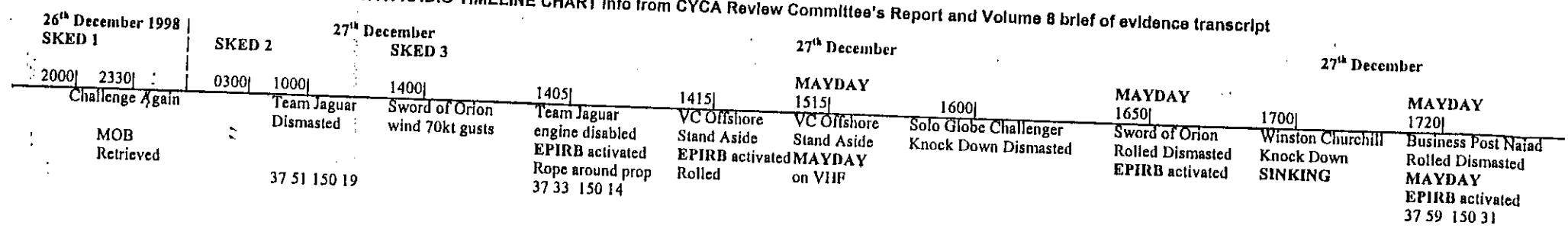
The Australian Yachting Federation in their publication The Racing Rules of Sailing fail to address the radio practices and procedures necessary for the proper and safe conduct of such a race.

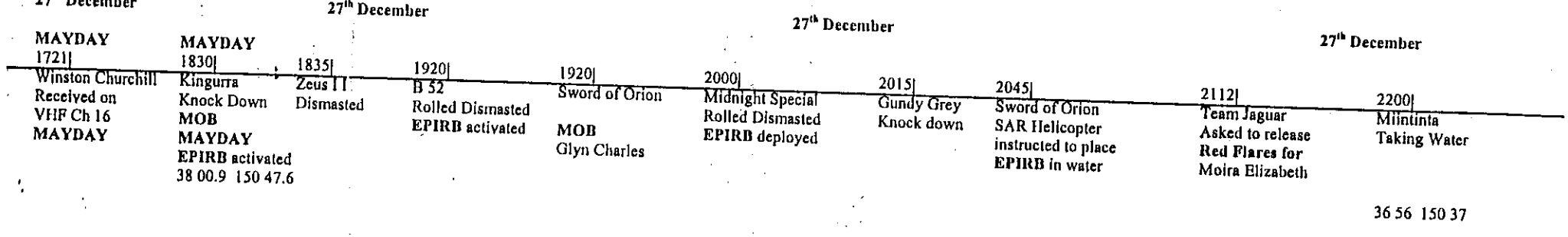
Similarly, the CYCA also fail to address the radio procedures necessary for the proper and safe conduct of the race and failed to provide adequate radio communication infrastructure and expertise.

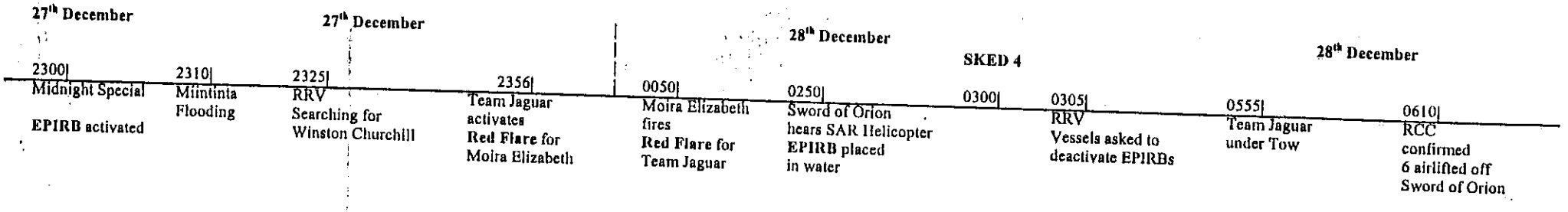
Michael Collinson

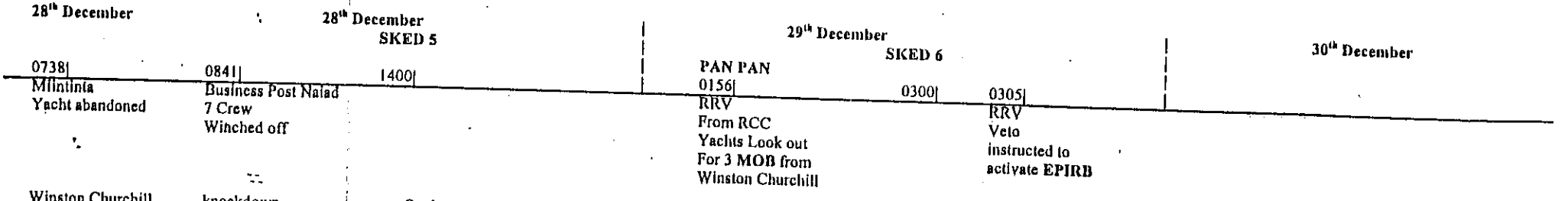
Hobart
28th March 2000
via E-mail from: - mcollins@tassie.net.au

1998 SHYR RADIO TIMELINE CHART Info from CYCA Review Committee's Report and Volume 8 brief of evidence transcript









Winston Churchill	knockdown		Sunk	3 Lives Lost	Challenge Again	MOB Retrieved	Kingurra	MOB Recovered by Police Helicopter
Business Post Naiad	rolled & dismasted			2 Lives Lost	Solo Globe Challenger	Dismasted	Team Jaguar	Dismasted Towed in
Sword of Orion	rolled & dismasted	MOB	Sunk	1 Life Lost	VC Offshore Stand Aside	rolled & dismasted	Sunk	
Midnight Special	rolled & dismasted		Sunk		Mlintinta	yacht abandoned		
B52	rolled & dismasted							

Michael Collinson

28/03/00

Report of Radio Communication procedures and practices
Volume 8 Radio Communication RRV "Young Endeavour" CRN 403.128
1998 Sydney-Hobart Yacht Race

Reference Documents:

Marine Radio Operators Handbook, Dec 1998, Australian Communications Authority
Notice of Race
Sailing Instructions

Lewis Carter

p "Its easy to loose control of the Sked"
p7 "we've got probably direct access via Sydney radio"
p15. "4484 Penta Comstat skeds for Coffs Harbour Race".
p28 "they shouldn't have then ignited red flares which is sort of a Mayday situation"
p38 "ANSAR are listening in to my conversations throughout the duration"
p54 "We were contacting them (AMSA?) via HF"
p62 "we certainly should have a manual that alerts us to all possibilities of things that could happen throughout the Race"

26th December
Tape 1

p28 Challenge Again MOB
p29 Batemans Bay Coastal Patrol
p29 Questions about working Rescue vessel on VHF Ch73
p32 Bay Rescue A.B.N. Amro Telstra Control using name Baywatch consistently
p- Narooma Coastal Patrol
p34 Batemans Bay Coastal Patrol advised Telstra Control that rescue boat is Bay Rescue
p34 Telstra Control repeatedly refers to the rescue boat as Baywatch

Yachts using "ROMEO" Telstra Control using "ROGER"

27th December
Tape2
0300
27th Dec
Sked 2

p16 Storm Warning
p16 Sledgehammer heading for Jervis Bay
Telstra Control "Roger to that, Sledgehammer – You're heading for J.B. –"
p21 Storm Warning broadcast by Telstra Control not proceeded by: -
SECURITE SECURITE SECURITE

Sked 3

p29 Telstra Control to fleet "make sure batteries are fully charged"
"monitor 2182 and VHF 16 throughout evening"
"Young Endeavour will be monitoring 2182 VHF 16 4483 throughout "
p31 Ausmaid has not come up for two scheds Sailing Instructions safety schedule no 43 p13

Tape 3

Sked 3

p8 Eden Coastal Patrol
p8 Secret Mens Business injured crewman suspected fractured leg.
p9 Secret Mens Business – injured crewman will require assistance
p10 Sword of Orion reports gust to 78 knots
p23 sked on 4483 then 6227
27th Dec about 1430 p25 Urgent Message EPIRB 37 33 150 14 "all check to check their EPIRBs and make sure they have not been activated"

Telstra Control did not proceed this Urgent Message with PAN PAN

p27 yacht in distress
p29 Telstra Control uses first name "Tony" in place of the yacht's name
p29 Team Jaguar "activated EPIRB because they had rope around their propeller (engine) disabled"
p29 Sword of Orion to Team Jaguar

p31 Telstra Control "I would like all yachts to stop transmission other than Sword of Orion Secret Mens Business the Coastal Patrol and ourselves until this matter is over"

Team Jaguar activated an EPIRB but did not declare a MAYDAY

p32 Team Jaguar activated EPIRB have been dismasted require assistance.
Telstra Control did not declare a MAYDAY
Telstra Control did not transmit a MAYDAY Relay
Telstra Control confirms with Coast Guard Eden that they "copied all that"

p33 Team Jaguar turning their EPIRB off

p36 Telstra Control did not use yacht names

p38 Mallacoota Coast Guard

p40 Telstra Control broadcasts "disclaimer"

p41 "Coastal Patrol Eden now going ahead with a gale warning, an upgrade from a storm."

p42 Most yachts using "Romeo" to acknowledge a message

p42 Telstra Control using "Roger"

p47 MAYDAY Winston Churchill

p48 Telstra Control fails to control radio traffic on 4483 inspite of MAYDAY from Winston Churchill.

p49 Telstra Control to Trust Bank "I wonder if you could try 2524. We're using this 4483 and we've got a MAYDAY situation"

p50 Telstra control to Penta Comstat "sorry for the interference that we've been causing you —— we've just had now a MAYDAY, over."

p50 Michael Brown "It's a MAYDAY within our vicinity here. ——they're within this vicinity," and they're handling it on the Bridge, (2182 kHz or VHF)

Tape 4

p10 Yendys relays to Telstra Control "Business Post Naiad just posted a MAYDAY".

p10 Michael Brown appears to be on (mobile) phone

p11 Lewis Carter queries "did they have a MAYDAY situation."

p11 Telstra Control to Yendys "if you could get a confirmation of a MAYDAY for me, over."

p11 Michael Brown on (mobile) phone "Hello - - its engaged"

Lewis Carter fails to maintain control over the use of 4483 and fails to follow up the situation with Business Post Naiad. Fails to prioritise, and act on MAYDAY

p12 Team Jaguar "we can't transmit on VHF"

p12 Coastal Patrol Eden requesting Telstra Control for a mobile phone number for Team jaguar

Lewis Carter did not follow Distress Traffic protocol. He did not control radio traffic on a frequency being used for Distress traffic.

Absence of any guidelines or procedures to be followed. Define function of Radio Relay vessel.

MAYDAY situations ongoing with Winston Churchill and Business Post Naiad

p13 Unknown yacht. Lewis Carter refers to as "Bill"

Lewis Carter does not adopt good radio procedures, calls yachts by the first name of the skipper.

p12, 13 ,14 Prolonged communication concerning Team Jaguar and Moira Elizabeth

p16 "Telstra Control MAYDAY MAYDAY MAYDAY Telstra Control Yacht Kingurra, over **MAYDAY calls and messages are not addressed to a particular station. MAYDAY message should have followed with name, position, and nature of distress. Time wasted in seeking information.**

p16 Kingurra Man Over Board, overturned, engines stopped.

Three MAYDAY situations now running – Winston Churchill, Business Post Naiad, and Kingurra

p17 Zeus II dismasted

p20 Yendys calls Business Post Naiad

p20 Lewis Carter interrupts radio monitoring to speak to Sam Hughes on (mobile) phone Takes phone away from Michael Brown

p24 Lewis Carter "Team Jaguar you might ask Kingurra if they have a mobile phone"

p25 Telstra Control asks if Kingurra have a mobile phone

p29 Lewis Carter communication with Kingurra and Chutzpah re MOB then Team Jaguar re Moira Elizabeth going to use 4483 kHz

p20 Yendys calls Business Post Naiad

p29 Yendys calls Business Post Naiad

p29 Yendys advises Business Post Naiad that "Telstra Control is tied up with a Man Over Board of Kingurra" - - - "I received your last transmission that said that your situation was stabilised."

Use of Zulu (UTC) by Young Endeavour. Telstra Control using local time.

p30 yachts advised by Telstra Control to use VHF 16 to talk to the police helicopter.

p33 Telstra Control "We've got about 10 things going on at the same time, maybe more, actually."

p38 Conversation still ongoing with Team Jaguar re position (GPS).

p39 Team Jaguar – Telstra Control – white hand held flare – trying to identify for Moira Elizabeth

p39 Gundy Grey told to stand by when she called Telstra Control.
Telstra Control "I have an emergency situation"

The "emergency situation" was Moira Elizabeth trying to identify Team Jaguar

p40 Yendys calling Business Post Naiad

p40 Yendys raises concern with Telstra Control over Business Post Naiad

p40 Tilting at Windmills advises Telstra Control that Business Post Naiad "had three crew go over the side. They've all been retrieved" – "suffering from exposure and shock."

Tape 5

Sked 4
0300
28th Dec

p36 In the middle of SKED 4 Telstra Control interrupts the sked saying: -
"Interrupt us Team jaguar, when you want to "

p39 Moira Elizabeth and Team Jaguar using 4483 in the middle of the Position Reporting sked trying to get a tow line on board Team Jaguar.

CrownSol
29/03/2000 17:30

To: Pamela Lazzarini/CSO/NSW_AG@NSW_AG
cc: Ian Linwood/CSO/NSW_AG@NSW_AG
Subject: Sydney-Hobart Yacht Race Attn Pam Lazzarini

Forwarded by CrownSol/CSO/NSW_AG on 29/03/2000 17:34

HO Comcen <ho_comms@antdiv.gov.au> on 29/03/2000 15:59:37

To: CrownSol/CSO/NSW_AG@NSW_AG
cc:
Subject: Sydney-Hobart Yacht Race Attn Pam Lazzarini

12/95

USE OF CELLULAR TELEPHONES FOR DISTRESS AND SAFETY COMMUNICATIONS

Within the Australian maritime community the use of mobile cellular telephones is becoming widespread.

A growing number of incidents have occurred where vessels requiring assistance from rescue authorities have communicated the request via cellular telephone. This procedure is strongly discouraged for the following reasons:

1. It is not possible for the vessel in distress to communicate directly with other vessels in the vicinity which may be able to render immediate assistance. Valuable time will be lost while the relevant Search and Rescue (SAR) authorities receive and then re-broadcast the information to other vessels.

2. On scene distress communications will be restricted and delayed, as the cellular system only allows for communication between two parties at any one time. In addition, few SAR craft or aircraft will be fitted with cellular telephones, which will necessitate messages being passed via a third party. There is a real risk that elements of vital information could be lost or misinterpreted through intermediaries.

3. The cellular system does not provide for distress priority alerting, consequently it is possible that calls may not be immediately connected if the system is very congested, such as in areas around major cities.

of the

4. Cellular telephone coverage is restricted in many areas

difficulties

Australian coast. Consequently a risk of communication

incident

or even a complete communication breakdown exists if an

should occur at the edge of a cell coverage area.

position,

5. For vessels requesting assistance, and not sure of their

direction finding (DF) equipment for cellular telephones is not available. Using approved maritime communications equipment allows DF equipment to be used.

For these reasons, owners and operators of vessels are strongly urged to utilise properly installed and maintained marine communications equipment, and to use this equipment as the primary means of distress and safety communications.

P M McGrath

Chief Executive

September 1995

Australian Maritime Safety Authority

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File: C95/1244

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TO	Organisation	Fax #
	MRS PAM LAZZARINI	02 9224 5177
Total no. of pages (including this one):	17	Printed 29/9/99 13:07 PM

Message

16 pages from the Marine Radio Operators Handbook required to be carried on board every vessel with radio equipment

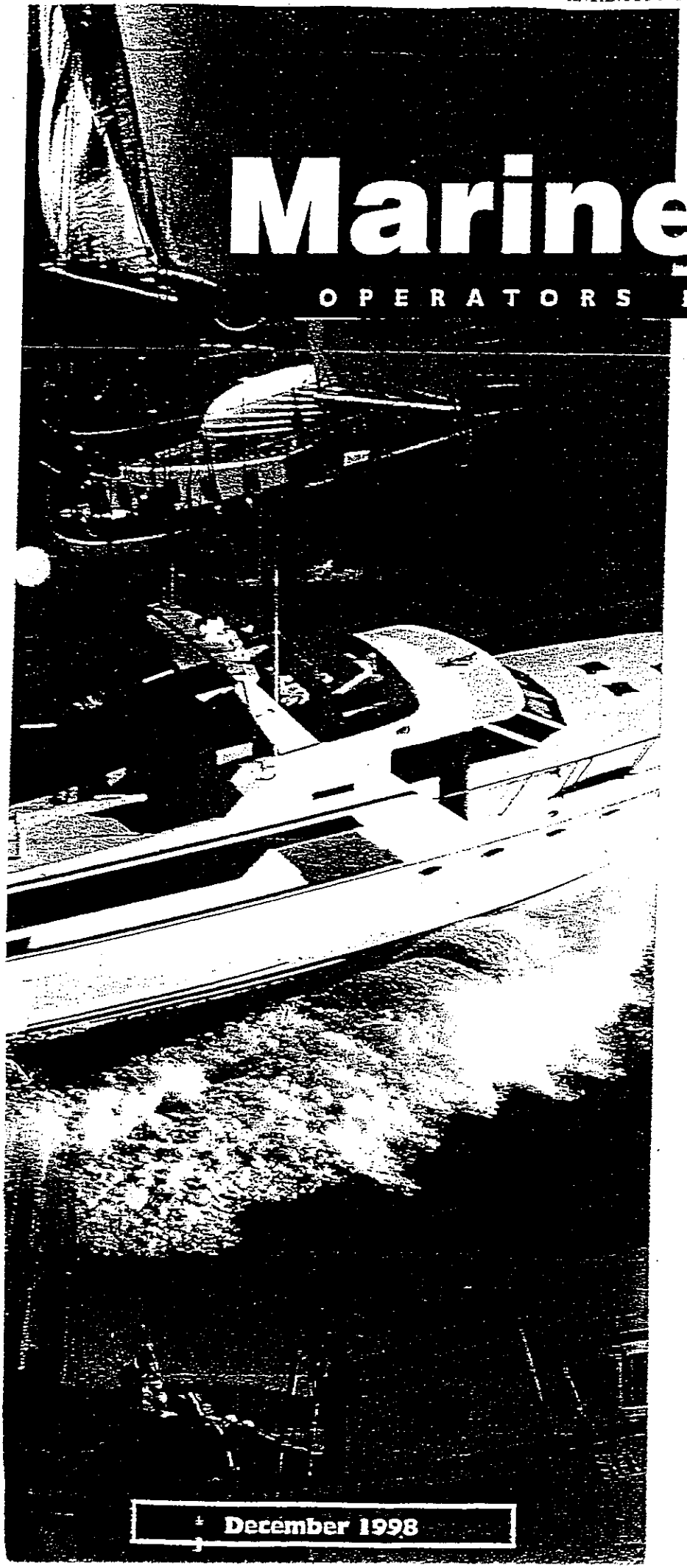
Name Michael Collinson

Title

Marine Radio

OPERATORS HANDBOOK

This handbook is intended as a guide for operators of marine radio equipment on small craft



December 1998

Australian Communications Authority

Foreword

This handbook is intended for the guidance of radio operators:

(a) on Australian vessels which are compulsorily fitted with marine radiotelephony, marine radiotelephony with digital selective calling capability, and/or Inmarsat satellite communications, in accordance with State or Territory government legislation; or

(b) on Australian vessels which are voluntarily fitted with marine radiotelephony, marine radiotelephony with digital selective calling capability, and/or Inmarsat satellite communications; or

(c) at limited coast stations, particularly those operated by marine rescue organisations.

Sydney - Hobart yachts

Royal Volunteer Coastal Patrol

It is the recommended textbook for candidates undertaking examination for the Marine Radio Operators Certificate of Proficiency (MROCP), the Marine Radio Operators VHF Certificate of Proficiency (MROVCP), and the Marine Satellite Communications Endorsement.

Procedures and requirements outlined in the handbook are based on the International Radio Regulations formulated by the International Telecommunication Union (ITU), on radio procedures used by coast stations operated by Telstra Mobile Satellite and Radio Services, on provisions governing the use of radio transmitters in Australia laid down in the *Radiocommunications Act 1992*, and on radiocommunications station licence conditions set by the Australian Communications Authority (ACA).

Careful observance of the procedures covered by this handbook is essential for the efficient exchange of communications in the marine radiocommunication service, particularly when the safety of life at sea is concerned. Special attention should be given to those sections dealing with distress, urgency and safety.

It should be noted that no provision of this handbook, the International Radio Regulations, or the *Radiocommunications Act 1992* prevents the use by a vessel in distress of any means at its disposal to attract attention, make known its position and obtain help.

Similarly, no provision of this handbook, the International Radio Regulations, or the *Radiocommunications Act 1992* prevents the use by vessels engaged in search and rescue operations of any means at their disposal to assist a vessel in distress.

This edition of the Marine Radio Operators Handbook contains information about new marine communications techniques which are available for small vessels in Australia as a result of the finalisation of the Global Maritime Distress and Safety System (GMDSS) on 1 February 1999.

The GMDSS is the result of international efforts to update marine radiocommunications used universally for the safety of life at sea. The system uses advanced technology and automation to ensure that search and rescue authorities, as well as ships in the vicinity of an emergency, are alerted reliably and rapidly. Both satellite and terrestrial communications form essential components of the GMDSS.

The ACA acknowledges the contribution of the Australian Maritime Safety Authority in the preparation of Chapter 11.

Contents

Section 19 121.5/243 MHz EPIRBs

109. Methods of detection and location

109.1 A 121.5/243 MHz EPIRB, once activated, simultaneously radiates a continuous series of distinctive descending tones on the aeronautical distress frequencies of 121.5 and 243 MHz. Providing its batteries are in good condition, this signal should continue to be transmitted for a minimum of forty-eight hours. The signal can be detected and located by:

- aircraft within range which are listening on either the civil aeronautical distress frequency of 121.5 MHz or the military aeronautical distress frequency of 243 MHz; and
- the COSPAS-SARSAT satellite system.

110. Detection and Location by Aircraft

110.1 Military, civil international and some domestic aircraft on major air routes maintain a listening watch on one of the aeronautical distress frequencies of 121.5 and 243 MHz. The distance that such an aircraft is likely to detect an activated EPIRB depends entirely on the height of the aircraft. A high flying passenger jet aircraft would probably hear the signal at a radius of about 330 km (180 nautical miles), while a smaller aircraft flying at medium altitudes would hear the signal within about 185 km (100 nautical miles).

110.2 An aircraft hearing an activated EPIRB will immediately make a report to aviation authorities who, in turn, will pass this information to the RCC. An approximate position estimate of the activated EPIRB can be made by plotting the "first heard" and "last heard" positions.

110.3 Once a general search area has been established, military or civilian aircraft with specialised direction-finding equipment will be used for the task of localising the EPIRB. Survivors should use all appropriate visual signals to attract the attention of searching aircraft during the final stages.

111. Detection and Location by Satellite

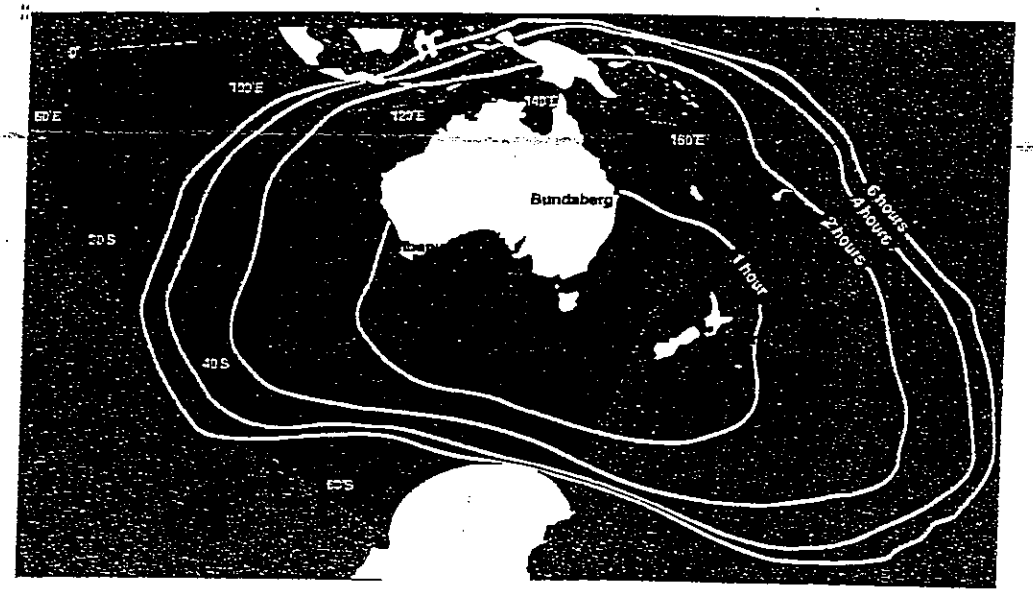
111.1 Signals radiated from a satellite-compatible 121.5/243 MHz EPIRB can also be detected by the COSPAS-SARSAT system's orbiting satellites. These signals are relayed by a satellite directly back towards the Earth. If the activated EPIRB and the ground receiving facilities of a local user terminal (LUT) are simultaneously within view of the satellite, the EPIRB signals are received by the LUT.

111.2 This information is processed by the LUT to provide position information and then is passed directly to RCC Australia in Canberra. Successive satellite passes are used to refine this information.

111.3 A 121.5/243 MHz EPIRB can generally be located by the COSPAS-SARSAT system to within 20 km (11 nautical miles). Aircraft can be used for the final location of the distress position as described in paragraph 110.3.

111.4 Because of the requirement that an orbiting satellite must simultaneously "see" both the activated EPIRB and a LUT, detection and location of 121.5/243 MHz EPIRBs is limited to particular geographical areas surrounding a LUT. ◆■

111.5 The diagram shows the approximate geographical limits and median detection time for 121.5/243 MHz EPIRBs using the combined resources of the LUTs in Queensland, Western Australia and New Zealand.



COSPAS-SARSAT system coverage for 121.5/243 MHz EPIRBs using local user terminals located in Queensland, Western Australia and New Zealand. Median time to detect and locate an activated beacon is also shown (the darker shading indicates Australia's area of responsibility for search and rescue).

111.6 It can be seen from the diagram that the 121.5/243 MHz EPIRB can provide significant support to search and rescue operations in all Australian and New Zealand coastal waters. Parts of the Indian, Southern and Pacific Oceans, the Timor Sea and waters around Papua New Guinea also fall into the service area of the three LUTs.

111.7 Although LUTs established in other countries provide a service for 121.5/243 MHz EPIRBs in other areas, major parts of the Indian, South Atlantic and Pacific Oceans remain uncovered.

111.8 Vessels making voyages outside 121.5/243 MHz service areas should carry a 406 MHz EPIRB. It is recommended that vessels proceeding more than 30 nautical miles offshore carry a 406 MHz EPIRB.

112. Satellite Detection and Location of Older 121.5/243 EPIRBs

112.1 Because of the sophisticated technology used in the COSPAS-SARSAT satellite detection and location system, the ACA (and its predecessors) has enforced stringent technical standards for 121.5/243 MHz EPIRBs manufactured and sold after March 1990.

112.2 All EPIRBs manufactured to this standard, which since December 1996 is known as Australian/New Zealand standard AS/NZS 4330:1995, are capable of being detected and located by satellites in the manner described in paragraphs 111.1 - 111.4. Previously this standard was known as Ministerial Standard 241 (MS241).

112.3 Tests carried out by search and rescue authorities on earlier models of 121.5/243 MHz EPIRBs, which are likely to bear a label certifying compliance with specification DOC 241A or 241B, show that very few of them are likely to be detected by the satellite system. Of those beacons which were detected, the calculated positions were inaccurate and misleading.

112.4 The Australian Maritime Safety Authority (AMSA) has stated that an owner of a 121.5/243 MHz EPIRB manufactured prior to 1990 should assume that this beacon is incompatible with the satellite system. The Authority strongly recommends that boat owners replace older EPIRBs with a type that meets AS/NZS 4330:1995, or the earlier MS 241 standard.

Section 20 406 MHz EPIRBs

113. Methods of Detection and Location

113.1 The 406 MHz EPIRB radiates signals on the frequency of 406.025 MHz. Those 406 MHz EPIRBs manufactured to Australian specifications will additionally radiate signals on 121.5 MHz for aircraft homing purposes. Australian 406 MHz EPIRBs can be detected and located by two methods:

- by aircraft within range listening on the civil aeronautical distress frequency of 121.5 MHz; and
- by the COSPAS-SARSAT satellite system.

114. Detection and Location by Aircraft

114.1 The method of detection and location of the 121.5 MHz signal component of a 406 MHz EPIRB by aircraft is similar to that described in paragraphs 110.1 - 110.3 for 121.5/243 MHz EPIRBs.

115. Detection and Location by Satellite

115.1 Signals radiating from an activated 406 MHz EPIRB will be detected by satellites of the COSPAS-SARSAT system and relayed back towards the Earth. These signals are similar to those from a 121.5/243 EPIRB, and in a like manner, will be received by any LUT in the satellite's view.

115.2 Because signals from a 406 MHz EPIRB are in a digitised form, they can also be stored in the satellite's memory. As the satellite's path brings it into view of a LUT, information, including time of first detection, is retrieved from the satellite's memory and relayed down to the LUT. This information is processed and passed to a rescue coordination centre, providing both an alert and a position.

115.3 A 406 MHz EPIRB can generally be located by the satellite system to a radius of better than 5 km (2.7 nautical miles). Final location of the distress scene can be carried out by aircraft "homing" on the 121.5 MHz component of the EPIRB signal.

115.4 Because of the satellite's ability to memorise signals from a 406 MHz EPIRB, detection and location of this type of beacon does not suffer the geographical limitations of the 121.5/243 MHz model. An activated 406 MHz EPIRB can be detected and located at any place on the Earth's surface. ◆●

115.5 It is strongly recommended that all vessels making a voyage from Australia to any destination outside the limits of 121.5/243 MHz beacon coverage carry a 406 MHz EPIRB.

115.6 406 MHz EPIRBs have numerous advantages over the 121.5/243 MHz types. These advantages include:

- the ability to be located more accurately;
- identification of the owner/operator enables search and rescue authorities to obtain more intelligence before initiating a response;
- future generation beacons will have the capability of detection by geostationary satellites enabling near instantaneous detection; and
- future generation beacons will have the capability of transmitting position data memorised from an interface with satellite navigation receivers (GPS).

116. Identification of 406 MHz EPIRBs

116.1 Every 406 MHz EPIRB has a unique identity code which is transmitted as part of its signal and which also indicates the country of registration. This code is programmed into the beacon by the supplier before it is offered for purchase. ◆◆

116.2 As a result, local user terminals anywhere in the world receiving a distress alert and location from an activated 406 MHz EPIRB, can also identify the vessel in distress and the beacon's country of registration.

116.3 If this system is to work successfully, and for their own safety, it is essential that purchasers of 406 MHz EPIRBs complete the registration form provided by the supplier and mail it to RCC Australia in Canberra. The completion of this registration process will ensure that the RCC is equipped with information vital to a successful rescue mission. ◆◆

116.4 It is just as important that purchasers of second-hand 406 MHz EPIRBs, also provide their details to the RCC.

117. Activation of 406 MHz EPIRBs

117.1 406 MHz beacons are available in two types:

- those that require manual activation; and
- those that can be activated manually or will float-free and activate automatically should a vessel sink.

117.2 The manual activation type may offer an electronic menu of distress situations. Selection by an operator prior to activation will provide the rescue coordination centre with an identification of the vessel's type of distress, as well as its identity and country of origin.

117.3 Vessels compulsorily fitted with 406 MHz EPIRBs under Commonwealth legislation must carry the float-free type.

Section 21 Care and Maintenance of EPIRBs

118. Servicing

118.1 Vessels fitted with 121.5/243 and 406 MHz EPIRBs under Commonwealth and State legislation should refer to the relevant regulations concerning performance verification tests and battery replacement.

118.2 Boat owners voluntarily carrying EPIRBs of either type should refer to the owner's manual concerning recommended servicing and battery replacement.

118.3 An EPIRB must not be tested except strictly in accordance with the manufacturer's instructions for self-testing. ◆●

119. Stowage of EPIRBs

119.1 Many EPIRBs are supplied with a bulkhead mounting bracket. It is recommended that this be used to stow an EPIRB in a place where it is both readily visible and accessible for use in an emergency.

119.2 If an inflatable liferaft is carried on board, consideration should be given to stowage of an EPIRB inside the raft.

119.3 The float-free type of 406 MHz EPIRB should be carefully located and mounted to ensure that it is not fouled by the vessel's superstructure should the vessel sink and the beacon be released.

120. Inadvertent Activation of EPIRBs

120.1 Every year valuable government and search and rescue resources are wasted in locating EPIRBs which have been activated inadvertently and without the owner's knowledge. Most cases of accidental transmission result from poor or inappropriate storage, or failure to totally disable an old model EPIRB before disposal. The need to treat EPIRBs responsibly cannot be too highly emphasised. ◆●

120.2 To minimise the possibilities of accidental activation, EPIRB owners are urged to pay careful attention to:

- the need to avoid the stowage of EPIRBs in lockers with other equipment or objects that may subject the beacon activation switch to pressure (vessel movement should be considered);
- the need to avoid the stowage of EPIRBs in places where they may lie in water or be subject to occasional high water pressure such as from a hose (the entry of water into the circuitry through deteriorating watertight seals may activate the beacon);
- the complete removal of batteries or destruction of an EPIRB before disposal into the public garbage system;
- the need to ensure that an EPIRB will not be activated through physical movement or shock during any form of transport away from a vessel;
- the need to educate other persons aboard a boat regarding the consequences of activation;
- the need to prevent interference with the beacon by children; and
- the fact that a float-free EPIRB which has been "armed" will activate immediately on removal from its cradle (transportation away from the cradle should be made in the "safe" or "off" condition).

Section 28 Care and Maintenance of Lead Acid Batteries

142. Construction of Lead Acid Cells

142.1 A chemical combination of lead and lead peroxide plates, and the sulphuric acid in the electrolyte (the liquid solution within the cell) produces a voltage difference between the plates which allows a current to flow.

142.2 When the acid in the electrolyte or the material in the plates is used up, the voltage no longer exists and current cannot flow. At this point, the cell is said to be discharged or "flat".

142.3 This situation is reversible by passing a current in the opposite direction. This process reverses the chemical reactions in the cell and is known as charging.

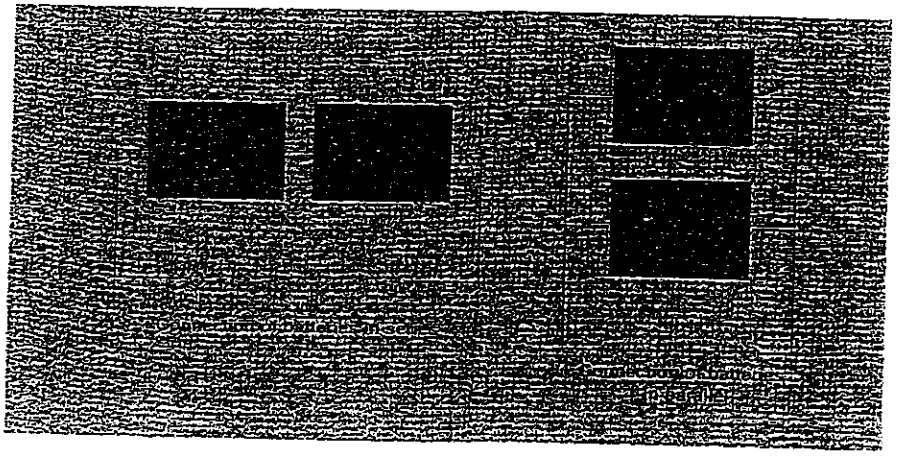
142.4 Lead acid cells have a voltage of 2 volts per cell, regardless of size. Larger size cells will supply higher currents than smaller cells, or the same current for longer periods. The ability of a cell to produce current for a period of time is known as the cell's capacity and is usually measured in ampere-hours, or with batteries designed for motor vehicle use, as cranking current amps (CCA).

143. Connection of Lead Acid Cells

143.1 Cells may be connected in series, that is, the positive terminal of one cell to the negative terminal of another, to produce higher voltages. Three cells connected in series will give a "battery" of 3 x 2 volts = 6 volts; six cells connected in series will give a "battery" of 6 x 2 volts = 12 volts. ◆●

143.2 Most modern lead-acid batteries are supplied in 6 or 12 volt combinations and may themselves be connected either in series to provide the required output voltage, for example, two 12 volt batteries connected in series will produce a voltage of 2 x 12 volts = 24 volts. ◆●

143.3 Connection of lead-acid batteries in parallel, that is positive terminal to positive terminal, negative terminal to negative terminal, will produce the same output voltage as a single battery, but the ability to supply current (capacity) will have been lengthened. For example, two batteries each supplying 12 volts with a capacity of 60 ampere-hours, when connected in parallel will provide a voltage output of 12 volts with a capacity of 120 ampere-hours.



144. Essential Battery Maintenance

144.1 The functioning of radio equipment is dependent on power supplied by the battery. If it is to provide adequate performance in the event of an emergency, regular and careful maintenance is required.

144.2 A battery's service life also depends on the manner in which it is treated.

144.3 To ensure the best performance from a battery it is important that a battery:

- is kept clean, dry and free from terminal corrosion;
- has the electrolyte kept at the correct level; and
- is kept correctly charged. ◆●

145. Battery Cleanliness

145.1 A battery should be kept clean. A dirty battery may hold spilt electrolyte on its surface thereby providing a path for the electrical current to leak away. It is important to keep the outside surfaces of a battery dry and free of contamination. ◆●

145.2 Corrosion forming on terminal clamps may seriously affect, or even prevent, the ability of the battery to supply current. Corrosion will be evident by the formation of a white-green powder between the battery terminals and the terminal clamps. In this situation, the terminal clamp should be removed and both it and the terminal post cleaned. ◆●

145.3 To minimise the likelihood of corrosion, terminal posts and clamps should be lightly smeared with petroleum jelly.

146. Electrolyte Level

146.1 The level of electrolyte inside a battery is important. As a result of the chemical action inside a battery, water is lost. This should be replaced with distilled or demineralised water. ◆●

146.2 Seawater must not be used under any circumstances.

146.3 The level of the electrolyte should be maintained at approximately 10 mm above the plates unless otherwise specified by the manufacturer. ◆●

146.4 If the electrolyte level is too high, it may overflow during charging providing an unwanted discharge path. If the electrolyte is too low, the plates are exposed to the air and permanent damage and loss of capacity may result.

146.5 It may be noticed that a battery that is nearing the end of its useful life will require more frequent topping-up than has been previously necessary.

146.6 Low-maintenance batteries will require infrequent topping-up. Maintenance-free batteries may require none at all.

147. Correct Charging

147.1 To provide the best service, a battery must be correctly charged. Both overcharging and undercharging can seriously affect its performance. ◆●

147.2 On small vessels the usual means of charging the radio battery will be an alternator or generator attached to the vessel's engine. An associated regulator, which reduces the charging current as necessary, should prevent overcharging.

147.3 Vessels that are used frequently (say, several times each week) should have no problem maintaining a fully charged radio battery. However, on vessels that are used relatively infrequently (say, once every few weeks), it is likely that during storage even a battery that starts as fully charged, will self-discharge and go flat.

147.4 For safety reasons, it is important that a small boat owner is able to determine the general condition of a battery and its ability to supply current over a period of time (its capacity). An indication of the level of charge in a battery may be obtained by either:

- measuring the specific gravity of the electrolyte; or
- measuring the on-load terminal voltage. ◆●

148. Measuring the Specific Gravity

148.1 The specific gravity of the electrolyte (the liquid inside the battery) varies proportionally with the amount of charge in the battery. It is highest when the battery is fully charged, and lowest when the battery is fully discharged or flat. It follows that the amount of charge in a battery can be determined by measuring the specific gravity of the electrolyte. ◆●

148.2 A simple, inexpensive device called a hydrometer is used to measure specific gravity. ◆●

148.3 In general, for a fully charged battery, the specific gravity should measure about 1250. Half charge will be indicated by a reading of 1200 and fully discharged by 1150. All cells in a battery should indicate a similar specific gravity. ◆● A variation of more than about 25 "points" will indicate a faulty cell and the battery should be replaced.

148.4 Due to differences in manufacturing techniques, specific gravities may vary slightly from brand to brand. The manufacturer's specifications should be consulted for more precise figures.

148.5 The temperature of the electrolyte will also affect specific gravity readings. Manufacturers normally provide specifications at the industry standard of 25°C, and a correction should be applied if the temperature is significantly above or below this figure. Two specific gravity "points" should be added for each three degrees above 25°C, and two "points" subtracted for each three degrees below 25°C: for example, a hydrometer reading of 1250 at 4°C when corrected gives an actual specific gravity of 1236, indicating that rather than being fully charged, the battery is approximately 86% charged.

148.6 Specific gravity readings should not be taken immediately after topping-up a cell as the added water will float towards the top of the cell and give a false reading. Charging for thirty minutes or more after topping-up will mix the electrolyte and allow accurate readings.

148.7 Batteries which have cells where specific gravity readings fail to rise, or respond poorly, to adequate charging should be replaced.

149. Measuring the On-Load Terminal Voltage

149.1 Measurement of the on-load (that is, when the battery is supplying current) terminal voltage will also provide an indication of the amount of charge in a battery. ◆●

149.2 For a 12-volt battery, the on-load terminal voltage should not fall below approximately 11.4 volts while transmitting. If the voltage does fall significantly below this figure, the battery requires charging. If after charging, the on-load terminal voltage still falls significantly below 11.4 volts, it is an indication of a faulty cell and the battery should be replaced.

149.3 Measuring of the off-load (that is, when the battery is idle) terminal voltage of a battery is a poor indication of its condition. ◆●

150. Loss of Capacity

150.1 A battery will suffer a gradual loss of capacity during its life. This is inevitable and the battery should be replaced when the capacity loss becomes significant.

150.2 Many lead-acid batteries have a commercial life of only two to three years.

150.3 However, the useful life of a battery can be considerably shortened by:

- operating a battery in a low state of charge for long periods;
- allowing a battery to stand in a discharged state for long periods;
- leaving a charged battery for long periods without periodic charging; and
- overcharging.

151. Battery Hazards

151.1 There are two hazards associated with lead-acid batteries that ship station operators should be aware of:

- the risk of explosion; and
- the risk of chemical burns. ◆●

151.2 As a result of the chemical process occurring within the cells of a battery during charging, hydrogen gas is produced. When mixed with air, this can form a highly explosive mixture which can be ignited by a naked flame, a lighted cigarette, or a spark. The spark caused by breaking or making an electrical connection in the vicinity of the charging battery may be sufficient to ignite the hydrogen-air mixture. ◆●

151.3 If using metal tools to work on battery connections, extreme care must be taken to ensure that terminals are not short-circuited. ◆●

151.4 The electrolyte in battery cells is sulphuric acid. It is sufficiently concentrated, particularly just after charging, to damage eyes, skin or clothes if spilt or splashed. Immediate and prolonged application of running water is recommended to minimise its effect. ◆●

151.5 It is recommended that eye protection be worn when a person is carrying out maintenance on batteries. Batteries should not be topped-up whilst on charge. ◆●

152. Location of Batteries

152.1 The location of a battery supplying marine radio equipment should be chosen to ensure that, as far as practicable, the battery is:

- protected from the elements;
- readily accessible for routine maintenance;
- located reasonably close to the transceiver;
- located as high in the vessel as practicable;
- well ventilated to dissipate the hydrogen gas produced (if located within a wheelhouse or other compartment, venting to the outside may be necessary);
- not located with other items of equipment that could, in heavy weather, fall across the battery and cause short-circuiting; and
- not located in the same compartment as a different type of battery, for example, alkaline cells.

Section 29 Faults in Marine Radio Equipment

153. General

153.1 Regular inspection and maintenance of the antenna, transceiver and battery power supply will minimise the likelihood of faults occurring at sea.

153.2 However, the owners of small vessels should be prepared to deal with minor faults on their marine radio equipment.

153.3 Faults can be usually divided into three categories:

- faults occurring on the antenna system;
- faults occurring in the transceiver; and
- faults occurring with the battery power supply.

154. Antenna System Faults

154.1 Antenna system faults may include:

- poor or broken connections in the antenna or radio earth system;
- the antenna broken or shorted, or a fracture inside a whip antenna; and
- broken, deteriorated or contaminated insulators. ◆●

154.2 A poor or loose connection between the transceiver and the antenna will affect both transmitted and received signals. Received signals will be broken and the loudspeaker will "crackle". Other stations may report broken transmitted signals. ●● With MF/HF equipment, normal tuning positions on the antenna tuning unit (ATU) may vary. ◆

154.3 A completely broken connection between transceiver and antenna will result in receiver hiss, but few or no signals. Transmission will not be possible. ●●

154.4 An antenna which is shorted to a vessel's metal hull or superstructure is likely to produce similar results. ◆

154.5 On vessels equipped with MF/HF equipment, faults occurring on the radio earthing system, although relatively uncommon, may cause transmitting problems. The most likely faults are breaks in the metallic connections at the transceiver, antenna tuning unit (ATU) or at the radio earth plate itself. On rare occasions, a radio earth plate may become detached from the hull. ◆

154.6 Radio earthing problems will usually be evident by abnormal or changing ATU tuning positions. Often a faulty (or non-existent) radio earth may cause the metallic parts of the transceiver and ATU to become "live" during transmission. This is not dangerous, but a sharp, burning sensation may be felt when in direct contact with these parts. ◆

155. Transceiver Faults

155.1 A transceiver fault is usually obvious and probably will require specialist attention. A faulty microphone cord may prevent transmission, but not affect reception. ●●

156. Power Supply Faults

156.1 Power supply faults may include:

- loose or corroded battery terminals;
- a discharged or defective battery;
- blown fuses; and
- loose or frayed connecting cables. ◆●

156.2 Loose battery connections will be evident by intermittent operation of the receiver and transmitter, and flickering dial lights or channel display. ◆●

156.3 A battery which is defective or close to discharged may be able to supply sufficient current to operate the receiver, but not the transmitter. Should the transmitter fail to operate and dial lights or channel display dim significantly when the transmit button is operated, the battery should be suspected. Heavy corrosion at the battery terminals may cause similar symptoms. ◆●

156.4 Blown fuses will mean that the equipment will fail to operate in any way. Frayed power supply cables touching together or to metal parts of the vessel are a frequent cause of blown fuses. ◆●