

Her father said the aircraft would not land. He then pointed out where the aircraft would be going, and said that it would be travelling down McMurdo Sound and would keep "fairly close to this bumpy lot", meaning thereby, the eastern coast of Victoria Land. Elizabeth Collins left the room and some time later returned and heard her father explaining the flight to Kathryn. Elizabeth Collins was shown a number of maps but could not identify the map her father was using that night. She said that the map her father showed her was quite a large scale map and that when opened out it was too large for the table and had to be placed on the floor.

262. Some questions were asked of Mrs Collins in cross-examination, but no counsel questioned her on the evidence that Captain Collins had been working on maps with a ruler and/or plotting instruments, and no counsel desired to cross-examine either daughter on the same topic. It therefore appears that Captain Collins had acquired two maps to which he referred on that night, in addition to the atlas which formed part of the family library. The probabilities are that Captain Collins used one or other of the large maps to plot a track from Auckland leading through each waypoint down to the termination of the nav track at the head of McMurdo Sound, and that he performed the same plotting procedure on the Ross Dependency map, illustrated at page 184 of his atlas. Finally, there can be no doubt at all that on page 185 of his atlas, which showed the McMurdo area on a scale of 16 miles to the inch, he plotted the last leg of the nav track from a point a little to the west of Beaufort Island down to the false co-ordinates near the Dailey Islands.

263. It will be noted that Captain Collins spent between 1½ and 2 hours working on these maps with the "other materials" referred to which were, no doubt, his briefing documents. If Captain Collins had plotted the complete flight path of TE 901 from Auckland to McMurdo and return, then in order to be able to refer to the various waypoint co-ordinates he would need to have had in his possession a computer print-out for the antarctic route. In my opinion he did in fact have such a print-out. Numerous print-outs have been produced in evidence, and there was evidently no difficulty in obtaining a print-out of the route if required for some particular purpose. According to Mrs Collins, her husband concluded his work with the maps at about 10 p.m. and then packed the maps and other written materials into his black flight bag in preparation for the following morning. It is clear, as I have said, that the atlas must also have been packed into the flight bag because it left the household that night and has never been seen again. The decision of Captain Collins to take with him the atlas is significant in the extreme. It could only have been taken because of the large scale data on page 185, which, with a line drawn down to the false waypoint, would show him his exact position at any moment in relation to Ross Island, Mt. Bird, Mt. Erebus, and McMurdo Station. The detail on page 184 would be available, almost certainly on larger scale, on one or other of the 2 maps, which he had been using, and the deduction is clear that the atlas was taken on the flight because of the track which Captain Collins had plotted on page 185. Fig. 7, page 96 shows the relevant section of the flight plan produced to Captain Collins at his briefing, and fig. 8, page 97 the corresponding section of the flight plan delivered to him on the morning of the fatal flight.

264. The witnesses in the case who were asked to describe the personality and working methods of Captain Collins were unanimous in their opinion. It did not matter whether they were executive pilots or line pilots. They said that he was careful, conscientious and methodical. The

latter adjective was particularly stressed. The fact was that there had been no topographical map produced at the briefing upon which the nav track had been plotted. And so Captain Collins, being a methodical man, did exactly what the chief inspector considered ought to have been done. He plotted all the waypoints on maps of his own on the night before the flight and packed the maps away, together with his atlas, and took them on the flight in his flight bag.

265. The airline, in its very comprehensive final submissions, did not touch upon the question as to whether Captain Collins had plotted the nav track in reliance upon the flight plan produced to him at the briefing. The final submissions of the Civil Aviation Division likewise omitted any specific reference to this point. No doubt the very experienced senior counsel appearing for both organisations could see that there was no point in disputing a self-evident fact.

VISIT TO ANTARCTICA 26-29 NOVEMBER 1980

266. It was apparent that for the purposes of examining all possible causes of the disaster I would need to go to Antarctica, and I decided to coincide the visit with the first anniversary of the date of the disaster so that the southern point of the ice break-up would be about the same. It was arranged through the good offices of the Royal New Zealand Air Force that I would fly down to Antarctica on 26 November 1980. I was accompanied by Mr Baragwanath and Mr Harrison in their capacities as counsel assisting the Commission, by Air Commodore David Crooks (now Deputy Chief of Air Staff) and also by Air Marshal Sir Rochford Hughes. A further member of the party was Mr Edward Davies of Air New Zealand, who was going down for the purpose of laying a wreath at the cross which had been erected on the mountain side a week or two after the date of the disaster.

267. We travelled to Antarctica on a C-130 Hercules aircraft of the R.N.Z.A.F. The pilot was Flight Lieutenant Russell, and the commander of the flight was Wing Commander Gayfer. Upon approaching the continent of Antarctica I went on the flight deck for the remainder of the journey. The aircraft was flying at 29 000 feet, and with about 250 miles to run, we had crossed the Admiralty Mountains and the Victory Mountains and had come out over the Ross Sea. The view ahead was perfectly clear. There was a very long range of vision over Victoria Land to the right. There was no cloud, and the view of the continent was composed entirely of snow-covered mountains. In the distance as the aircraft came closer, there could be detected the outline of Ross Island, and the configuration of the island had been previously picked up by the aircraft radar.

268. At about 150 miles from McMurdo Wing Commander Gayfer took over the co-pilot's seat and said that it was proposed with my approval to bring the aircraft to the track followed by the DC10 and to execute the orbit to the right and the orbit to the left which the DC10 had followed. Thereafter the wing commander said he intended to fly directly at the mountain side along the exact track taken by the DC10 and he would pull away at a fairly late stage. I said I agreed with all this.

269. First of all, the aircraft flew to the Byrd Reporting Point to establish its position with Ground Control, and then we flew over the crash site, where parts of the wreckage are still visible. The aircraft was then flown away to the true north, reaching the same altitude as the DC10 before it had commenced its first orbit.



FIGURE 9

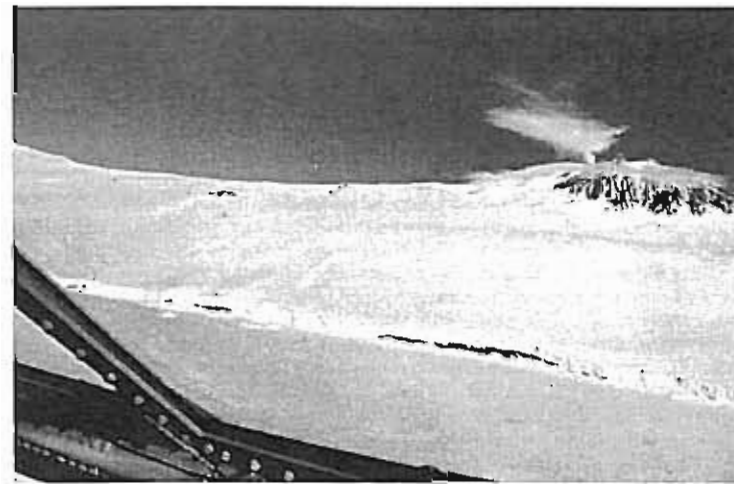


FIGURE 10

270. Wing Commander Gayfer had a map upon which had been plotted the exact location of the figure-8 manoeuvre adopted by Captain Collins as he accomplished his descent from 17 000 to 2000 and then 1500 feet. Thereafter the wing commander directed the course, speed, altitude and rate of descent so as to follow exactly the flight of the DC10. At the appropriate moment he ordered the commencement of the right-hand orbit and he controlled the descending altitude and angle of turn at each stage, with the flight lieutenant carrying out these instructions. After completion of the first orbit the aircraft commenced the second orbit to the left and the wing commander kept the aircraft on its descent at the same descending altitudes as had been followed by the DC10. From time to time, if there appeared to be slight deviations from the actual track of the DC10, the appropriate modifications were made to the heading.

271. Eventually, the second orbit was completed and the aircraft was straightened out for the run towards the mountain. The wing commander suggested to me that he flew in at 1500 feet at 260 knots with the result that we would be flying at the same altitude and speed of the DC10 and along its exact course. I agreed to this, and Flight Lieutenant Russell was then directed to drop to a flight level of 1500 feet and hold the speed at 260 knots. Wing Commander Gayfer then instructed the pilot that at the appropriate moment he would direct a left-hand 180° turn.

272. As we approached the mountain there was bright sunshine and the ice cliff could be seen in the distance without any difficulty. There appeared to be only two shallow patches of black rock visible at about the level of the ice shelf at the bottom of the cliff. These were in line with the crash site. They were not very long and on my estimation about 20 or 30 feet high. Apart from these two dark areas, and possibly one or two other smaller but similar areas well to the true east, the ice shelf in front of us was uniformly white. We could see the crash site without difficulty in the clear air. The wing commander warned the flight lieutenant that he was about to issue the order to bank left and then, at a point 2 miles from the crash site, he gave the necessary order. The aircraft banked sharply left and held a 180° turn so as to then adopt a heading of 180° grid. Since the approach speed was approximately 300 miles per hour, we had turned away when about 30 seconds from the crash site, and consequently the reconstruction of the final approach of the DC10 was suitably realistic. The aircraft was then flown on a heading of true north, turned left around Cape Bird on the military track, and thereafter adopted the glide path to the ice runway. It was Flight Lieutenant Russell's first landing on the ice runway, but the touch-down was impeccable, almost imperceptible. I remarked on this to the flight lieutenant after the aircraft had taxied to a stop. His response was non-committal. But I had the impression that his composure did not entirely conceal his satisfaction. The sequence of photographs in fig. 9, at page 100, and fig. 10, at page 101, show the line of approach to the mountain as executed by Wing Commander Gayfer.

273. On 27 November we were taken on an extensive tour, in a tracked vehicle, of the McMurdo area. The weather was quite fine in the morning with bright sunshine. In the afternoon over by the Scott Hut, a northerly front was seen to be approaching. Standing on a height near Scott Hut we could look out across the ice at the Ross Sea and at the mountains along Scott Coast, and the visibility range was more than 100 miles to the north. On the right there was seen the black outline of Tent Island and behind Tent Island, but obscured by it, was Cape Royds. When the United States Air Traffic Control say they can see 40 miles, they mean that they can see



FIGURE 11

the mountains. Visibility is then usually 100 miles or more. Fig. 11, page 103, is a view to the north from Hut Point looking up McMurdo Sound with Tent Island on the right. The expected line of approach of the DC10 on 28 November 1979 was from that part of the horizon to the left of the centre line of the photograph.

274. In the afternoon the northerly front enveloped Ross Island in accordance with an extremely accurate forecast by Sir Rochford Hughes, but still left a clear area looking down the Sound a few points to the west of true north, and Scott Coast was entirely clear. Mt. Erebus then totally disappeared in pale cloud and as one looked at it the cloud pattern which obscured the mountain kept shifting and changing. The plume of steam at the top of the crater was no longer visible. Sometimes a long streamer of cloud near the top altered from a horizontal angle to a downwards angle pointing to the true east. The light cloud patterns around the mountain kept changing both in contour and in colour throughout the afternoon. The conditions then began to resemble what they had been like on 28 November 1979, that is, a low overcast had come in with the northerly front, but as stated previously, the vision out towards McMurdo Sound into the north-west was clear and bright. To the true east, that is to say looking to the right of Ross Island, the snow now blended with the horizon so as to make the horizon invisible, and it was impossible to say where the snow ended and the cloud began.

275. A plan had been made for me to fly by helicopter on to the mountain side the next day, but this was thought to be a doubtful procedure if the cloud covering Ross Island continued to persist as it would be impossible to fly in conditions where both ground and horizon definition had entirely disappeared. In such circumstances, the helicopter pilot would not be able to tell whether he was flying into or over the slopes of Mt. Erebus. In the meantime, however, a programme was scheduled whereby the helicopter would leave at 11 a.m. next day.

276. A helicopter was provided by the United States Navy on 28 November. The low overcast still persisted. The overcast had spread over Scott Base and well to the true north. Out over McMurdo Sound, a little left of true north, visibility was still quite clear, and in particular towards the eastern border of Victoria Land. The helicopter flight to Mt. Erebus had been scheduled for 11 a.m. but had to be cancelled because the overcast and the cloud concealing Mt. Erebus made it impossible to approach the mountain from the true south. The flight was postponed on more than one occasion, but eventually we were advised that visibility over Lewis Bay was thought to be reasonably clear, and we took off at 4 p.m. in the helicopter. Those present apart from the pilot and co-pilot, were myself, Mr Baragwanath, Air Marshal Sir Rochford Hughes, Mr R. B. Thomson, and Mr Edward Davies. We flew towards the saddle which runs between Mt. Bird and Mt. Erebus. Heavy cloud concealed Mt. Bird and the cloud was drifting in a general easterly direction across the saddle. There were however certain thin breaks in the cloud which could be discerned by strips of sunlight on the snow.

277. The pilot first attempted to fly through the narrow cloud breaks as revealed by the sun, but as this seemed hazardous he elected to turn about and fly over the saddle but under the cloud base. The gap available for this purpose was minimal, but there was enough clearance between the cloud base at the top of the saddle for the helicopter to fly through.

278. It had been decided that if Lewis Bay was either in cloud or covered by low overcast, that we would have to fly away to the true north

and return to the base. However, the weather over Lewis Bay was free from cloud and there was bright sunlight, so we were able to carry on. The helicopter then flew towards the true north and turned and came back on a heading of 357° grid which put it upon the same track as the DC10.

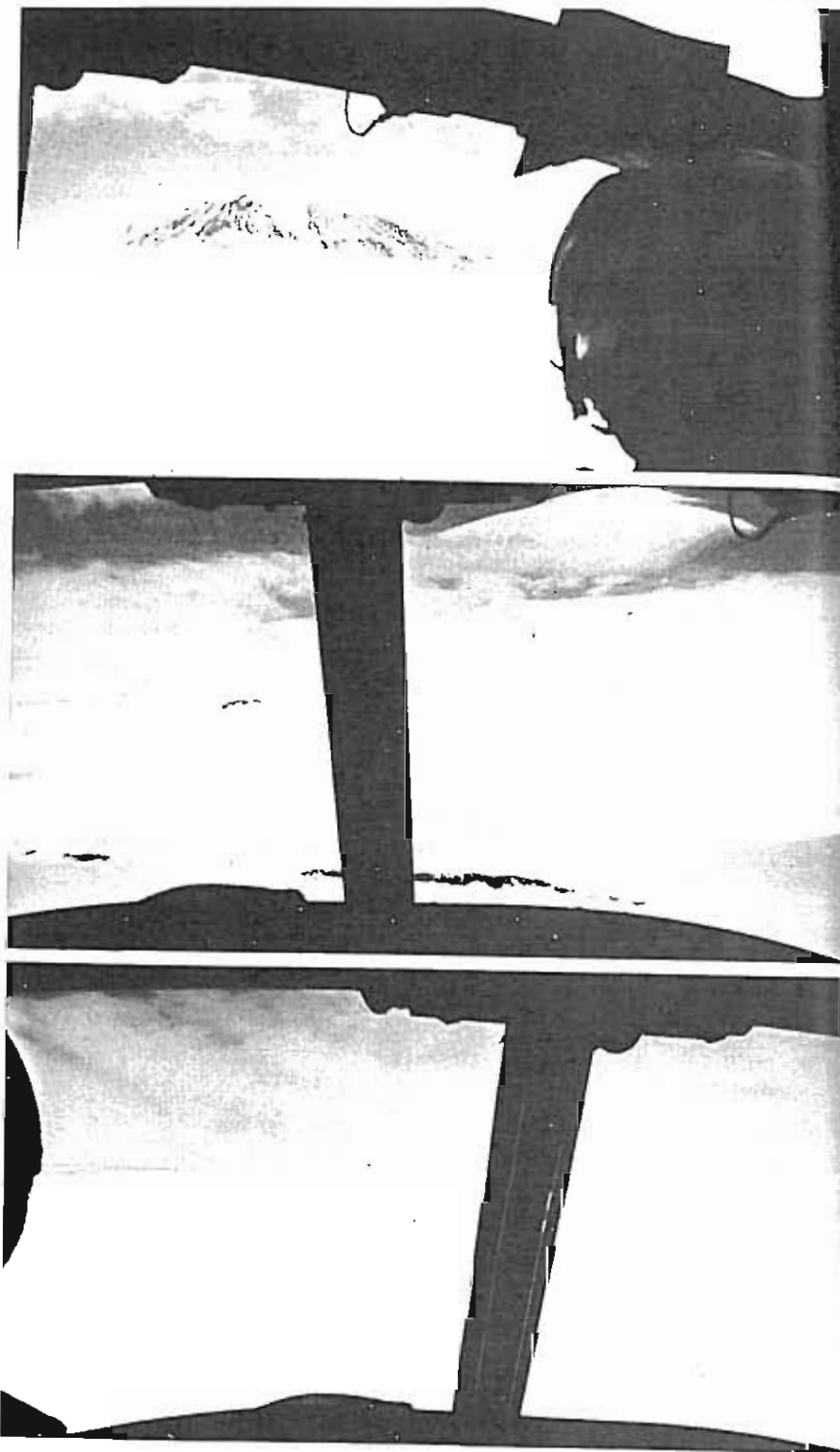
279. As we approached the ice shelf at about 75 knots, the latter could clearly be seen as on 26 November, and the rising ground which commenced at the ice shelf was also clearly apparent in the sunlight, but the mountain itself was becoming enveloped in pale cloud, and in a minute or so it totally disappeared from sight. Even though the mountain slope began only some 2 or 3 miles ahead of the crash site, no part of the mountain could be seen, Fig. 12, page 106, are photographs taken from the helicopter which show the partial then total envelopment of Mt. Erebus in cloud. Each photograph is aimed directly at the mountain.

280. Over to the true east we could see a narrow strip of black rock at about the level of the sea ice which marked the western border of Cape Tennyson. However, in towards the bay from Cape Tennyson there could be seen an ice fog lifting off the solid ice which was drifting over the ice shelf and which was entirely concealing 3 or 4 miles of the ice shelf. Over to the right we could see the narrow strip of black rock which marked the tip of Cape Bird. The approach towards the ice shelf was made over solid ice, covered with snow, and in sunlight.

281. We flew over the crash site and made several passes back and forth at a low altitude and the pieces of wreckage previously mentioned could now be seen more exactly. We then flew on to a point about 4000 feet up the mountain and the helicopter was then landed on a rock outcrop after some delicate manoeuvring of the landing gear so as to avoid boulders. I was able to look at the whole of the area surrounding the site of the disaster and I shall at a later stage describe the various combinations of light and cloud which were present on that occasion. About 200 yards down the slope from where we landed was the small cross which had been installed there in the previous year. Air New Zealand's representative, Mr Davies, had with him a wreath and also four containers of ashes of victims which the relatives desired to be scattered on the mountain side. These victims were one American, one Australian, and two New Zealanders. The wreath was duly placed, and Mr Davies scattered the ashes. We went back through the volcanic rock and snow to where the helicopter was waiting, with its engines still prudently running, and took our departure by flying away to the true west around the steep slope of Mt. Erebus and down towards the flat land to the true south, and after a flight of about 20 miles landed at Scott Base.

282. It was then decided that Air Commodore Crooks, Mr Thomson, Mr Davies and myself would leave that night for New Zealand by a Royal Australian Air Force Hercules which was flying out at about 6.30 p.m. local time. The Australian flight crew asked me to sit on the flight deck during the take-off as there was something which they said they wanted me to see. The overcast was still low over the whole area and they said that the conditions were virtually identical to those prevailing on the same day last year.

283. The pilot told me that he would fly out to the true east and attain a height of 1000 feet, and then he would turn back and fly to the true west and pass Scott Base at 500 feet, before commencing the climb away to New Zealand. He asked me to look out for a snow ridge which we would encounter as we approached Scott Base.



284. Near the left hand top edge of this ridge was a black outcrop of rock and the snow ridge then ran off to the right from that point. It was at a height roughly approximate to the height of the ice cliff which marks the commencement of the snow slopes running up to Mt. Erebus. The purpose of the Australian flight crew in asking me to note in advance the position of this snow ridge was to demonstrate the visual illusion which they said I would observe as we approached the snow ridge from the air. I knew that the snow ridge was present, and had seen it on the previous two days in bright sunlight, and it was a very discernible feature, but the flight crew were aware that with a low pale overcast of the kind which was then present it would be difficult to distinguish from the air the presence of this snow-covered feature. They told me that I would find it was difficult to discern in the diffused light under the overcast where the slope began and where the top of the ridge was located. The pilot radioed his intended departure course to Mac Centre and obtained their clearance. He then flew off in the indicated direction for a few miles and attained an altitude of 1000 feet, and then reversed his course and descended to 500 feet as we approached Scott Base. At this juncture I could see the snow ridge lying ahead, in that I could make out the top of the ridge, though not its base, but when I lifted up one hand and blocked out the view of the black outcrop of rock the ridge immediately disappeared. All that could be seen was a flat expanse of snow-covered ground running on for many miles ahead, and in the distance I could see the mountains of Victoria Land.

285. The crew told me that the overcast then subsiding at Scott Base was approximately the same as it had been 1 year before, and that the visual illusion to which I had been subjected was characteristic of what happened when flying over uniformly white terrain with an overcast of that nature. The flight captain and the navigator said that in their opinion this would be an exact replica of the visual deception to which Captain Collins must have been exposed as he flew under the same level of overcast approaching Mt. Erebus 1 year ago.

286. After passing Scott Base the aircraft flew out into the Sound, turned right and began its climb to its cruising altitude. I kept an eye on the altimeter, and noticed that we entered the bottom of the cloud base at 3000 feet and that we emerged from the light-coloured cloud at 5000 feet. Looking over to the right the top 7000 feet of Mt. Erebus was clearly visible. We in due course attained cruising altitude and arrived after a flight of several hours at Christchurch International Airport.

287. This had certainly been a striking demonstration of the whiteout phenomenon to which I have previously referred. As will be recalled, I had known the location and the appearance of this snow ridge. I had seen it on the two previous days in bright sunlight. Its exact configuration had been clear and unmistakable, with the sun shining down upon it out of a blue sky. But with a low overcast—despite the clear vision which extended for something like 100 miles in all directions—all slopes and undulations in the terrain ahead of the aircraft had disappeared. This long snow ridge about 200 feet high, which lay in the direct path of the aircraft, had totally disappeared once the rock outcrop on its left-hand extremity had been shut off from view. And so, by a coincidental similarity of weather, I had been able to see and understand the dangerous visual deception with which experienced polar pilots are all familiar, and which had without doubt confronted Captain Collins 1 year ago that day.

288. As the chief inspector had said in his report (paragraph 1.17.48) "those who have not been exposed to whiteout are often sceptical about

the inability of those who have experienced it to estimate distance under these conditions, and to be aware of terrain changes, and the separation of sky and earth." I must express my gratitude to the intelligence and initiative of this Royal Australian Air Force flight crew who knew that the conditions were substantially identical with those obtaining on the day of the fatal flight, and who saw the opportunity to demonstrate this optical phenomenon which is difficult to understand unless it has actually been seen. Here are their names and ranks:

Captain—Flight Lieutenant J. R. Howie
Co-pilot—Flight Lieutenant J. G. Thyer
Navigator—Flying Officer C. J. McHugh
Flight Engineer—Sergeant J. P. Vellacott
Loadmaster—Flight Sergeant G. I. Pollard

They are members of No. 36 Squadron, Royal Australian Air Force.

AREAS OF PILOT ERROR SUGGESTED BY THE AIRLINE OR BY CIVIL AVIATION DIVISION

289. I now propose to set out the different aspects in which it was alleged that the pilots of TE 901 were at fault, and shall indicate my view in respect of each such allegation.

- (a) It was suggested that the crew should have plotted in flight on a topographical map the co-ordinates for each position as they went along. But the captain in this case had plotted the flight path on a map before he left New Zealand, and I can see no justification for taking any further steps with regard to a map. The maps supplied by the company for the flight did not have any track marked upon it, and if Captain Collins had not plotted the track on his own maps and atlas the night before leaving, he would no doubt have checked his flight plan and no doubt plotted the co-ordinates during flight on the map supplied to him by the company. But for obvious reasons he did not need to do that. It was also suggested that the flight crew could have waited for each waypoint to be reached, and then verify the co-ordinates as appearing on the print-out in the aircraft instruments, and thus plot the track in flight, but I discount that suggestion for the same reason as already indicated. The crew had no need to plot their track on a topographical map or maps, because it had been done already.
- (b) It was suggested that the crew could have checked their position at different times by looking at the print-out of latitude and longitude which is continuously available on an instrument panel. I quite agree that this would be a simple method of determining where the aircraft was at some particular moment. Even though there was no plotting table or other place for a navigator on the aircraft, the co-pilot or engineer could work out the last latitude and longitude displayed and then plot that on a map so as to give the aircraft's position, although by that time the aircraft would be many miles ahead of that position. Indeed, it seems a simple thing to do, and I have no doubt that it could be done so as to fix the position of the aircraft within a few miles by this method of marking the printed co-ordinates on a map. But the question arises as to why such a course would be adopted in the case of this particular flight, or in any

scheduled flight. This print-out is situated in the roof of the flight deck at about eye level. It contains the geographical position of the aircraft as ascertained by one of the inertial sensor units. Its purpose is to enable the crew to call up on the computer display unit the geographical position of the aircraft as fixed by the computer, and then to compare that figure with the continuous readout provided by one of the sensor units. Thus the correct functioning of the computer may be checked, and this is part of the comprehensive system of monitoring the functions of the AINS as a whole. The provision of a continuous display of latitude and longitude is not for the purpose of assisting the crew to keep plotting on maps their position. Their position is ascertained by the simple process of looking at the distance to run, and then pinpointing on their track and distance guide where that distance is in relation to the next waypoint. I have already found that at all material times the crew were certain as to their position. If certain as to their position, then no member of the flight crew would adopt this suggested course. To do so would be in effect to disregard the unerring accuracy of the AINS as demonstrated to these pilots for thousands of hours spent in flying DC10 aircraft, and to go back to the days of navigators.

- (c) At pages 23 onwards on the brief of evidence of Mr Amies, he describes four different checks which were available to flight crews on the antarctic flights prior to the fatal flight, in respect of which there were the "incorrect" co-ordinates for McMurdo printed on the computerised flight plan. The purpose of setting out these four instrumental checks which might have been made by pilots was to answer the chief inspector's criticism that this mistake in the McMurdo co-ordinates should have gone unobserved for a period of 14 months. Mr Amies makes it clear, at paragraph 8.9 of his brief, that his detailed description of the four in-flight checks of the progress of the aircraft in relation to its flight plan, each made possible by calling up various print-outs on the CDU screens, are not applicable to the fatal flight because in the case of that flight the co-ordinates for McMurdo had been corrected. Consequently, there is no point in my discussing the four different tests which could have been applied by previous flight crews in the manner suggested by Mr Amies. I would only say that in the case of the fatal flight the crew would without question, for this was agreed by Mr Davison, have performed the first two tests. The third and fourth tests however, depended upon the existence of a non-directional beacon at McMurdo, and this beacon had been withdrawn. However, as inferentially conceded by Mr Amies, the performance of the first two of his tests by the crew of the fatal flight would have revealed nothing, because of course, the aircraft was in fact flying in accordance with the computerised flight plan which had been handed to the crew on the morning of departure.

However, despite the fact that the four tests propounded by Mr Amies were not applicable to the fatal flight, I have given careful attention to other checks which might have been made by Captain Collins and his crew in respect of the accuracy of the nav track as it approached and passed Cape Hallett. If it was shown that the crew had been able to verify the accuracy of the AINS up to and including Cape Hallett, then of course it follows that they could rightly expect that upon arrival at McMurdo there could not be a cross-track error