

FIRE!

WHY should three of the country's finest powerboats catch fire? **Don Shead**, driver of *Thunderfish III*, **Farrant Gillham**, owner of *Jolina IV*, **Ron Bacchus**, crew of *News of the World*, and **Neill Bennett**, a fire protection company executive who has sailed all his life, search for the answers. The Editor, **Bernard Hayman**, was in the chair

Hayman: Perhaps tonight's discussion really begins with the fact that there is practically nothing in the *Merchant Shipping (Fire Appliances) Rules 1965*, which gives yachtsmen any clues as to what they should do about fire at sea. We are told that we have to carry two portable fire extinguishers and that if the boat is fully decked we should also have a fireman's axe. I did not find this particularly constructive. Further, the Home Office has recently published a book called *Fire Precautions in Pleasure Craft*, which contains a great deal of good general advice, particularly about installations; but it ends by recommending dry powder extinguishers only, with a note saying that you can have CO₂ or foam if you like, but it also says that vaporizing liquid extinguishers are not recommended.

This last statement is without any qualifications, despite the fact that I believe the vast majority of yachts carry vaporizing liquid extinguishers. Coupling these thoughts with the recent explosions some of you have been involved with I should like us to talk about fire because, frankly, three of you are lucky to be alive.

Don, only a few days ago you were showing me *Thunderfish's* engine installation and you mentioned that the scrutineers had commented favourably on it. Could you tell us a little about what happened to you?

Shead: As far as the installation goes, it was done to a decent, thorough racing standard, and all one can say is that the fire equipment was the minimum called for by the race rules. The reason it was the minimum was because I had never really considered that more was needed. Fire was probably something that we had thought about but never really done anything about.

Hayman: To set the scene a little more; you had petrol engines. How many gallons of petrol?

Shead: About 300 gallons. That is the normal sort of figure for the petrol engine boats currently racing offshore.

Hayman: Do you know, or think you know, what happened?

Shead: We know exactly what happened. It was nothing to do with the fire installation; nothing to do with the fuel tanks. We just happened to have a faulty drive shaft joint which hadn't shown up previously. The actual joint broke and the drive shaft then whirled around and went through the bottom of the boat, the tank and the electrics; everything. The thing which was actually at fault on our boat was probably the way in which we had got the drive shaft captive. All drive shafts, according to the rules, should be captive, which means they should have hoops round them to restrain them should a joint break. There is no way of testing this. There are no standards by which anybody can look at it and say, "That will stop the shaft whirling."

Hayman: It was the universal coupling that gave?

Shead: Yes.

Hayman: If you remember, I commented on this and said I was surprised at the angle through which you were driving. You said something like, "Well, that's nothing."

Shead: It wasn't. The angle at which we were driving was under 6 degrees, which is well within the capacity of the joint and the shaft which were being used. When the joint broke, the shaft probably jammed in the actual guard which was on it, and



it then took the guard, complete with half the engine beds, around with it and whirled about. I saw it through a window in the engine hatches; I saw the whole lot going round together, great baulks of timber and the guard and the shaft; the lot.

Hayman: And then?

Shed: Well, then this mess was cutting through electric cables, fuel pipes, fuel tanks; every mortal thing which was on that side of the boat. Then the whole lot went up. . . .

Hayman: An explosion?

Shed: Not really an explosion, just a sort of great wave of fire swept through the boat. No explosion as such, no. The fire extinguishers worked very well. . . .

Hayman: Were they automatic?

Shed: Fully automatic. We didn't really have time to think and push buttons or anything. The fully automatic extinguishers put everything out. Dead quiet. We then had time to think about it, look for the hand fire extinguishers, which, of course, were stowed in the cabin, get up on the foredeck, look for the liferaft—we never had time to get at it—and we had one engine hatch open and were just about to disconnect the battery. We had got the tools ready and John, the mechanic, was down there when the whole lot went up for the second time. By which time, of course, the automatic fire extinguishing equipment had done its job and there was nothing left in it to put out the fire.

Hayman: And you then jumped overboard?

Shed: Yes. We got out of it. Quick.

Hayman: Did she explode then, or just burn.

Shed: No, she never exploded; she just burned. I think probably one of the joys of the wooden fuel tanks she had was that they let out the fuel gradually and nicely at the bottom of the boat and it just burned. Had they been metal fuel tanks I am certain we should have had an explosion blowing the whole boat apart from one end to the other.

Hayman: You mean wooden tanks—what, tongued and grooved boarding?

Shed: No, just plywood tanks, glass fibre lined; just one coat of scrim with. . . .

Hayman: This is a deliberate policy?

Shed: Oh, absolutely. Using the actual hull of the boat as one side of the tank and then just using a bulkhead and a side as the rest. When that begins to burn, it burns nicely and lets the fuel out gradually and the fuel then gets consumed.

Hayman: Which type of automatic extinguisher did you have?

Shed: Quite honestly I don't know. It was just an automatic extinguisher which was the cheapest possible available to meet the race rule.

Hayman: Set off by heat or what?

Shed: By heat. It was a Noxfire—incredibly effective. It did the job perfectly. Absolutely immediate. Whoof, there was a great wave of flame and then back down again.

Jolina IV

Hayman: Farrant Gillham, you own what was last year's "Boat of the Show," *Jolina IV*, and, coupling this fact with your enormous experience of the sea, we must assume that she is way above average in her standard of efficiency, installation and build. Could you tell us about your recent experience?

Gillham: We were coming back from Brittany, running fairly slowly—about 2,000 revs.—somewhere off Brest. We had just been through the Raz de Sein. Oddly enough, I was looking at my instruments and I saw the temperature gauge going up very rapidly. This is really a red herring, because the capillary tube for the gauge was attached to the throttle cut-off cable, and that cable was actually on fire. It was really a bit of luck. What in fact had happened was that the overflow pipe from the port engine injectors had been fractured for some reason. I don't know why, and it had dropped on to the only part of the engine that could ignite the fuel—that was the hot spot on the manifold as it leaves the block. This had set fire to the overflow. Now, if that capillary tube hadn't heated up—it was like the small boy with his thermometer and a candle underneath trying to see if it works—I wouldn't have seen anything on the instruments for quite a long time. I thought I had got an overheated engine and I tried to shut the engine down, but I couldn't shut the throttle. I was using Morse cable for the cut-off, and you know, the red jacket of that cable burns beautifully! This was highly dangerous because the inner rod seized itself to the outer casing. This meant I couldn't shut the engine off. Probably from panic, I pulled it out by the roots—that shut the engine off.

Hayman: You said your overflow was cracked. That is the return pipe on the injector, which is a short length of plastic?

Gillham: It is a copper pipe joining the injectors and it goes into a little plastics pipe, back into the pump, I think.

Hayman: One of these came adrift?

Gillham: It had presumably fractured, because it was burnt right away by the time I got at it.

Hayman: And that was then squirting. . . . ?

Gillham: No, it dripped oil on to the hot manifold. I have a Perkins engine and Perkins, as you know, have raced in every Offshore Powerboat Race and they have never had anything like this happen. It is the only instance and, as they said to me afterwards, if they had offered a £1,000 prize to anyone who could fire an engine this way probably

no one would have won it. They have, of course, modified the pipe now. I started to go down below but when I opened the hatches and saw flame, I shut the hatches immediately and I, too, had a Noxfire and I thought "It's all right; as soon as it gets hot enough it will blow off." But it didn't get hot enough and we had rather a long period when quite a lot of damage was being done and nothing was happening. Here I should like to have had a hand-operated extinguisher.

Hayman: You shut the hatch to keep the oxygen out, and you knew your engine-room was alight?

Gillham: Yes, and I shut both engines off. We drifted then. We got the liferaft out, and someone said, "Whatever you do, don't pull that yet!" We put lifejackets on. And we stood about and nothing happened, except that smoke came up through the engine hatch.

Hayman: You didn't have separate hand extinguishers as well?

Gillham: We did, yes. A little bit later on, I don't know how long, we decided this wasn't very clever. We were going to be in a liferaft, we thought, for quite a long time, so we went down to get hats, and we also thought we might have a little quick drink before we left. So preparing to go down to get the quick drink, I said to one of the crew, "I'll open the hatch and you follow me with the Pyrene," and we opened the hatch and three quick squirts and the fire was out. That's the end of the story. After that we travelled thirty-odd hours on one engine.

Hayman: So the Freon gas extinguisher never went off?

Gillham: No. In fairness to it, of course, it never got hot enough. Now we ought to have assessed the extent of the fire, but quite honestly, opening the hatch and looking at fire, well you have a moment of panic. I thought, the first thing to do is to shut it down. If I had held the hatch open for a moment and really had a jolly good look, all that was happening was that fuel was pouring along the rocker box and on fire and the hull was slightly on fire at the bottom of the boat. The moment we turned the engine off, of course, we did in fact cut off the fuel, although we hadn't realized.

News of the World

Hayman: Ron, one of your problems with the fire on the *News of the World*, I understand, was that you couldn't turn the engines off?

Bacchus: This was a definite problem, yes. The engines could only be turned off at the engines.

Hayman: Let's get the story straight. You were motoring along quite happily in comparatively calm weather. . . .

Bacchus: Yes. I think Don Shed and Farrant Gillham had much better warning than we did. They each had some

sign that there was something wrong. We had no sign whatsoever. Every dial was reading correctly, every noise was correct—you know how you get attuned to the noise of the engines and there was no change whatsoever before this sheet of flame erupted from the engine room. And that was it. As you probably know, *News of the World* had a doorway into the engine room on either side with a half moon window in the top, which we had open, and seconds before the fire started I had my head through this half moon window, looking at the engines, and everything was visibly perfect. I had hardly got my head out again when this sheet of flame just shot out, and I am afraid from then on there was no possible chance of doing anything at all.

Hayman: Can you describe the sequence? The sheet of flame shoots out. Did you immediately jump overboard?

Bacchus: The sheet of flame shot out and immediately set light to the after side of the driver's seat, where the controls for the fire extinguisher and so forth were. I would say, from this, that no fire system is worth while unless it is automatic, because for us there was no method of setting off the extinguishers without getting our hands completely burnt. Either the system should be automatic or a second point of control, could be rigged, but I still feel that everything should be automatic. The cockpit caught fire very rapidly.

Hayman: What do you call "very rapidly"?

Bacchus: Within seconds. There was no let up at all.

Hayman: You were still motoring along at 40 knots, or something?

Bacchus: We were still motoring along. I was in the prime position and we had worked out some signals with the driver—two taps to draw his attention—I didn't even realize that I did it, but I gave him the two taps and he turned round and saw the sheet of flame and pulled the throttles back and took her out of gear. But, of course, the engines were still running and there was no way of stopping them without going down into the engine room. The engines did stop before we got off the boat. Another thing which possibly helped to make it worse, we were doing the correct thing, pumping fuel from the wing tanks into the centre, so that the centre tank, when we stopped, was literally jam full. I think the heat of the fire expanded the fuel and almost immediately fuel started running over the decks from the breather pipes, which, of course, didn't help the general situation.

Hayman: At what point did you abandon ship?

Bacchus: Well, first we got out of the cockpit—and quite frankly I have never seen four people get out of that cockpit so rapidly. We went forward and decided to hang on a moment to see if it would die down so that we could do something. But then there was an explosion

down below, and I think we all decided that it was better to get off and see if we could possibly come back later.

Hayman: You had no automatic system?

Bacchus: No. So we got off the boat. But it didn't die down in any way at all; it just got fiercer and fiercer. Don fortunately came along and picked us up and we sat and watched it burn out.

Hayman: Could you tell us a little about the conclusions you have come to about the cause?

Bacchus: We have discussed this at great length and we still cannot think of a definite cause. Many theories have come forward but I think Colin Mudie and Rosemary and Jack Miller and myself have more or less eliminated them. The sheet of flame was, literally like a gas flame; it was definitely a forced flame and it was coming from the starboard after engine, or that direction, but one cannot say what it was. All the dials were reading absolutely correctly. There was no drop in oil pressure; there was no increase in temperature on any engine; there was no drop in revs.

Hayman: Colin was telling me something about a lubricating oil pipe which could have fractured without showing on any of these gauges.

Bacchus: That would be the return from the intercooler. This is the only one which could have fractured and sprayed oil without showing a drop in pressure. But I don't think the pressure would have been enough for the force of this flame. That is my own view.

Hayman: So really you don't know.

Bacchus: No.

Scrutineering

Hayman: Tony, you, as Chief Scrutineer for powerboat racing, have to show a lot of tact and diplomacy as well as having to do a certain amount of guessing. Are you satisfied that these things are bound to happen, or do you feel that we are going to get to a situation where they won't?

Needell: We are a very, very long way from achieving that, and however near perfection we get there will still be the inevitable one-in-a-million accident; you never get away from that. But it is largely a matter of education; we have got to make people realize the dangers inherent in bad design and bad installations. We need a vastly greater understanding of the problems by the public, by boatbuilders and by the authorities. In my professional life as a surveyor there have been occasions when I have seen a boat fitted out with something which in my opinion is a death trap, and when it comes to litigation I have been astonished to hear the barrister on my own side say, "Oh, I've listened to what you say about this alleged defect, but I am afraid we couldn't really pursue that." Now when we come nearer home, to powerboat racing, what do we find? The rules, published last February, say that the lay shaft

between the engine and the vee-drive, the very thing that Don has just mentioned, must be protected. Yet at Cowes, three days before the Cowes-Torquay Race, I saw five or six boats without one vestige of protection to their lay shafts. The owners were going to scratch around in those last three days and find something to fit it. They were drivers with international licences, competing in an International World Championship event and they had not read the rules. Until we can persuade competitors, and organizers, to study and follow the rules we are bound to run into dangers of this kind.

Hayman: Are you saying, in effect, that the rules are good enough if only they were observed?

Needell: The rules are not good enough, no. But the rules as they stand could be better studied. I am not saying they are not observed, but there is a degree of observation. If people don't understand a rule, they should take the time to find out its intention. Some competitors do this. When it comes to introducing new rules, however desirable the rulemakers may think the change may be, they are bound to meet with opposition from people who think they are going too far. You can make a rule, but how do you teach people to do what the rule really wants? The scrutineers, and they are all amateurs, are faced with a mighty responsibility and a mighty difficult job.

Fire Protection

Hayman: Neill, you have heard, briefly, the stories of the three fires we know about. Are you, from your side of it, happy that yachtsmen have got the right approach to fire at sea?

Bennett: No, certainly not. In fact I should not think there are any users of petrol, diesel or kerosene who potentially have greater risks of fire than the boating fraternity. And when it comes to regulations and legislation as you mentioned earlier, we have a most unhappy state of affairs. There is a tremendous amount of education that has to be done. The poor boatbuilder has not got access through any codes of practice to the hard lessons learnt in aviation; how to protect against fire, not just by hanging fire extinguishers here, there and everywhere but by proper engineering to engineer the risk out of the installation to the maximum, and then, but not until then, considering what fire extinguishers should be used.

Hayman: But let's be fair. At least two of the three instances we have heard about to-night were almost acts of God, weren't they?

Bennett: No. We haven't heard in detail what caused them, except in Don's case. If we are talking about engine installations, now, I think that Don would be only too pleased to learn, if he hasn't already done so, about some of the details of fireworthiness built into aircraft installations—which are not so unlike boats—to protect against the sort of situation he had

Hayman: I want to pick your brains a little more about what is available and what is good and what is bad. We all used to use CTC, Carbontetrachloride, until it was shown to be very toxic; that's the old pump-type Pyrene that practically everybody used to have.

Gillham: That's what I put my fire out with!

Hayman: CTC is now illegal in America on boats; the Coast Guard won't allow it. Here it was then superseded by CBM, Chlorobromomethane, which is more efficient, not much more expensive, but it attacks the resin in glass fibre, therefore is not so suitable for general use in boats. Then this, in turn, was superseded by BCF, which stands for the glorious word Bromochlorodifluoromethane. It is slightly cheaper than the CBM, not so toxic and just as efficient. We also have dry powder, which the Home Office appears to like: we have foams and we have Freon. Is that a summary of what is available?

Bennett: And CO₂, though that can asphyxiate you because the concentration you require for fire extinguishing will suffocate you if you happen to be in the same compartment. And water.

Hayman: Lots of water. Which of these general types do you favour for boats, and why?

Bennett: There are three classes of fire, A, B and C. Class A: clothing, draperies, paper, wood, where you want to wet it to put it out. Class B: where you have burning liquid, like oil or fuel; then you want a gas, preferably, to envelop it to put it out. Class C: where you may have both A and B plus electricity, which is not so serious on a small boat because you are unlikely to be electrocuted. Ideally you want a general purpose fire extinguisher, water is very good for Class A but very dangerous for Class B—squirting it into a pan of burning chips, for example. CO₂ because it has to have a very strong container under pressure, is heavy, and I have always thought that on a boat, just as on an aircraft, it is nice to be able to hold on with one hand and use the device with the other, instead of having both hands occupied. Dry powder is good for certain classes of fire, but it does leave a mess. CTC is out, I think we all recognise that . . .

Hayman: Because of its toxicity?

Bennett: Yes. I think, in the present state of the art—of course we are constantly hoping to find something which smells like Chanel No. 5, and is excellent as a fire extinguisher—BCF is probably the best, because it deals with Class A and B and C. It doesn't interfere with delicate mechanisms; yours or anyone else's.

Hayman: I am delighted to hear you say this, because I chose BCF for my own boat, and was then horrified to find the Home Office dismissing it.

Bennett: Maybe this is because the Home Office, and particularly the Board of

Trade, have to deal internationally with all these other countries. And in their wisdom many, many years ago CO₂ was specified. It is my understanding that the Board of Trade is very keen indeed to adopt BCF, but they have to get the agreement of all the other countries involved.

Hayman: But after the publication of the Home Office's latest leaflet, published only a few months ago, I went to see them about it, and they still insisted that dry powder is the best thing for small boats.

Bennett: They're a wee bit out of date. It comes back to this education problem. There is such a tremendous amount of spin-off information from aviation that could be applied to boats. There is nothing I should like to do more, for example, than try to write down a code of practice for the Ship and Boat Builders' National Federation, to help them to take advantage of the available experience. Do they know, for instance, that while it requires about 700°C to ignite kerosene if it is squirted on to a hot plate, if the same kerosene is put in a semi-enclosed location it will blow off at 212°C, which is an awful lot cooler than a turbocharger, for example.

Leads to Designers

Hayman: Really! Well, this in a way is what I am hoping will come from our discussion; I am hoping that there will be some leads to the trade and to designers. But may I continue to pick your brains a little more. Where does Freon come into this? We have heard that it does a good job.

Bennett: Freon does a very good job, but again it requires a very strong, thick-walled container because it has to be contained at a very high pressure.

Hayman: Am I right that Freon is the same stuff that is in an aerosol bottle?

Bennett: Technically you are not . . . but near enough, yes.

Hayman: But the aerosol bottle is quite thin?

Bennett: Yes, but there isn't much Freon . . . it's mostly flykiller. There is one point I should like to get in. One of the biggest objections I have to hand fire extinguishers in this country is that anyone going into a store to buy an extinguisher has got nothing whatsoever to guide him. There is no grading. You cannot ask for one that will deal with a tray of given dimensions for a burning liquid. You have got nothing at all to guide you. You have got nicely painted containers, different prices, but no grading by the authorities of this country. No yardstick. I think it is disgraceful.

Specification for engine room

Hayman: Going back to Don's fire. Here we have a magnificent boat, superbly equipped by a very experienced man. He admitted he economized on the fire extin-

guisher; presumably he wouldn't again. If he came to you and asked for a specification for his engine room, would you like to recommend something?

Bennett: Not for the fire extinguisher in the first place. That is the last specification you write out. Our specifications would be for his installation, just as we do for aircraft. Design the risk out, to the best of current available knowledge. Then deal with the fire extinguishing.

Hayman: I should still like to hear what "then" is. When you have got the design side to your satisfaction, what type of fire extinguisher are you going to supply him with? Would it be automatic, or do you pull a string, or . . .

Bennett: It should be both, in my view. At this state of the art I do not agree with wholly automatic extinguishers in an attended boat.

Gillham: A handle was one thing we urgently needed, actually . . . we knew we had got a fire; I was waiting for an automatic extinguisher to go off and it never got hot enough. If I could have pulled a handle I could have got my engine running again.

Shed: That is what your hand extinguishers are for.

Gillham: But you have to open the hatches to use them. That is a bad thing. If I could have pulled a handle I could have put the fire out. It was a very small fire, in fact, once the engine was stopped. We didn't know this . . . smoke was coming out and we didn't know how big it was . . . and we were against letting air into the engine compartment. This was wrong, as it turned out.

Bennett: If I could follow up my argument, I should say that automaticity is a good thing on an unattended boat, for obvious reasons, but again, just as in aircraft, if you have detected a fire, as you did, in the aviation manner, by looking at instruments, or by a detector, I should far prefer to see a manually operated, fixed installation, properly engineered in the power plant. Just press a button, or pull a lever.

Compartmentation

Hayman: Could we hear a little more about this. What is it in the first place that starts the device that stops the fire? Is it heat and is the mechanism foolproof?

Bennett: Yes, it is heat and it is as foolproof as it can be made with our present knowledge.

Bacchus: In our particular case the warning lights didn't even have time to illuminate. There was no warning at all.

Bennett: This is not at all surprising. If you have a fire, be it in a power plant or anywhere else, and you don't contain it, you have got very little chance of putting it out. If we didn't have cowlings round the engines of our aircraft, when

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