SECTION 17. CONCLUSIONS

17.1 This section reproduces all the conclusions and findings made in the report. The first number in the list is a conclusion number included for convenient reference. The second is the paragraph number of the reference in the body of the report. The page number at which the conclusion is found follows the conclusion.

Rec no.	Para no.	Conclusion	Page no.
		Section 3 – Actions of the Ship's Company and their Training and Competence	
1.	3.10	The command team should have consulted to determine the objectives, strategies and tactics to combat the fire.	46
2.	3.11	The command team did not meet on a frequent basis during the incident to pool information, evaluate strategies and set appropriate objectives.	46
3.	3.12	The command communication chain was very long.	46
4.	3.33	The Board is not convinced by the reasons offered for the decision not to anchor. If an emergency cable run was rigged between the emergency switchboard and the hydraulics room, the anchor might have been able to be raised. Whilst breaking the cable and slipping an anchor is not an everyday occurrence, such an evolution could have been undertaken with tug assistance if the CO considered it necessary. The Board considers that the decision not to anchor was an error of judgement. Anchoring would have reduced areas of concern to the command team, particularly that of a possible grounding.	49
5.	3.34	Had the ship gone to anchor this would have released a number of experienced personnel for firefighting, as well as allowing the command to	49
6.	3.34	concentrate totally on the emergency at hand without the nagging worry of running aground.	50
7.	3.38	The Board supports the CO's command decision to CO_2 drench and is of the view that the reasoning behind the decision to activate the system at 1101 was appropriate.	51
8.	3.45	The SSFB should have been properly trained to make a controlled entry into the MMS to:	52
		a. evaluate the situation;	52
		b. conduct a snatch rescue; and	52
		c. guide personnel to safety.	52
9.	3.49	AB Noles should not have been on watch alone in the tiller flat.	52
10.	3.50	AB Noles should have advised CPO Jenkins that he had to report to the bridge before assisting to shift the firefighting gear.	52

11.	3.54	The comment made about 'no girls' was well intentioned but inappropriate. Female members of the crew performed their duties as competently as their male counterparts.	53
12.	3.65	There was a major fuel leak on the PME.	55
		a. A thorough evaluation of the situation was not undertaken.	55
		b. Unnecessary personnel should have been withdrawn from the MMS.	55
		c. The situation was hazardous enough to warrant the isolation of electrical equipment and the application of foam onto the fuel and into the bilge.	55
		d. If fire hoses laid out for use are not charged and ready, it is highly likely that they will not be used as there will be no time to charge the hoses once a fire has started.	55
13.	3.72	The fire was too large to be contained with extinguishers.	56
14.	3.78	The funnel ventilation exhaust flaps should have remained open until Hose Team 1 had exited the MMS.	57
15.	3.85	RAN hose team training is excellent.	58
16.	3.88	There was a delay in providing fluids for the refreshment of hose teams after firefighting. Each of the key catering staff had ancillary duties that diverted them from this task.	58
17.	3.94	Breathing apparatus control procedures were not always followed. Of particular concern was the failure, on some occasions, for personnel in OCCABA to work in pairs.	59
18.	3.102	Not all personnel wearing OCCABA monitored their pressure gauges.	60
19.	3.109	On the day of the fire bearded members of the ship's company wore breathing apparatus. Personnel did not have a thorough understanding of how beards could reduce the wearing time of an OCCABA. Accordingly, no allowance was made for personnel with beards when calculating OCCABA duration.	61
20.	3.110	The practice of allowing bearded personnel to use breathing apparatus does not comply with AS/NZS1715-1994.	61
21.	3.118	Stage 2 BA control procedures would assist with the management and coordination of activities in an emergency.	63
22.	3.123	Ship's personnel knew little, if anything, about the international shore connection.	63
23.	3.134	ABR 5476 provides insufficient information on the properties and extinguishing characteristics of CO_2.	65
24.	3.135	The command team had limited knowledge of the properties of CO_2 and its hazards. As a result the decision to send in the hose teams after the drench to fight the fire, was premature.	65
25.	3.143	The ship's emergency file provided incomplete and incorrect advice to any incident commander.	66
26.	3.144	The SOPs were followed without any lateral thinking.	66
27.	3.145	The Sea Training Group did not identify that the ship's emergency file was inadequate.	66

28.	3.152	In general officers and senior sailors displayed a poor knowledge of the ship, particularly of the emergency systems.	66

Section 4 - Medical Response to the Incident

29.	4.12	The initial medical response proved to be appropriate. Improved flexibility would have been achieved had the Duty SMET been mustered in conjunction with the SSFB from the outset.	72
30.	4.21	The initial identification of missing personnel was achieved as quickly as practicable under the circumstances, but was completed in HQ1 in a non-systematic way. The initial notification to external authorities was inaccurate.	74
31.	4.27	The source of the inaccurate information that the first casualty found in the MMS may have been alive has not been established. It may have derived from the request for an ELSRD, or the transfer of comments or concerns expressed by those attending to LS Meek. There appears to have been a failure to pass clear casualty information over the normal communications circuits.	75
32.	4.28	The initial assessment of the casualties by members of the hose teams was appropriate, but was hampered by antiflash gloves, which should have been taken off.	75
33.	4.29	The placing of LS Meek in a Paraguard stretcher was uneccessary. If extrication was required to allow attempts at resuscitation it should have been done by the quickest available means, and if resuscitation was not to be attempted the evolution was unnecessary.	75
34.	4.30	The establishment of a casualty reception bay following the receipt of information that one of the casualties in the MMS may have been alive was appropriate. The bay was adequately equipped under the circumstances.	75
35.	4.38	Medical staff supplementation was appropriately requested and promptly provided.	76
36.	4.41	The provision of continuing medical care of the injured was left to the SMET members and was well carried out.	76
37.	4.44	The decision to implement the medevac was taken by command without consultation with either of the two key medical personnel who were in the MMS at the time. Inadequate consideration was given to the preparation of the injured for medevac or their requirements in flight, and this resulted in no medical escort being despatched, and the management of the intravenous lines being an afterthought. Despite these shortcomings, there was no adverse impact on casualty care.	77
38.	4.50	Although the circumstances that led to the decision to remove the fatalities from the MMS are understandable, a better course may have been to leave them within the MMS, covered and placed in a suitable location.	78

39.	4.51	The quality of body bags and the lack of a suitable and serviceable stretcher inhibited the fatality extrication process. Extrication was delayed because there was a lack of ready appreciation of mechanisms that could be employed in order to lift casualties in the event the hoist was unserviceable.	78
40.	4.52	The difficulties encountered in extricating the fatalities highlighted the potential for significant problems had urgent extrication of a live casualty from the MMS been required.	78
41.	4.66	The Board is of the view that the medical incident management could have been achieved more effectively, and that this resulted in inappropriate disposition of medical personnel to meet overall requirements, and inadequate medical control of the medevac. This occurred because the ship's medical coordinator, and the more experienced of the two medical officers, had their attention diverted towards the identification and confirmation of death of the bodies in the MMS. The Board considers that the more experienced of the two MOs would have been better utilized if she had taken over the role of medical incident management on arrival, utilising the ship's senior medical sailor as her senior adviser in relation to ship-specific matters. The Board considers that this did not occur because of the inadequate training of MOs in shipboard medical incident management, and the relative inexperience of the senior medical sailor in this role.	80
42.	4.74	Casualty status awareness was complicated by the decision to keep casualty information perceived to be sensitive off the normal communications circuits. This resulted in inaccurate information being passed and a failure to keep proper records. Neither the DC state board nor the casualty state board was properly completed.	81
43.	4.80	There were adequate quantities of medical materiel available during the incident. Some difficulties were encountered at RASCO because access to the Sick Bay to replenish stocks was inhibited by smoke boundaries.	82
44.	4.88	While there were no specific difficulties associated with the use of the SMET Jacket during the incident, HMAS WESTRALIA's SMET members find them inconvenient and awkward to use.	83
45.	4.89	Medical personnel were difficult to identify because they were not wearing Red Cross Brassards.	83
46.	4.100	The clinical training of medical staff and SMET members was adequate to meet the needs of this incident.	85
47.	4.101	Shipboard medical training provided to SMET members and ship's company was adequate.	85
48.	4.102	The conduct of major damage control exercises did not provide realistic casualty scenarios, either in numbers or types of casualties, and the POMED, because he assumed the role of an umpire, did not obtain sufficient experience in medical incident management.	85

Section 5 - Death and Injury of Personnel

49.	5.17	All the deaths resulted from carbon monoxide toxicity prior to the activation of the CO_2 drench, and probably within 10 minutes of the outbreak of the fire.	88
50.	5.21	The Board is of the opinion that the assessment of the circumstances of the deaths has not been inhibited by the fact of the bodies being moved prior to examination by Coroner's staff.	89
51.	5.25	The Board finds that Able Seaman Phillip John Carroll S155254 Date of Birth 17 June 1974 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.	89
52.	5.26	AB Carroll was not suffering from any pre-existing condition or intercurrent illnesses that could have affected his escape or survival.	89
53.	5.27	The Board is of the view that AB Carroll continued to fight the fire for a time after its commencement. The Board believes he would have been aware that MIDN Pelly was in the MMS, both by seeing her and through her attachment to the 3rd Hand. The Board concludes that AB Carroll, having given up firefighting, probably searched for MIDN Pelly and, having found her, attempted to assist her from the MMS before being overcome by fire fumes.	89
54.	5.33	The Board notes there is some evidence that LS Meek may have been seen at the top of the port ladder in the MMS by LS Bromage, viewing from the fridge flat door, after the fire erupted and before the CO_2 drench. This information was not positively passed to HQ1 until after the CO_2 drench had occurred. The Board finds it hard to understand how such a sighting could have occurred from a distance in conditions of poor visibility caused by thick smoke and very low light.	90
55.	5.35	The Board finds that Leading Seaman Bradley John Meek S147321 Date of Birth 16 July 1972 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.	91
56.	5.36	LS Meek was not suffering from any pre-existing condition or intercurrent illnesses that could have affected his escape or survival.	91
57.	5.37	The Board is unable to determine exactly where LS Meek was on the outbreak of the fire. It is of the view that, by the time the fire enlarged, he had made his way to the bottom of the port ladder to the top plates and stood there assisting LSMT Smith, and POs Francis and Hollis to make their way up that ladder. At some time after the last of those three exited, he also attempted to make his way up the ladder, probably after realising he was becoming incapacitated, but became overcome by fire fumes at its top, where he collapsed. The Board is of the view that the	

		burns sustained by LS Meek occurred certainly after the onset of unconsciousness and probably after his death.	91
58.	5.43	The Board finds that Midshipman Megan Anne Pelly L154029 Date of Birth 8 December 1975 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.	92
59.	5.44	MIDN Pelly was not suffering from any pre-existing condition or intercurrent illnesses that could have affected her escape or survival.	92
60.	5.45	The Board is of the view that MIDN Pelly probably attempted to escape the fire by moving aft between the DAs, this being the logical means of escape for one unfamiliar with the space. Being unable to find an escape ladder (there was none), she may have either made an attempt to return forward or alternatively may simply have stayed aft in the hope that the smoke might not affect her. In either event, the Board is of the view that AB Carroll, who was aware she was in the MMS, found her and led her back towards the port escape ladder before both were overcome by the fire fumes.	92
61.	5.46	The Board finds that no blame for MIDN Pelly's presence in the MMS can be attached to anyone. That she was there is of profound regret, however the occurrence of a second fuel leak causing a major fire could not have been foreseen, and the initial leak was being effectively dealt with.	92
62.	5.50	The Board finds that Petty Officer Shaun Damian Smith S138258 Date of Birth 27 November 1968 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.	93
63.	5.51	PO Smith was not suffering from any pre-existing condition or intercurrent illnesses that could have affected his escape or survival.	93
64.	5.52	The Board is of the view that PO Smith may have attempted to assist AB Carroll to fight the fire from the port side of the middle plates. Of the three engineering staff who perished, PO Smith was the least familiar with the space, having joined WESTRALIA on 27 Apr 98. It is conceivable that, he became disorientated in his efforts to escape, and so was unable to find the port ladder before being overcome by fire fumes.	93
65.	5.62	There were some deficiencies in the provision of specific treatment for the smoke inhalation casualties as compared to laid down protocols. These deficiencies did not in the event adversely affect the clinical outcome, and were contributed to by the relative lack of medical officer or sailor supervision of the casualties at RASCO.	94

Section 6 - External Assistance

66.	6.22	The Board is of the opinion that the Sea King was the ideal aircraft on the day. Apart from the minor difficulty with the overriding winch wire, the aircraft flew without incident.	98
67.	6.26	The Board notes that whilst the Seahawk is not a utility helicopter, the aircraft made a valuable contribution to the timely transfer of necessary resources to WESTRALIA without incident.	99
68.	6.42	The Board finds that the support provided by naval units was timely, well coordinated and in the best traditions of the service.	101
69.	6.48	The Board finds that WESTRALIA's command team made an error of judgment by not making a prescribed urgency call.	102
70.	6.57	The Board agrees that a MOU should be developed between Navy and the Fremantle Port Authority for handling naval vessels in distress.	103
71.	6.96	A significant CISM intervention was mobilised during and after the incident. It received a high level of acceptance at all levels.	108
72.	6.102	The CISM debriefing process, occurring as it did before the great majority of personnel had made any written record of their recollections of the day, had the potential to contaminate evidence presented to it.	109
73.	6.103	The Board is of the view that, given the significant resources involved in the provision of CISM, steps should be taken to evaluate the efficacy of the intervention in this incident.	109
74.	6.109	The Board considers that more extensive preparation of personnel for critical incidents, including pre-training in stress/trauma management, may have resulted in a reduction in the size of the CISM response required for this incident, including the need for On-Scene Support and individual counselling.	110
75.	6.115	The provision of at least one Peer Support Member on each Major Fleet Unit at all times will assist in providing post trauma management to personnel involved in incidents that occur in combat or isolated operations.	111
76.	6.122	There was a significant chaplaincy effort in support of personnel, family and friends on the day of the incident and subsequent to it.	112
77.	6.138	The Board considers that family liaison and support services of a very high order were provided throughout the incident and the days that followed.	114
78.	6.139	The Board is of the view that an inappropriate delay occurred in officially notifying PSO WA of the incident and its scope. The mechanisms that were in place to keep PSO WA updated as the incident unfolded were inadequate.	114
79.	6.140	The Board considers it likely that at least one of the families of the deceased heard, indirectly, of their loss through media reports. This probably resulted from a deduction based on early notification that the member was missing, followed by public	

		confirmation of the occurrence of fatalities. The Board is of the view that, once NOK had been notified that a family member was missing, no further information on the fate of these personnel should have been released until such time as the NOK had been officially notified.	114
80.	6.149	St John of God Hospital Murdoch is well equipped to receive casualties by helicopter from ships at sea, and transfer them to other hospitals if clinically indicated.	115

Section 7 - Firefighting and Safety Equipment

81.	7.5	The TIC currently in service suffers from overload in large fires and was of marginal utility in this case.	116
82.	7.17	The number of OCCABA carried by the ship was appropriate. The ship carried a greater number of spare cylinders (by a factor of almost two) than the number specified in the RAN Damage Control Manual - ABR 5476 Vol 1.	118
83.	7.18	In a major incident the utilisation of breathing apparatus should be managed by one person.	118
84.	7.33	The Board has serious concerns regarding the servicing of OCCABA sets, the unacceptable number of equipment failures and the monitoring of the servicing. The Board also notes that the OCCABA sets exceed the weight recommended by the AS/NZS 1716:1994.	120
85.	7.34	RAN OCCABA sets have three high-pressure hand wheels. If these are not fully tightened damage to O-rings can result. As there are three high pressure connections rather than the one found on BA generally, there is a three-fold risk of failure.	120
86.	7.44	BA control tags are available to assist board markers maintain entry control.	121
87.	7.45	Distress signal units are an additional safety device that can be fitted to OCCABA.	121
88.	7.48	The ship had no spare fuel supplies for the forward Bauer compressor.	121
89.	7.54	The Maxon radios did not work effectively on the day and communications with the hose teams failed on occasions.	122
90.	7.60	There were no reserve supplies of diesel fuel for the emergency fire pump.	123
91.	7.61	Current Lloyds and SOLAS regulations state 15 hours reserve fuel must be available outside the MMS.	123
92.	7.62	Regardless of the Lloyds or SOLAS requirements, the endurance of the fire pump should have been known by the command team and spare fuel should have been kept in an accessible place outside the MMS.	123
93.	7.69	The hose teams had inadequate head protection.	124
94.	7.74	The number of ELSRDs within the MMS was insufficient and confined to the bottom plates.	125

Section 8 - Materiel State

95.	8.35	The penetrations in the MCR deck for the passage of electrical cables and pipes had not been properly sealed.	130
96.	8.36	The electrical cable runs above the engines are poorly located.	131
97.	8.48	The Board concludes that the CO_2 system was not well maintained and failed to operate correctly because of incorrect tensioning of the actuating wires.	132
98.	8.62	The ship's maintenance history does not support the proposition that there was any policy to reduce or deprive WESTRALIA of funding. In 1996 the ship spent six months undertaking an extensive refit. The ship undertook AMP 10 early in 1997. AMP 11 involved a significant over-spend of the budget allocation.	134
99.	8.80	The Board notes the failure of Lloyd's to answer the questions and in the absence of further advice, the Board considers that the arrangements for means of escape from the MMS is not in the spirit of the Convention requirements and is dangerous.	137
100.	8.97	The normal access ladders from the middle plates to the top plates are exposed, and were extremely dangerous to use once the fire had started.	140
101.	8.98	The ladder from the fridge flat to the top plates and the port ladder between the middle and top plates are difficult for hose teams to use.	140
102.	8.103	The Board is of the view that the lack of MMS to MCR communications is unacceptable.	141
103.	8.112	Suitable data recorders strategically placed in command positions such as the bridge, MCR and HQ1 can play an important role in enhancing safety at sea.	142
104.	8.117	Once shut there is no means of opening the funnel flaps without entering the funnel space.	143
105.	8.124	The present system of isolating the MMS detection zones to prevent false alarms is dangerous.	144
106.	8.125	The fire detection system fitted to the MMS of WESTRALIA is not fit for purpose.	144
107.	8.126	There are a number of possible systems available to enhance the level of fire protection.	144
108.	8.133	There was insufficient lighting or reflective tape at a low level to guide personnel to safety.	145
109.	8.135	When WESTRALIA sailed there were a number of deficiencies in the materiel state of the ship. The two serious deficiencies, the flexible supply and return fuel hoses and the CO_2 system were not readily apparent. At that time the flexible fuel hoses gave no sign of any inherent flaw. The condition of the CO_2 system, and particularly the tension of the operating wires, would only have been apparent to an expert on close inspection. At 0900 on 5 May 98 there was no obvious materiel deficiency that should have prevented the ship from sailing.	145

Section 9 - Causes of the Fire

110. 9.23 The Board accepts the hypothesis of Detective Senior Constable Hawes as to the start of the fire and finds that the fire started as a result of the ignition of atomised fuel from a leak in the new flexible return hose on no. 9 cylinder on the starboard main engine (S9R). The Board finds that the possibility of some other source of the fire is not sustained by the evidence. The source of the ignition was probably the adjacent indicator cock on no. 9 cylinder. It seems that fuel may have continued to supply the fire for at least 15 minutes at a diminishing, and relatively small, rate. 151

111. 9.33 Flexible fuel hoses S9R and P8S failed by reason of fatigue of the stainless steel braiding. 153

112. 9.37 The Board is satisfied that the results of the metallurgical testing indicate that any mishandling, if it occurred during or after initial installation, did not contribute in any significant way to a major reduction in the burst strength of the hoses. 154

113. 9.46 Sufficient pressure pulses to cause fatigue failure of the braiding could easily have been generated since installation of the flexible fuel hoses. 156

114. 9.55 Regardless of the quality of the information contained in the Pielstick Service Bulletins, information on the subject of spill pulses was available from the Pielstick engine agents, NEI Crossley Engines, at the time of AMP 12. Even a cursory examination of the Bulletins should have alerted a reasonably competent engineer to the existence of the spill pulse phenomenon and should have aroused sufficient curiousity in any technical person to make further enquiry. A reasonably competent engineer would have given the phenomenon due consideration and would have communicated with the engine agents. Indeed, any technical person who was charged with having the flexible fuel hoses manufactured and installed should have communicated with the engine agents. 157

115. 9.59 The Board is of the view that information concerning the spill pulse phenomena was available and accessible had it been sought. It was not sought. 158

116. 9.64 Marine engineers with qualifications acceptable to the Merchant Navy would probably have been aware of the nature of pulses caused by jerk pumps, if not the full extent of spill pulse pressure. 159

117. 9.65 Neither Dr Goodwin nor Mr Burge have relevant expertise on the subject of RAN marine engineering training. The purpose of RAN marine engineering training is not to develop expertise in all aspects of engineering design but is more targeted at machinery operation, accordingly, knowledge of ‘spill pulses’ is not an essential training requirement. Appropriate experts in industry are usually used for deep specialist skills. 159

118. 9.77 The fuel boost pump in use at the time of the fire was set at the correct pressure and was not capable of producing the full scale

		deflection pressure indicated by the defective fuel system gauges.	162
119.	9.78	Based on the expert evidence presented to the Board and the results of testing carried out on the fuel boost pump and pressure gauges, the Board prefers Dr Goodwin's evidence on the subject of fuel gauges. The Board is satisfied that there is no evidence of a mechanism which could have produced an abnormal pressure pulse of sufficient magnitude to cause failure of the flexible fuel hoses.	162
120.	9.83	Whilst Dr Goodwin's measurements are not exact, they provide strong indications that the minimum hose bend radius requirements were ignored by the design.	162
121.	9.93	The hose arrangement did not conform with good engineering practice in various respects, as well as the failure to take into account spill pulses.	167
122.	9.94	The flexible fuel hoses were not properly designed and they were destined to fail.	167
		Section 10 - How Hoses of Inadequate Design Came to be Fitted	
123.	10.48	A change to the flexible fuel hoses was clearly a configuration change as defined in RAN documentation and the correct procedure for obtaining approval was not followed.	177
124.	10.49	The weight of evidence is against WO Jones' account, which is not accepted, and WO Bottomley' s account is regarded as the most reliable. The Board is of the opinion that WO Jones told the ship simply to raise a TM200.	177
125.	10.50	WO Jones' statements to LCDR Crouch and WO Bottomley concerning the TM200, were such as to mislead them into believing that circumstances had transpired which made a TM200 the appropriate procedure to obtain funding for the work.	177
126.	10.51	Nonetheless, LCDR Crouch should have made his own enquiries in the absence of any official approval documentation, namely, a TM188.	177
127.	10.52	The Board has difficulty in understanding why none of the documentation relating to the SG2 remained on an OAWA file. WO Bottomley and LCDR Crouch gave evidence of frequent mention or discussion of the flexible fuel hoses with WO Jones.	177
128.	10.53	It is remarkable that despite WO Jones' long association with WESTRALIA's fuel leak problem, his obvious commitment to the ship, and his ongoing discussions with WO Bottomley during 1997, that WO Jones does not remember any of the circumstances surrounding the SG2 application in late 1996 and that it did not come to mind during his ongoing conversations with WO Bottomley and LCDR Crouch.	177
129.	10.64	ADI were not specifically requested to do an engineering analysis, certainly not one of the type called for by a TM187. Neverthless, the Board is of the opinion that the ship's request to	

		ADI to 'investigate' cannot be confined in the ways ADI contend. In addition ADI had a general obligation as the engineering contractor to make a proper engineering assessment of the proposal taking all factors into account. The standard of that consideration should have accorded with the engineering expertise [T3096] and 'world class' [E405] which ADI claims.	179
130.	10.71	Lloyds was not involved by either ADI (or its subcontractor) in approval of plans and particulars of the flexible fuel hoses or in inspection and assessment of their manufacture and installation. 'Lloyds approved' hoses were not manufactured and installed.	180
131.	10.82	The Work Instruction prepared by ADI was deficient in that it failed adequately to specify the job which the ship wanted done.	182
132.	10.93	ADI did not send the Lloyds list of approved hoses with the invitation to quote.	184
133.	10.101	The differences between Mr Old's account and Mr Morland's account concerning the choice of hose is noted and the Board considers that Mr Old's evidence is more reliable.	185
134.	10.102	Mr Old, the Hose Doctor, failed:	185
		a. to supply a hose to Lloyd's approved standards.	185
		b. to make any, let alone adequate, enquiries of Lloyds.	185
135.	10.115	ADI paid insufficient attention to the Enzed quote, particularly in relation to the evidence which it contained suggesting that the quote was not for a hose which was 'to Lloyds approved standards'.	187
136.	10.116	Approval of the work order was one of the critical checkpoints for the process of fitting the new flexible fuel hoses. WO Jones gave insufficient attention to the documentation supplied by ADI. WO Jones approved the work order for the fuel hoses without having seen an original quote. Had WO Jones seen the original quote, it is possible that he may have been alerted to the fact that the Parflex 919 hose quoted on by Mr Old was not Lloyds approved. WO Jones would then have been aware of the basis for the quote.	187
137.	10.117	Mr Old presented himself to ADI as a representative of the Parker Enzed Technology organisation and this implied a depth of expertise and knowledge which Mr Old could not, and did not, provide.	187
138.	10.127	The Board finds that Parker Enzed Technology:	189
		a. failed to give Mr Old sufficient assistance by way of training and product information to enable him to comply with contractual duties or other duties in respect of the flexible fuel hoses; and	189
		b. failed to give Mr Old adequate product information concerning SST-12 for use by himself, ADI or Navy.	189
139.	10.140	Mr Old failed to advise ADI that he had not supplied Parflex 919 hose but another generically described SST hose product.	191
140.	10.141	The prototype produced by Mr Old, simply involved the substitution of the rigid steel lines with flexible hoses. There is	

		no evidence of any consideration of the different characteristics of the flexible fuel hoses and rigid steel lines or of good engineering practice.	191
141.	10.142	It is extraordinary that ADI, via its employee Mr Morland, would give the ship an assurance that the flexible fuel hoses were Lloyds approved without carrying out even the most fundamental checks to ascertain whether that assurance was correct.	191
142.	10.143	The Board finds that Mr Morland's action in assuring WO Bottomley that the flexible fuel hoses were Lloyds approved when they were not, eliminated a major safety check point. ADI's failure to ensure the flexible fuel hoses were Lloyds approved was a major contributing factor to the accident.	191
143.	10.147	The fact that Mr Sergeant directed Mr Old to increase the amount of his invoice seriously detracts from the acceptability of Mr Sergeant's evidence on the subject of the quotation and evaluation process. Although this is not within its terms of reference, the Board consequently feels concerned about the ADI RPLSS tendering practices.	192
144.	10.158	Because of design deficiencies, the hoses could not be installed without damage to them. Whether any damage done to hoses on 4 May 1998 was more significant than any damage done to hoses by when they were installed or otherwise handled before 4 May 1998, is impossible to say. Testing has, however, established that such damage was not relevant to the leaks in the hoses which occurred on 5 May 1998. In any event, susceptibility to damage under these circumstances would have demonstrated their unfitness for purpose.	194
145.	10.165	The Board finds that the WMO was not adequately trained for his role within the OAWA.	195
146.	10.166	WMO failed to give attention to the documentation, to confirm that the job on the flexible fuel hoses was being done as requested by the ship.	195
147.	10.175	The Parker Enzed Technology organisation apparently allowed Mr Old to present himself to ADI as representing the Parker Enzed Technology organisation thereby giving rise to an unwarranted expectation of the level expertise and knowledge he could provide.	196
		Section 11 - RAN Configuration Management	
148.	11.6	The formal RAN configuration change process is circumvented at times, generally by well intentioned personnel, and this can have a severe impact on safety.	198
		Section 12 - Quality Assurance	
149.	12.13	The quality management system of OAWA is inadequate, particularly in relation to the management of maintenance for WESTRALIA.	201

150.	12.24	The internal and external quality audits of the ADI quality management system failed to identify significant deficiencies in the implementation of that system	202
151.	12.25	The ADI SOP for Service Design Control was suitable to ensure an adequate product. That procedure was not followed, however, and internal and external audits failed to detect this situation.	202
152.	12.28	Mr Old was unaware of his quality assurance responsibilities and had not been adequately trained in relation to them.	203

Section 13 - System Safety Management

153.	13.46	There are systemic defects within RAN and ADI safety management.	210

Section 15 - Recognition of Personnel

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