an incendiary device, and that is what caused the fire. What that substance was, I don't know.

MR VAN ZYL: Even if it had been anything not anything like an incendiary device, it would also have been about a kilogram or any size - a package size?

MR SOUTHEARD: No, I can't be specific I'm afraid. You just can't say.

MR VAN ZYL: But it could have been, from what you've seen from the cargo list, it could have been packed - put into one of the ...

MR SOUTHEARD: One of the boxes, that is right.

MR VAN ZYL: Mr Southeard, the next thing I would just like to verify with you. Looking at the insulation blankets and we've looked a lot at the insulation blankets, but your opinion of what would happen to the pallet itself, we're faced with from the photo's that we've recovered, that some of the cargo nets obviously had the tops burned away, so one could possibly expect a collapse of the packages themselves, either to the side or whatever. Could that protect the floor and the side, like the windows?

MR SOUTHEARD: Do you mean the unburned portion of a pallet?

MR VAN ZYL: Yes. You can have a complete collapse to the outside of a pallet.

MR SOUTHEARD: It's possible but whatever causes, surely on top

of that you've got burning debris?

MR VAN ZYL: Yes.

MR SOUTHEARD: Now if you've - even if you have that covering the floor, if burning debris falls on that, you're likely to get burning on top. Now I agree that that would cover the floor, but then you would still go through the windows on the right-hand side.

MR VAN ZYL: But the packages are, I think, reasonably higher than the pallet size itself - quite substantially higher than the windows themselves. Could that fall against the side of the airplane and in fact protect the windows from any damage?

MR SOUTHEARD: I don't know.

MR VAN ZYL: As well as the insulation blanket as we've seen here.

MR SOUTHEARD: I don't know what - I mean you're suggesting the whole of the pallet then falls down and fills up the gap, are you?

MR VAN ZYL: Yes.

MR SOUTHEARD: It's possible at a later stage.

MR VAN ZYL: Could one get the same sort of situation developing on - with the pallet collapsing and looking at the type of cargo, there's a lot of metal parts and forms in there that could in fact direct or funnel the fire to produce local hot spots?

MR SOUTHEARD: No, I don't believe so because whatever they're packaged in, the fire is going to travel through

the packaging, so it's going to go around that object. It's not going to be channelled by a computer because it's going to spread around the computer to involve the packaging around the computer.

MR VAN ZYL: But could the way in which the computers collapse not form a funnel?

MR SOUTHEARD: Yes, but by that stage I believe - then you've got your - your event has already occurred.

MR VAN ZYL: Yes, I would agree with that.
Mr Southeard, the other thing that I would like to ask you. In this field, are you aware of all the cargo fire tests that were done by McDONNEL DOUGLAS and the FAA and what their results were ; what sort of damages they found?

MR SOUTHEARD: No, I don't.

MR VAN ZYL: Distribution of the - on the affects on the structure?

MR SOUTHEARD: No, I'm not.

MR VAN ZYL: Not at all ? So what we've seen here could possibly have been found in other fires?

MR SOUTHEARD: If you could read the evidence then I'd like - yes, I would see. But I can't possibly say.

MR VAN ZYL: Alright. Then Mr Southeard, the one question as well is, could this fire in your opinion, seeing the type of size and the extent to what it had

developed, could this fire have been extinguished by the use of first of all the one 16 lb Halon bottle on board?

MR SOUTHEARD: If you accept that it's a promoted fire which I believe, I don't think it could have - neither the equipment nor the crew could have dealt with it.

MR VAN ZYL: Do you feel that the temperatures that had been generated in the cargo compartment; that there's any feasibility of a flight attendant or a flight crew member having the chance of entering that compartment?

MR SOUTHEARD: It depends solely on the build-up, but if it's as rapid as you could get in a promoted fire, then probably not. They may have just opened a door but probably not.

MR VAN ZYL: In an unpromoted or - what did you call it?

MR SOUTHEARD: An ordinary diffusion flame?

MR VAN ZYL: Yes.

MR SOUTHEARD: That depends solely on the rate or initiation of that fire and I really just don't know that.

MR VAN ZYL: And your experience with these types of fires and the packaging materials which we obviously had with all the computers and other stuff on board with the smoke itself, do you feel it's feasible that anybody could have seen any of the pallets to be able to get to it to fight the fire?

/Again, depending ...

MR SOUTHEARD: Again, depending on the initiating source. If the initiating source is rapid and again it depends on what's burning but you would get a large volume of smoke there, and it is quite possible that your visibility would be severely restricted in addition to the heat coming across the crown.

MR VAN ZYL: Do you feel if you look at the AD itself that has been produced with fire fighting, that it's feasible to look at a fire fighter really extinguishing a fire of this magnitude?

MR SOUTHEARD: I can't comment on that really, because the FA have spent a long time on this and I haven't and it would be wrong of me to just comment just here and now without considering it properly.

MR VAN ZYL: And then Mr Southeard, in your report as well you made reference to the HALON and the water extinguishant being used on metal fires...

MR SOUTHEARD: That is correct.

MR VAN ZYL: ...and really aggrevate the situation.

MR SOUTHEARD: That is correct.

MR VAN ZYL: Is this applicable in this fire?

MR SOUTHEARD: It is quite possible. If the fuel involved - oxydising agents are metals, then HALON will have a promoting effect rather than an extinguishing effect.

MR VAN ZYL: But the size of the fire and metals that are involved here, do you feel it would have had any significant effect?

MR SOUTHEARD: It could well have had, yes.

MR SOUTHEARD questioned by MEMBERS OF THE BOARD:

MR TOMPKINS: Mr Southeard, do I understand from your report that in your opinion the fire had been well underway by the time the smoke alarm went off in the cockpit?

MR SOUTHEARD: I believe by the time it was detected you had flames impinging on the crown.

MR TOMPKINS: By detection you mean the smoke detectors in the cargo bay?

MR SOUTHEARD: That is correct, yes.

MR TOMPKINS: And would your type of fire reach such an intensity in 69 seconds so as to burn through the CVR wiring?

MR SOUTHEARD: Yes.

MR TOMPKINS: And that it would have been fuelled by substances in the cargo pallet?

MR SOUTHEARD: Yes, I think the question is here, I don't know of anyone that has postulated another source in this Inquiry, other than something in the cargo. So therefore, in my belief it has to be something that is not on the manifesto, not on the cargo list that started this fire. The debate is probably between what time that cardboard box fire took over from the promoter. My belief is that the original promoter caused enough damage to that skin to see the heat and damage that we have seen. At what stage that cardboard box fire takes over, I don't know,

/because ...

because at some stage that fuel is going to run out. It is not going to carry on forever and then the cardboard box fire will take over. So at what stage that has happened, I can't gauge.

MR TOMPKINS: Under what circumstances would the smoke detectors not pick up the presence of the fire?

MR SOUTHEARD: If we are assuming that they were operating? Correct?

MR TOMPKINS: They were operating, yes.

MR SOUTHEARD: (a) If you have an initial promoted fire which doesn't produce a lot of smoke, but I don't know the other reasons. I can't envisage another reason why they shouldn't, except that it is obviously not reaching the intensity which the photocell is measuring.

MR TOMPKINS: If you had a smouldering fire within the centre of the pallet, which was producing only smoke, do you have any view on how long it would take the smoke to reach the crown to hit the smoke detectors?

MR SOUTHEARD: No, it is a very varying thing because it depends on how much smoke is generated initially. If you get a very small source of smoke, it could be filtered out as it passes through the boxes and it would take a long time before it is detected. And if you got a large generation of smoke - a large volume of smoke generated initially, then it obviously will be a quicker

response.

MR TOMPKINS: If the flames initially were confined within a box or under the covering of the pallet and then intensified to a point where they broke loose and found an easy route to feed upon, would that cause the smoke then to rise at a more rapid rate and trigger the smoke detectors?

MR SOUTHEARD: It could do, yes.

MR TOMPKINS: Do you know how long that would take in this type of fire we're talking about?

MR SOUTHEARD: I don't know because it is just such an indeterminate thing.

MR TOMPKINS: Do you know where the CVR wiring passes through the cargo compartment?

MR SOUTHEARD: Yes.

MR TOMPKINS: Where?

MR SOUTHEARD: It is either side of the crown. I have a diagram - a cross-section. Do you want to see it?

MR TOMPKINS: Would it be on the outside of the pallets or in the centre?

MR SOUTHEARD: It's just across the top, actually. Just either side of the crown.

MR TOMPKINS: Alright.

MR SOUTHEARD: But they are in bundles of many wires. Now we don't know exactly where this CVR wire would be. It could be on the outside of the bundle or it could be on the inside.

MR TOMPKINS: If I look at your EXHIBIT "U", on the first page,

- it's our EXHIBIT "U" actually, your diagrams. This one - here it is. Do you see the wire referred to?

MR SOUTHEARD: Yes, I do. Would you like this diagram which actually shows it.

MR TOMPKINS: I don't need the real technical detail. Does the wiring go down the centre line of the pallets in the crown?

MR SOUTHEARD: The raceways are about halfway between the centre of the crown and stringer 15R. That sort of position on either side of the aircraft.

MR TOMPKINS: With the wires burning through in 69 seconds from the alarm bell going off, would that give you any indication as to the location of the intensity of the fire at that point?

MR SOUTHEARD: No, it wouldn't because as I say, these are bundles of wires - quite a lot of wires together - and it would depend on whether that particular wire was on the outside of the bundle, or on the inside. It would make a lot of difference because the other wires are protecting the one in the inside.

MR TOMPKINS: Would it give you any indication if you look again at your diagram as to whether the fire was most intense on the outside of the pallet in which it started, or the inside? By "outside" I mean the window's side as opposed to the centre side of the cargo compartment.

/In ...

MR SOUTHEARD: In terms of how long it took to burn those through? No, it wouldn't because once the flames grew and impinged on that crown, they would extend; due to the hot gases coming across the crown; those flames would impinge right across the top of the crown. So it is not a question of just going up and touching a wire. They would carry over the whole of the arch of the crown.

MR TOMPKINS: At that point the flames would be over the entire crown of the aircraft.

MR SOUTHEARD: That is correct and that would happen at a fairly early stage.

MR TOMPKINS: Thank you.

DR GILLILAND: Mr Southeard, could you perhaps express an opinion on the type of fire that would promote concentrations of soot and carbon monoxide in the passenger cabin? Would it be more likely to be a slowly burning smouldering fire, or a rapidly flaring fire?

MR SOUTHEARD: It would generally be sir, an incomplete combustion which would mean a slow smouldering, rather than a very rapid flaming.

DR GILLILAND: Thank you.

CHAIRMAN: You have expressed the view on page 8 of your report, EXHIBIT "M" that the size of the fire would be equivalent to one involving an armchair at the lower end, or a large settee at the higher end. Do you mean that the fire - that that

relates to the size of the fire?

MR SOUTHEARD: Yes, Mr Chairman. It is just an indication to try and visualize what the fire would look like. I mean this corresponds to about 250KW. That would be the armchair, or the megawatt would be a large settee.

CHAIRMAN: Yes.

MR SOUTHEARD: I am just trying to give an indication of what it would look like to somebody who doesn't know what a fire ...

CHAIRMAN: Mr Southeard, the point I want to put to you is that this fire directly or indirectly, destroyed the aircraft. It didn't consume it, but it resulted in the aircraft hitting the sea out of control.

MR SOUTHEARD: That is correct.

CHAIRMAN: Is that consistent with the description that you have given? I know that you have circumscribed it by reference to the hot spots.

MR SOUTHEARD: But there is no evidence Mr Chairman, that a fire raged throughout the whole of the cargo compartment.

CHAIRMAN: That is what I want to hear from you.

MR SOUTHEARD: That is just not correct. It may have gone down and flames extended down, or certainly hot gases have extended down the crown of the aircraft.

CHAIRMAN: What do you think caused the link between, or

/was ...

was the link between the fire and the aircraft going into the sea out of control?

MR SOUTHEARD: I have no idea I am afraid Mr Chairman; that is just not my field. All I can say is how the fire developed.

CHAIRMAN: But if it was a fire of these limited dimensions such as you have described, it ought to have been capable of being fought.

MR SOUTHEARD: Unless it is a promoted fire and therefore it gets out of hand so quickly that the crew could not do anything about it.

CHAIRMAN: Whether it got out of hand or not, isn't the question for the moment. I am referring you to the size of it.

MR SOUTHEARD: Right. By the time that that has died back, you've got a lot of smoke and a lot of hot gases built up in the crown and that is what would prevent them entering. It is the hot gases and the smoke.

CHAIRMAN: That, you suggest, is the link between the fire and the eventual destruction of the aircraft.

MR SOUTHEARD: I suggest that is the reason why the crew may not have been able to enter.

CHAIRMAN: To beat it.

MR SOUTHEARD: To extinguish it.

CHAIRMAN: To beat it.

MR SOUTHEARD: That is correct.

CHAIRMAN: Because of smoke and hot gas.

/That ...

MR SOUTHEARD: That is correct.

CHAIRMAN: Do you suggest that the fire started inside the pallet?

MR SOUTHEARD: Yes, I do. When you say "inside", inside one of the boxes of that pallet, not within the centre of the pallet, but it is certainly within one of the boxes on the pallet.

CHAIRMAN: Have you any re-examination?

MR CILLIERS: I have if I may, Mr Chairman.

MR SOUTHEARD re-examined by MR CILLIERS:

MR CILLIERS: The last matter which the Chairman raised with you Mr Southeard, within your field of expertise, is there anything which indicates a necessary direct link between the fire and the loss of the aircraft? To put it differently, need the aircraft have been lost because of the fire as far as your field of expertise is concerned?

MR SOUTHEARD: All I can say is I saw no evidence of the fire breaching the skin of the aircraft, but beyond that I can't comment.

MR CILLIERS: You mean beyond that it is a structures' matter.

MR SOUTHEARD: That is correct.

MR CILLIERS: Alright. You were also asked by DR GILLILAND in general terms what sort of fire would lead to a build up of carbon monoxide, a rapid burning fire or a slow burning fire, and you said - your words were in general terms : a slow, smouldering fire.

MR SOUTHEARD: Incomplete combustion, yes.

MR CILLIERS: Yes. The production of carbon monoxide, does it also depend on what burns? Let me complete what I am driving at, would cardboard and polystyrene even if it burnt rapidly, produce a great deal of smoke?

MR SOUTHEARD: Yes.

MR CILLIERS: MR TOMPKINS asked you about the possibility of a flame being contained, as I understood it,

/in ...

in a pallet with the covering round it and by the time it gets out of there, then it is already a flame which has already developed for some time and has generated some heat. In the case of the right front pallet which is where you believe the fire started, do you know whether there was any cover on that pallet?

MR SOUTHEARD: There wasn't any covering on that pallet.

MR CILLIERS: Yes. And lastly, the geometry of the fire. My learned friend MR PUCKRIN, put to you the proposition that maybe the blanket fell down - the insulation blanket fell down at stations eighteen to eighteen twenty, and maybe that is why that area was exposed to greater heat, and you gave him some answers on that.

I just want to ask, if you could perhaps just explain again with reference to your diagram, the question of the geometry of the fire and as I understood your evidence, a flame, as you put it, would have to go about 45° to reach stringer 15. So you have a lateral flame at about a 45° angle because it is not nearly so hot below stringer 15.

MR SPOUTHEARD: That is correct.

MR CILLIERS: Now instead of a lateral flame going from the edge of the pallet right up to stringer 15, could one have radiant heat there causing that type

of ...

MR SOUTHEARD: No, I believe that the energies involved, you must have flame impingement.

MR CILLIERS: And to the extent that one may think of it coming to radiant heat, how wide would your fire then have to be if you have to have sufficient radiant heat to start looking at that type of temperature?

MR SOUTHEARD: It is almost across the pallet.

MR CILLIERS: And if it were across the pallet and it was taking on those dimensions, what would you expect to happen to other blankets - insulation blankets?

MR SOUTHEARD: I would have expected them to fall in the same way as the eighteen hundred, eighteen twenty.

MR CILLIERS: Thank you, Mr Chairman.

CHAIRMAN: Thank you.

I would like that exhibit that was prepared by DR FOWLER to be handed in to us, please.

MR CILLIERS: Yes, Mr Chairman.

CHAIRMAN: We will designate it EXHIBIT "V".

MR CILLIERS: Mr Chairman, these are the two witnesses whose evidence did not depend on whether or not the evidence of the other witnesses on the structural aspects - MR ROGERS, MR VIQUESNEY and so forth; whether or not such evidence is given to you by way of report, or whether they are called as witnesses, which in turn dictates whether my learned friend MR PUCKRIN thinks of calling MR RYDER or not. Would it perhaps be convenient

Mr Chairman, if we could discuss this because we didn't have much time over the lunch hour, other than to discuss it each group amongst themselves; to discuss this and see what our suggestions could be on the way in which we seek to present our further evidence, with a view to shortening rather than lengthening the proceedings.

CHAIRMAN: The suggestion made by my colleague is that we adjourn for fifteen minutes, and then keep you to five o'clock if necessary.

MR CILLIERS: May we report to you and members of the Board what our attitude about further evidence is?

CHAIRMAN: Yes.

MR CILLIERS: Thank you. Yes, Mr Puckrin?

MR PUCKRIN: Mr Chairman, whatever the result of the discussions which are held, we would certainly crave your indulgence to hear short oral submissions assuming ...

CHAIRMAN: We want that, Mr Puckrin.

MR PUCKRIN: The suggestion that we have Mr Chairman, is that perhaps whatever happens in regard to the leading of further evidence, that we do that early on Friday morning.

CHAIRMAN: We had hoped to have Friday morning available for consultations among ourselves.

MR PUCKRIN: We are in your hands, Mr Chairman.

CHAIRMAN: Is there any prospect of the evidence finishing

tomorrow morning?

MR PUCKRIN: Potentially there would be three further witnesses.

CHAIRMAN: Who would they be?

MR PUCKRIN: It would be DR RYDER, there would be MR ROGERS and MR VIQUESNEY, Mr Chairman. And a medical witness. By that time we shall all need his assistance, Mr Chairman.

CHAIRMAN: That being so we have to use the time to the best possible advantage. Would it cause great inconvenience if we gave you only fifteen minutes?

MR PUCKRIN: I believe it will be sufficient time, Mr Chairman.

CHAIRMAN: Will you please come and let us know in chambers what the developments are.

We will take an adjournment for fifteen minutes.

INQUIRY ADJOURNED FOR A FEW MINUTES

INQUIRY RESUMED

CHAIRMAN: Mr Cilliers?

MR CILLIERS: My learned friend MR BOWMAN will lead the next witness, MR VIQUESNEY.