MARITIME NEW ZEALAND

Accident Report

Fire aboard ***Cleansweep***

13 February 2008

Maritime New Zealand

Maritime New Zealand (MNZ) is a Crown Entity appointed under section 429 of the Maritime Transport Act 1994, with the responsibility to promote maritime safety, security and the protection of the marine environment.

Section 431 of the Maritime Transport Act sets out MNZ's functions. One of those functions is to investigate and review maritime transport accidents and incidents.

This accident report is published by:

Maritime New Zealand
Level 10, Optimation House, 1 Grey Street
PO Box 27-006, Wellington 6141
New Zealand

2010

This document is available on our website: www.maritimenz.govt.nz

Contents

Figures

Narrative

1. The motor launch ***Cleansweep*** left Foxton on 7 February 2008 for a recreational fishing excursion in the vicinity of D'Urville Island. There were four people on board. The owner/skipper had a Day Skipper Certificate obtained in 1996. One of the crewmembers held a Commercial Launchmaster Certificate of Competence and the other two had many years of recreational boating experience.

2. ***Cleansweep*** departed D'Urville Island at about 0900 hours on 13 February, bound for Foxton. The weather conditions were overcast with a light breeze and calm sea. As the vessel headed out to sea the skipper heard an unexpected noise from the port engine. He stopped both engines and, on inspecting the port engine, found that a valve spring had broken and made a hole in the tappet cover. This had also resulted in a loss of oil pressure.

3. The skipper continued with the voyage, using the starboard engine. During the morning he transferred oil from the generator to the port engine in case both engines were required for crossing the Manawatu bar.

4. At about 1500 hours, in a position approximately 5 miles south west of the Manawatu bar, one of the crew remarked that the starboard engine bay scavenge fan warning light was lit on the control panel. The skipper went aft to check the fan, but when he lifted the starboard engine bay cover he was met by a fire ball. Two of the crewmembers leapt out of the aft accommodation door onto the after deck and the other crewmember exited via the foredeck hatch.

5. The skipper slammed the cover down and took the dry powder fire extinguisher off the after wheelhouse bulkhead. He lifted the cover and discharged the extinguisher into the engine bay, however this had no noticeable effect. The skipper closed the cover again and left the smoke-filled cabin for the after deck. The crewmembers were preparing the liferaft for deployment. The skipper went to the fore hatch, took a couple of deep breaths and then entered the fore cabin to recover safety equipment and lifejackets. The smoke was too thick for him to enter the wheelhouse to recover the hand-held VHF radio and cell phones. The smoke was toxic and there was no visibility.

6. When the skipper returned to the afterdeck the liferaft was inflated and in the water. The smoke and flames were more intense. One crewmember was left to tend the liferaft, and the skipper and the two other crewmembers starting extinguishing the fire using sea water and buckets. The skipper estimated that it took a good 15 minutes to extinguish the fire.

7. By the time they were able to get to the VHF radio, someone ashore had observed the smoke and had already raised the alarm. The Manawatu Coastguard vessel was responding. The skipper and crew donned lifejackets and waited for the Coastguard, who arrived about 5 minutes later at approximately 1530 hours.

8. The Coastguard vessel took them in tow, and they arrived at the launching ramp at Foxton Beach at 1630 hours and hauled out on the boat's trailer.

Figure 1 ***Cleansweep***

Comment and analysis

The fire

9. The exact cause of the fire is indeterminable, however, there are several common indicators that show the fire originated in an area containing the alternator and a bundle of wires that lead to the battery bank. These indicators include a classic “V” burn pattern visible on the inside of the hull and a heavy oxidation pattern on the outside of the hull.

10. It is common in a structural fire that V patterns are generated by a plume of flame spreading vertically from the base of the fire, and this, in consideration with all the other factors, is a commonly accepted technique used in determining the seat of a fire. On ***Cleansweep*** some oxidation is also present on the alternator, and there is no indication of this occurring elsewhere within the engine bay. Oxidation on a metal surface is known to indicate an area where the surface has been exposed to high heat or flame.

11. The area of heaviest charring is situated on the wooden framework above the alternator, with the top of this structure suffering only smoke damage. This indicates that the heat source came from beneath and the depth of the charring indicates that it burnt for some time.

12. The vertical engine bay framing situated near the alternator has suffered charring on the interior, with an area of undamaged framework visible on the exterior. This again indicates that the fire originated near the alternator and wrapped around the framework before travelling vertically along the framing.

13. Overall, the area containing the alternator and bundle of wires is the area with the most damage, with the remainder of the engine bay suffering only secondary heat and smoke damage.

14. The plastic coating of the bundle of wires lying on the alternator has completely burnt away, up to an area where it extends from a hole in the wooden framework. From then on the wire is undamaged, suggesting that this area was protected from the fire. Some oxidation is present on the exposed wiring. These factors again indicate that this area was the seat of the fire.

15. Most telling is the damage shown in figure 2, which shows an area of high heat damage situated directly above the alternator area. This supports the conclusion that this was the seat of the fire. Figure 2 also shows the way in which the noise insulation burnt away. A thin metal support beam divides the noise insulation, creating a join where the insulation meets the beam. A join like this creates a gap through which fire can penetrate and ignite rubber backing. It is highly likely that this occurred, as the seat of the fire was directly below the join.

16. It is apparent that the silver foil of the insulation remained intact, although it appears to have suffered some minimal charring around the edges while peeling away from the rubber foam backing, which was destroyed.

17. Two fans forced air into the insulated box in which the starboard engine was housed, and it can be assumed that these were running, as the light went on at some stage, indicating that there was an issue. Two things can be logically concluded from this; firstly, the wires lying on the alternator would have been live, supplying power to the fans. Secondly, the fans would have supplied a steady flow of oxygen, which is needed to start a fire.

18. On lifting the starboard engine bay cover, the sudden influx of oxygen created the fire ball. It is unknown to what extent the fire had been burning prior to this, however, it is possible that this was simply a smouldering electrical fire and this extra oxygen allowed it to take hold.

19. There are two plausible explanations as to why the fire began in this area:

- It is possible that the alternator overheated, and when fed with the right amount of oxygen from the fans, ignited the wiring lying on top of it. The fire then spread to the alternator and any oil, grease or debris in the surrounding area.
- It is also possible that through some electrical fault the fan wiring or the alternator itself overheated, and when fed with the right amount of oxygen from the fans, ignited.

20. In either scenario, it is clear that the fire then penetrated the join in the noise insulation, igniting the rubber backing and producing the dense toxic smoke. This may have occurred before or after the cover was lifted. It is most likely, however, that the sudden intake of oxygen when the cover was lifted would have greatly intensified the fire and the rate in which it was spreading.

21. It can be fairly concluded that the fire was electrical by definition when it began. However, this progressed to a general fire, with a variety of substances burning, including foam rubber, plastic, wire insulation, oil, metal, grease, debris, wood and paint.

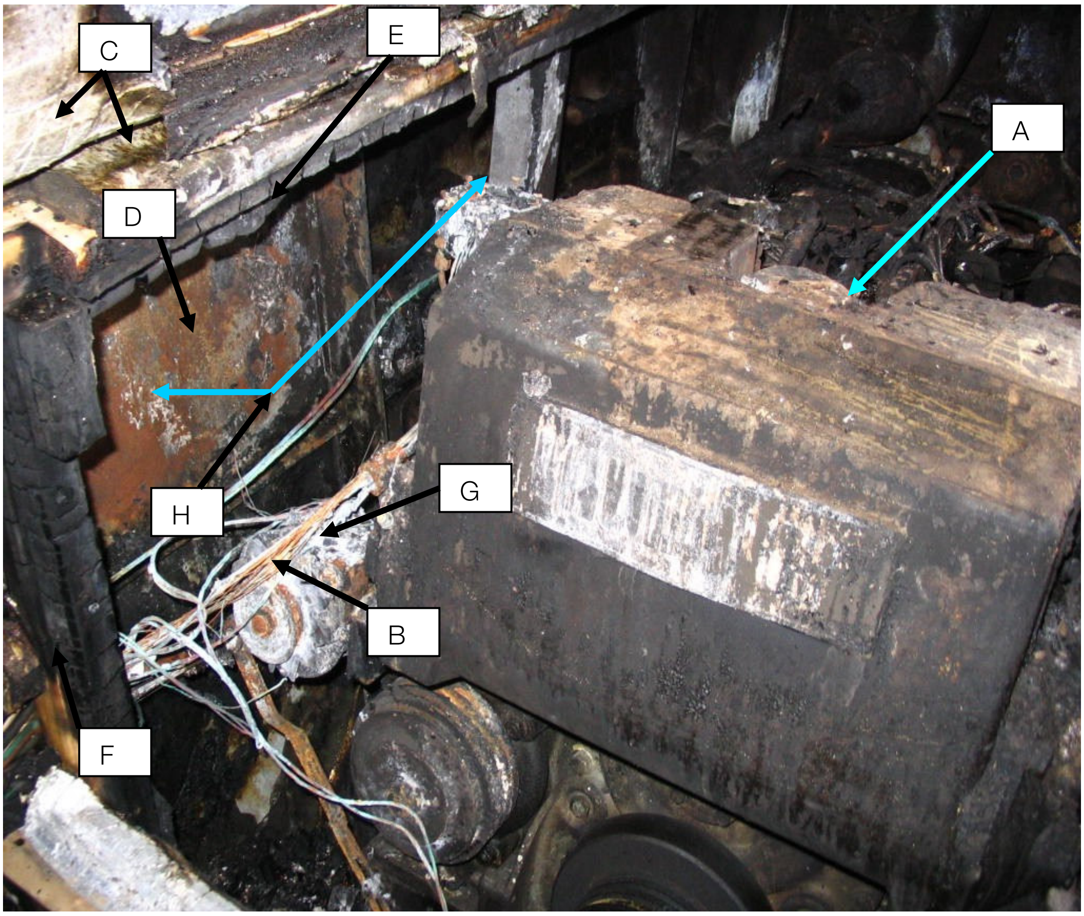

Figure 2

a) Heat damage caused from heat being reflected downwards from insulated hatch cover
b) Bundle of wires leading to battery bank
c) Smoke damage only
d) Oxidation on hull, indicating the height of the fire
e) Area of heaviest charring
f) Undamaged area, indicating the fire originated from the other side at around this height and wrapped around before travelling vertically along this beam
g) Alternator, showing an area of oxidation
h) The blue arrows show the V pattern and direction of the fire spread, which lead back to the seat of the fire

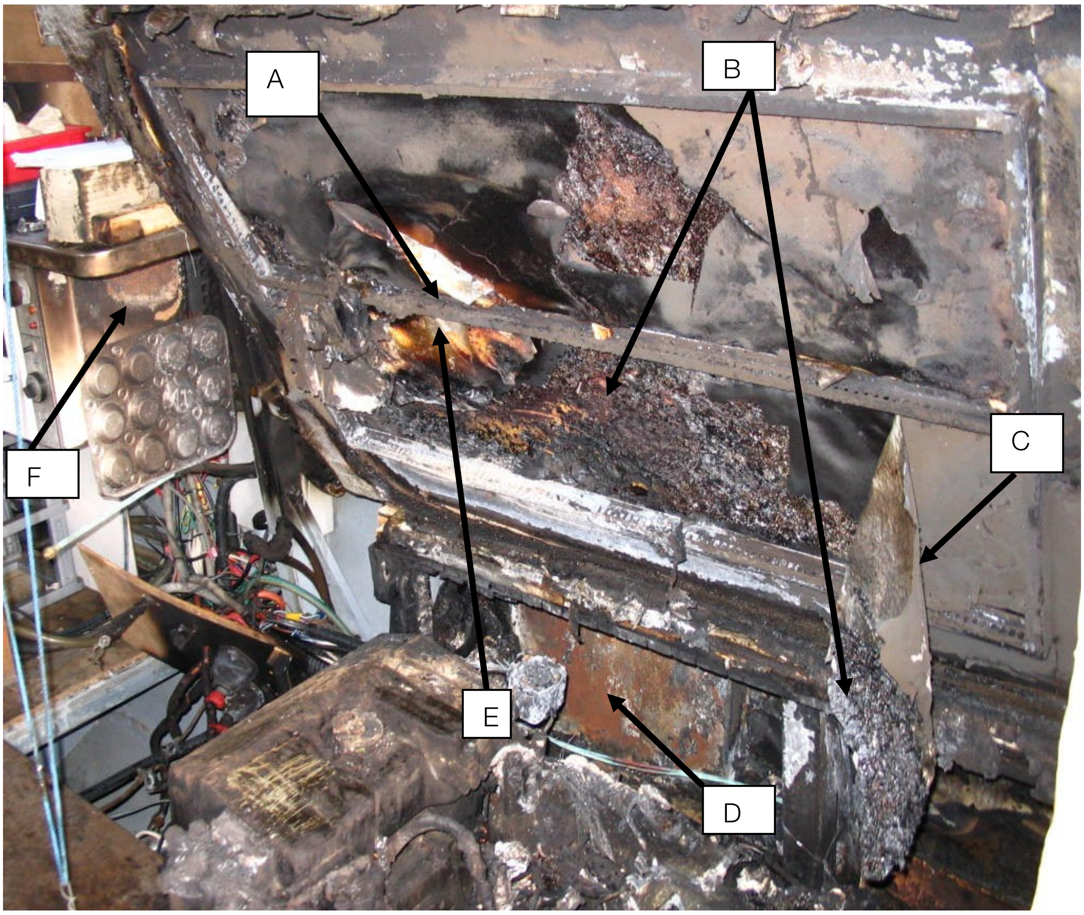

Figure 2

a) Join in insulation running along structural beam where fire may have penetrated to ignite rubber backing
b) Burnt rubber backing
c) Silver lining peeled away from rubber foam backing
d) General seat of fire, indicated by oxidation on hull
e) Area of high heat damage, indicating the source of the fire was directly below
f) Secondary damage, most likely to have occurred when cover was open

The insulation

22. The sound insulation fitted by the owner was Acoustop Multigrade, manufactured by Latimer Acoustics.

23. Acoustop Mulitgrade is a composite noise barrier and noise absorber designed to be used in machinery enclosures where there is a requirement for noise reduction.

24. The reinforced foil facing of Acoustop is advertised as:

"giving improved fire test results to AS1530, Part 3, Early Fire Hazard properties".

25. AS1530 part 3 standard is used to determine the early fire hazard ratings of building materials, components and structures. Four indices are generated by the AS1530 test – simultaneous determination of ignitability, flame propagation, heat release, and smoke release.

26. Acoustop Multigrade has been independently tested by an accredited laboratory with the following results obtained:

- Mean ignition time (seconds) = 0
- Mean flame propagation time (seconds) = 0
- Mean heat release integral (Kj/M2) = 0
- Mean smoke release (density/m) = 0.00870.

27. The indices determined were:

- Ignitability index (range 0–20) = 0
- Spread of flame index (range 0–10) = 0
- Heat evolved index (range 0–10) = 0
- Smoke developed index (range 0–10) = 1

28. The standard test for measuring the minimum oxygen concentration to support flaming combustion of products containing plastic, film or cellular plastic is referred to as the D2863-91 Standard. Materials are considered to be non-combustible when measured in accordance with this standard if the oxygen index is at least 21%.

29. Tests conducted by an accredited company found the oxygen index of Acoustop Multigrade as 27.3%. The product can therefore be referred to as non-combustible and the assertions made in the company's advertising are correct.

30. Testing also showed that the rubber layer burnt and turned to ash.

31. The rubber layer referred to comprises of a layer of "noise barrier" between two layers of 6mm "acoustic foam". Noise barrier is described by the manufacturer as being made of rubber, filled with ground rock and barium sulphate. Acoustic foam is described by the manufacturer as being "hydrolysis resistant polyether foam".

32. Acoustop's advertising also purports that the product is self-extinguishing. This claim comes from the laboratory tests which determined the burn rate (mm/min) as being 0mm/min. This result is described as self-extinguishing, which means the material ignited but extinguished itself before reaching the first measuring mark. This effectively means that the product can not sustain combustion. The manufacturer's assertion that the product is self-extinguishing is therefore correct.

33. Acoustop has been accepted for use on vessels within Maritime New Zealand's Safe Ship Management system.

Type of extinguisher used

34. Attempts to extinguish the fire were made with a 2.3 kg dry powder extinguisher. No other fire-fighting equipment was carried on board ***Cleansweep***.

35. Fires are classified as follows:

- Class A: Wood, paper and plastic
- Class B: Flammable and combustible liquids
- Class C: Flammable gas
- Class E: Electrically energised equipment
- Class F: Cooking oils and fats.

36. The International Maritime Organization (IMO) International Code for Fire Safety Systems 2007 Edition (FSS Code) recommends dry powder fire extinguishers for fires involving flammable liquids, electrical equipment and flammable gases, all of which are Class B fires.

37. FishSAFE's Safety Guidelines for Small Commercial Fishing Vessels (Maritime New Zealand safety guidelines) describe dry powder fire extinguishers as being:

> *"particularly good for fuel and oil fires such as Bilge Fire in a vessel's engine room. The dry powder extinguishes the flames over fire and is quicker acting than foam. Dry powder extinguishers deal more effectively with large areas of flame".*

38. The skipper reported that the extinguisher seemed to be feeding the fire. By the time the extinguisher was used the fire had progressed to include burning wood, plastic and polyether foam, all of which are classified as Class A fires.

39. It is recommended that when using a dry powder extinguisher it is directed in a sweeping motion from the front edge of the flames to the far edge. This is to prevent the propulsion of the extinguisher pushing the fire along and feeding it with oxygen, which will in turn create the appearance of actually feeding the fire, as mentioned by the skipper.

40. The IMO FSS Code recommends foam-filled extinguishers are used on fires involving wood, paper, textiles and flammable liquids, which are Class A and B fires.

41. The Safety Guidelines for Small Commercial Fishing Vessels also recommends foam-filled fire extinguishers for use in all Class A and B fires, and describes foam extinguishers as being:

> *"good for fuel and oil fires. The can also be used on wood, paper and fish bins (Plastic)".*

42. With the exception of Aqueous film-forming foam (AFFF) extinguishers, foam extinguishers are not recommended for use on electrical fires, as there is a possibility that the foam will conduct electricity and the user will be electrocuted. However, AFFF extinguishers are rated as safe for use in the presence of electricity.

43. Foam fire extinguishers can be used to complement dry powder extinguishers. This is done with foam being laid over an area that has been extinguished with dry powder, to dampen the area and reduce the likelihood of the fire re-igniting.

44. Generally, foam extinguishers are larger and heavier than dry powder fire extinguishers, and because of this they are not commonly carried on smaller recreational vessels.

45. Given the presence of electricity in this fire, which had progressed to Class A, an AFFF foam extinguisher could have also been used.

46. The use of water to ultimately extinguish the fire was a good alternative to using a fire extinguisher.

47. Water also cools an area once the fire is extinguished and prevents re-ignition. This is a recommended safe practice.

48. Another recommended good practice is to have a means of extinguishing a fire in an engine bay that is accessible without having to open the cover.

49. This can be achieved through the use of an enclosed smothering system, which involves permanently fitted CO_2 canisters inside the engine compartment. The advantage is that the engine bay can be flooded with fire-extinguishing gas without having to open the cover, which allows air to rush in.

50. These systems can be operated remotely or automatically with the use of heat-sensitive trigger devices. CO_2, however, is an asphyxiant, making it is unsafe to install these systems near sleeping quarters. It is also imperative to ensure that all people are cleared from the area before the system is activated.

51. A more rudimentary, yet highly effective method, is to simply have a covered hole or port through which an extinguisher can be dispersed into the engine bay, effectively smothering the fire without adding additional oxygen through the cover being opened.

Recommended fire-fighting equipment

52. Information provided to the public by Maritime New Zealand regarding fire-fighting can be found on pages 5 and 26 of the Maritime New Zealand Safe Boating Essential Guide. This guide can be found on www.maritimenz.govt.nz. The information advises that there are different types of extinguishes and recommends dry powder as a good general purpose extinguisher. The information also recommends that extinguishers are kept outside the engine space and in an area where they can be reached, which is good advice, although rather general.

53. The Safe Boating Essential Guide supplements this information by referring readers to the Coastguard publication Safety in Small Craft, which provides more detailed information on fire, fire prevention and fire-fighting.

54. Although ***Cleansweep*** is not a commercial vessel, maritime rules regarding fire extinguishers and/or fire fighting equipment for commercial vessels provides some guidance as to the quantity, type and positioning of fire extinguishers or fire-fighting equipment on board similar vessels, also the rules codify safe practice.

Maritime Rule Part 40C – design, construction and equipment non passenger ships that are not SOLAS ships

(2) A ship of less than 24 metres in length overall must be provided with at least the following number of portable fire extinguishers that comply with rule 42B.57:

(a) 3, if the ship is 15 metres or more in length overall; and
(b) 2, if the ship is 9 metres or more but less than 15 metres in length overall; and
(c) 1, if the ship is less than 9 meters in length.

Maritime Rule Part 42.57

55. For ships of 9 m or more in length overall, portable fire extinguishers must have the following minimum size and classification and rating determined in accordance with Australian/New Zealand standard AS/NZ 1850:1997.

Maritime Rule Part 42B.57

	Ships of 24m or more in length overall		**Ships of 12 or more but less than 24m length overall**		**Ships of more than 6 but less than 12m length overall**		**Ships of less than 6m length overall**	
Fire type	**Min. size**	**Class / rating**	**Min. size**	**Class / rating**	**Min. size**	**Class / rating**	**Min. size**	**Class / rating**
For fires involving wood, cloth, paper rubber and plastics	4.5 kg or 4.5 litres	3A	4.5 kg or 4.5 litres	2A	2.5 kg or 4.5 litres	2A	2 kg or 4.5 litres	2A
For fires involving flammable and combustible liquids	9 kg or 9 litres	Powder: 80B; Foam: 30B	4.5 kg or 9 litres	Powder: 60B Foam: 30B	2.5 kg or 4 litres	Powder: 40B; Foam: 20B	2kg or 4 litres	Powder: 30B; Foam: 20B
For fires involving combustible gases	4.5kg	C	4.5kg	C	4.5kg	C	2kg	C
For fires involving electricity	3.5kg	E	3.5kg	E	2kg	E	1.5kg	E

56. ***Cleansweep*** illustrated that a 2.3 kg dry powder extinguisher alone was insufficient to extinguish the fire with the skipper having to use sea water to extinguish the fire. Using the minimum standards prescribed in the maritime rules as a guideline of safety standards, ***Cleansweep*** should have had at least two 4.5 kg or 9 litre portable fire extinguishers, one of which should have been situated near the engine and been capable of fighting an oil fire. This could be either foam, dry powder or a combination of both.

Conclusions

57. The fire originated in the area containing the alternator and a bundle of wires that lead to the battery bank, although the exact cause can not be conclusively determined.

58. The Acoustop insulation fitted in the engine bay was appropriate and performed as advertised.

59. The 2.3 kg dry powder extinguisher carried on board ***Cleansweep*** was insufficient. The vessel should have been equipped with at least two 4.5 kg dry powder units.

60. The use of water to extinguish the fire was appropriate in the circumstances.

Safety recommendations

61. It is recommended that:

a) Maritime New Zealand promote lessons learned from the accident to the recreational boating community in New Zealand.

b) ***Cleansweep*** and vessels of a similar size should be fitted with a minimum of two 4.5 kg dry powder fire extinguishers. One of these should be fitted near the machinery space and the other in an easily accessible area. Consideration should also be given to creating a space through which a fire extinguisher can be discharged into an engine area without the cover being lifted.