(6) Checks made in flight at the Balleny Islands and at Cape Hallett demonstrated to the crew that the AINS was operating with its customary extreme accuracy, and that any cross-track drift upon arrival at the destination waypoint would not be greater than about 1 mile, or 2 miles at the most.
(7) McMurdo Air Traffic Control believed that the destination waypoint of the aircraft was 27 miles west of McMurdo Station, and that the aircraft would approach at a low altitude down McMurdo Sound.
(8) Mac Centre invited the aircraft to descend to 1500 feet in McMurdo Sound for the reason that visibility at that altitude was 40 miles or more.
(9) Captain Collins accepted this invitation and made the decision to descend to that altitude.
(10) The nature of the cloud base in Lewis Bay and the unrelieved whiteness of the snow-covered terrain beneath the overcast combined to produce the whiteout visual illusion.

388. If any one of these 10 factors had not existed, then there would have been no disaster. It therefore required the coincidental existence of no less than 10 separate factual circumstances to make the disaster possible at all. The collision of the aircraft with the mountain slopes was a million to one chance.

389. The 10 factors which I have isolated are all contributing causes to the disaster, and I was invited by counsel for the airline, in the course of their final submissions, merely to identify the contributing causes and to let the matter rest there. That submission was based upon the very proper philosophy that the prime purpose of aircraft accident investigations is to secure avoidance of similar incidents in the future, and not to identify and apportion culpability or blame for what occurred.

390. I entirely agree that a mere recital of the ascertained contributing causes, which in the present case in my opinion amount to ten in number, is fully adequate in respect of the accident avoidance feature of accident investigations. But my terms of reference preclude me from adopting that course. I am required, in terms of paragraph (g), to answer the question whether this disaster was caused or contributed to by blameworthy acts or omissions by any person or persons.

391. I must now look at the contributing causes which I have identified, and see whether any one or more of them is the result of a culpable act or omission. In my opinion the only contributing causes which I have listed which were created by blameworthy acts or omissions are those which I have identified as Nos. (2) and (5). They each result from culpable acts and omissions on the part of the airline, and in the case of No. (2), on the part of the Civil Aviation Division also.

392. As a result of forming that opinion as to contributing causes I am able to reach a decision as to whether or not there was a single cause of the disaster. In my opinion there was. The dominant cause of the disaster was the act of the airline in changing the computer track of the aircraft without telling the aircrew. That blend of act and omission acquires its status as the "dominant" cause because it was the one factor which continued to operate from the time before the aircraft left New Zealand until the time when it struck the slopes of Mt. Erebus. It is clear that this dominant factor would still not have resulted in disaster had it not been for the coincidental occurrence of the whiteout phenomenon. But the conditions of visual illusion existing in Lewis Bay would have had no effect on flight

TE 901 had the nav track of the aircraft not been changed, for it was only the alteration to the nav track which brought the aircraft into Lewis Bay instead of McMurdo Sound.

393. In my opinion therefore, the single dominant and effective cause of the disaster was the mistake made by those airline officials who programmed the aircraft to fly directly at Mt. Erebus and omitted to tell the aircrew. That mistake is directly attributable, not so much to the persons who made it, but to the incompetent administrative airline procedures which made the mistake possible.

394. In my opinion, neither Captain Collins nor First Officer Cassin nor the flight engineers made any error which contributed to the disaster, and were not responsible for its occurrence.

EPILOGUE

395. The circumstances of the final stage of the approach of Flight TE 901 towards Ross Island will never be fully known, and without the advantage of the CVR and the digital flight data recorder (the "black box"), would never have been known at all. The airline witnesses who appeared before me were intent, as I have indicated before, upon establishing pilot error as the effective cause of the accident. This is a conventional stance adopted by airline operators, and sometimes aircraft manufacturers, when an inquiry like the present is convened. In most cases the object is to persuade the tribunal that despite some technical malfunction of the aircraft which originated the chain of events, the pilot had the chance, even at the last minute, of avoiding the accident. The types of pilot error suggested in such cases normally include flying on a course or at an altitude which in the circumstances was unsafe, or was not authorised by the airline operator, or was forbidden by aviation regulations, and in suitable cases it may be alleged that the pilot was too slow in his response to an emergency. When the air crew has been killed in a flying accident, allegations of "pilot error" require careful consideration, for they will mainly depend upon inferential conclusions rather than direct evidence. It is a mistake to draw conclusions or to make deductive inferences without assessing all the known facts, and in the present case I think this error was made by the chief inspector when he deduced that Captain Collins was "uncertain" of his position, and I think the same error coloured a good deal of the evidence adduced on behalf of Air New Zealand.

396. The principal factors relied upon by these witnesses were altitude, speed, heading, terrain, and weather. But a conclusion based upon those five factors alone involved the omission of an additional and perhaps paramount factor, and that was the skill and experience of the two pilots. This was not the case of a top-dressing aircraft or deer-hunting helicopter in which a degree of risk is undertaken by the pilot as part of his operational duties. Nor is it the case of an amateur pilot flying a light aircraft in a manner suggesting or establishing his folly or his ignorance of sound aviation practice. The pilot and co-pilot of the DC10 were commercial pilots of long experience. Neither Captain Collins nor First Officer Cassin would consciously take the slightest risk in the course of

flying the aircraft. Once due weight is given to that factor then it becomes difficult to infer that the pilots were uncertain as to their position. But one can go further than that. Why did Captain Collins bring the aircraft back on to its nav track at the conclusion of the second orbit? This has been the continuing obstacle to any suggestion that the crew were "uncertain" as to their position. The re-arming of the nav mode could only mean that Captain Collins had in front of him a plotted track showing exactly where the nav track would take him, and this wholly negates any suggestion that he or First Officer Cassin were "uncertain" as to their position. On this basis the cornerstone of the whole allegation of pilot error begins to crumble away, because every alternative course of conduct which it is suggested the pilots ought to have adopted, and every additional monitoring precaution it is suggested they should have taken, is based upon the primary and false thesis that the crew were not sure where the aircraft was.

397. It is instructive to consider what might have happened had the altered co-ordinates in the flight plan not resulted in disaster. Suppose that as Flight TE 901 approached Ross Island the cloud obscuring Mt. Erebus had been dissipated for a moment, either by sunlight or by the wind, so as to reveal to the air crew the presence of the mountain in their path, and the aircraft had then climbed safely away. In due course there would have been instituted in New Zealand a public inquiry into the incident. At that inquiry the persons placed on the defensive from the outset would have been the relevant personnel of the Flight Operations Division of the airline. Captain Collins would have produced the whole of the contents of his flight bag, and they would have included his maps, his atlas, all his flight documents, and possibly his black ring-binder notebook (**Exhibit 251**) with all its pages intact. The crew would have testified as to the pre-descent briefing, and the pilots would have been able to say exactly what they saw on the approach to Ross Island. I doubt very much if there would have been too much heard at such an inquiry, with Captain Collins and First Officer Cassin present and listening, about wrongful reliance on the inertial navigation system, unlawful descent below minimum safe altitude, flying towards an area of deteriorating visibility, and the like. On the vital question of visibility there would have been, I need hardly say, the evidence not only of the flight crew but also of large numbers of passengers who must have looked at Ross Island in the course of the orbiting turns which the aircraft made. All this no doubt is obvious enough, but I only stress the point that there are areas of fact in this investigation which will always remain unknown simply because all the occupants of the aircraft lost their lives, and that inferences of "pilot error" should not too readily be drawn when the circumstances are equivocal, and when the tale of the air crew themselves can never be told.

398. I had these reflections in mind as I stood with my companions on the slopes of Mt. Erebus on the first anniversary of the disaster. Four thousand feet below were the ice cliffs which marked the frozen coastline of Lewis Bay, and over to the north-west, 12 miles away, the slopes of Mt. Bird were enveloped by streams of pale cloud which were drifting towards us. The northern aspect of Mt. Erebus was wholly concealed by cloud as from a level of about 1000 feet above us. But now and then, for a few seconds, the breeze would disperse the cloud and expose the wide buttress of black rock below the crater. Sometimes the drifting clouds from Mt. Bird would obscure the sun, and when this happened the bright

foreground of the snow below us would lose its shape and contour and appear only as a featureless white expanse. Towards the north, where the sunlight was sharp and clear, the flat ice shelf and pack ice stretched away into the far distance, and this had been the approach path of the aircraft towards the mountain. I could see the area about 25 miles to the north, where Captain Collins had re-armed the nav mode so that the aircraft would return to its nav track and thus fly, as he thought, down McMurdo Sound. At that time, there had been patches of cloud above the aircraft which therefore was flying over landscape of alternate sunlight and shadow. But further on, the cloud base had been lower and unbroken and there was no sunlight on the snow. Visual contrast had entirely disappeared, and the air crew could not discern that the white landscape ahead was sloping upward to meet the cloud. This could not have happened on the day of my inspection, but only because the cloud across Mt. Erebus was drifting, not static, and its base was high enough to reveal the rock outcrop on which we were standing. But the shifting variations of cloud and light demonstrated to us the simple fact that in Antarctica the occurrence of visual deception is not a phenomenon, as it might be in a temperate zone. It is part of the ordinary weather pattern of the region. On the day of the disaster there had been a solid and stationary low overcast over the whole of the McMurdo area, but it only created visual deception in those areas where landmarks had disappeared from view. Lewis Bay had been such an area. McMurdo Sound was not. By a navigational error for which the air crew was not responsible, and about which they were uninformed, an aircraft had flown not into McMurdo Sound but into Lewis Bay, and there the elements of nature had so combined, at a fatal coincidence of time and place, to translate an administrative blunder in Auckland into an awesome disaster in Antarctica. Much has been written and said about the weather hazards of Antarctica, and how they may combine to create a spectacular but hostile terrain, but for my purposes the most definitive illustration of these hidden perils was the wreckage which lay on the mountain side below, showing how the forces of nature, if given the chance, can sometimes defeat the flawless technology of man. For the ultimate key to the tragedy lay here, in the white silence of Lewis Bay, the place to which the airliner had been unerringly guided by its micro-electronic navigation system, only to be destroyed, in clear air and without warning, by a malevolent trick of the polar light.

399. I now proceed to summarise my report upon the matters specified in the terms of reference:

(a) The time at which the aircraft crashed:
— The aircraft crashed at 12.50 p.m. (McMurdo time) on 28 November 1979.

(b) The cause or causes of the crash and the circumstances in which it happened:
— The circumstances of the crash are described at length in the foregoing sections of my report. My opinion as to the cause of the crash is set out in paragraphs 385–394 of this report.

(c) Whether the aircraft and its equipment were suitable for Flight TE 901?
— The answer to this question is "YES"

(d) Whether the aircraft and its equipment were properly maintained and serviced?
— The answer to this question is "YES"

(e) Whether the crew of the aircraft held the appropriate licences and ratings and had adequate experience to make Flight TE 901?
— The answer to this question is "YES"

(f) Whether in the course of Flight TE 901, the aircraft was operated, flown, navigated, or manoeuvred in a manner that was unsafe or in circumstances that were unsafe?
— The answer to this question is "NO"

(g) Whether the crash of the aircraft or the death of the passengers and crew was caused or contributed to by any person (whether or not that person was on board the aircraft) by an act or omission in respect of any function in relation to the operation, maintenance, servicing, flying, navigation, manoeuvring, or air traffic control of the aircraft, being a function which that person had a duty to perform or which good aviation practice required that person to perform?

(1) The single effective cause of the crash of the aircraft was the act of personnel in the Flight Operations Division of the airline in altering the latitudinal and longitudinal co-ordinates of the destination waypoint without the knowledge of the air crew and in omitting to notify the air crew, either before departure or during flight, of the fact that an alteration had been made. The said act and omission each related to a function which the Flight Operations Division had a duty to perform.

(2) Although the single effective cause of the crash of the aircraft was as stated above, there were two contributing causes and they were:

(a) The failure of the Civil Aviation Division of the Ministry of Transport to ensure that the pilot-in-command of unscheduled flights to Antarctica was always provided at his pre-despatch briefing with a topographical map on which the programmed flight path of the aircraft had been plotted.

(b) The act of Civil Aviation Division in dispensing with the requirement that the pilot-in-command of a flight to Antarctica must have flown on that route before.

(h) Whether the practice and actions of the Civil Aviation Division of the Ministry of Transport in respect of Flight TE 901 were such as might reasonably be regarded as necessary to ensure the safe operation of aircraft on flights such as TE 901?
— The practice and actions of the Civil Aviation Division in respect of Flight TE 901 fell short of what might reasonably be regarded as necessary to ensure the safe operation of aircraft on flights such as this, only in the two respects described in my report as to paragraph (g) of these terms of reference.

(i) The working and adequacy of the existing law and procedures relating to:
(i) The investigation of air accidents; and
(ii) In particular, the making available to interested persons of information obtained during the investigation of air accidents.

With reference to this particular term of reference I had the advantage of detailed submissions made by Mr Connell, on behalf of the Civil Aviation Division, and by the chief inspector himself. Mr Connell adverted to certain aspects of regulation 15 which required minor amendment in order to achieve clarity, and in my opinion he is correct in his views but I do not make any positive

recommendation on this point. Having considered submissions made to me on this term of reference, and bearing in mind the evidence which I have heard during the hearings of the Commission, my opinion is as follows:

(1) Regulation 17 should be amended so as to provide that the Attorney General can reach a decision at any time after the accident as to whether he should direct a public inquiry. Further, the regulation should be amended so as to clarify the exact role of the chief inspector in a public inquiry, and that role should be that the chief inspector acts as the agent of the pending inquiry in collecting the facts, and that following the completion of his process of fact-gathering, he does not notify any party under regulation 15. He gives evidence at the inquiry, testifying as to the facts and circumstances which he has discovered, and any persons alleged to have been at fault in respect of the accident will then have the opportunity to present a case in rebuttal of such allegations. In other words, regulation 15 should not apply once a public inquiry has been ordered. Such a procedure would be in conformity with the practice of the Accidents Investigation Branch in the United Kingdom in carrying out its obligations under the Civil Aviation (Investigation of Accidents) Regulations 1969. The practice in the United Kingdom is that the Secretary of State (Trade) makes a decision, normally within 2 or 3 days after an accident, as to whether there shall be a public inquiry. If he decides upon a public inquiry then the Chief Inspector of Accidents, either personally or through his staff, does not proceed with the preparation of a report but acts as a fact-finding agency for the pending inquiry.

(2) The question of release of information to interested parties needs to be considered under two headings. First, there is the case where a public inquiry is directed. The inquiry itself will convey to interested parties such information as has been collected, and no difficulty seems to arise. Secondly, there is the case where a public inquiry is not directed by the Attorney General and the chief inspector and his staff proceed in accordance with regulation 15, which involves preparation of a draft report, notification to parties considered to be blameworthy, consideration of their submissions in reply, and then the preparation of a final report for delivery to the Minister of Transport, these being the steps taken by the chief inspector in the present case. At first sight, it seems as if the only information available to interested parties, apart from those who receive the statutory notice from the chief inspector, will only become available when and if the Minister decides to make the report a public document, and in the present case, owing to the periods of time which the chief inspector was obliged to allow for submissions by the persons who received his notification, his report was not signed until 31 May 1980 and was not approved for release as a public document until 12 June 1980, which meant that the information in the report did not become public until more than 6 months after the occurrence of the disaster. The occurrence of this long delay was due, without doubt, to the nature of the disaster itself and to the comprehensive and world-wide inquiries to which the

chief inspector became committed in the course of his statutory duty, it being remembered that he was obliged to give notified parties a period of 3 months within which to furnish their replies.

But as I read the provisions of regulations 15 and 16 I can see no case for recommending legislation requiring the chief inspector or his staff to make available information to interested parties during the course of his investigation. Under regulation 6 (3) the chief inspector has a discretion as to whether, after completion of his investigation, he will report to the Minister or whether he will refrain from that course and release a statement of his views to the aviation industry or to interested parties. Whichever course is taken, it is clear that the chief inspector must complete his investigation and elect not to furnish a report to the Minister before he can release a statement of his views under regulation 6 (3). I should think it inadvisable to give any person the right of access to information in the possession of the Office of Air Accidents Investigation prior to the completion of an investigation. The inspectors are required to obtain evidence from various persons in the course of their inquiries and may compel such persons to answer a summons, if necessary, so as to provide the inspectors with information. It would, I think, be an inhibiting factor if persons supplying information to the Office of Air Accidents Investigation were to do so on the basis that an inspector was to be obliged to pass such information on, at the request of persons who might have an interest in the accident, especially when his inquiries are not even completed. In short, the chief inspector and his staff should be protected against any obligation to supply information during the course of investigation. I do not believe that information supplied to an inspector should be the subject of privilege in the sense that he cannot be required to divulge, in litigation, what he was told. But I am not prepared to recommend any legislative measure which would enlarge the present avenues of inquiry available to persons interested in the outcome of inquiries into an air accident.

(3) The chief inspector has himself raised the question whether his office is sufficiently removed from the area of responsibility of the Civil Aviation Division, bearing in mind that his office and the division are each under the administrative control of the Ministry of Transport. The same situation obtains in the United Kingdom where the Chief Inspector of Accidents at the Department of Trade is required to report to the Secretary of State, who is the political head of the Department of Trade, and if it becomes the duty of the chief inspector to criticise any official of the Department of Trade then he does so as an independent officer not subject in any way to the influence of any official of the Department of Trade.

I can see the advantages of removing the Office of Air Accidents Investigation from the ambit of the Ministry of Transport so as to separate the chief inspector and his staff from any presumed or suggested influence which might be exercised by the Civil Aviation Division. On the other hand, there was not in the present case the slightest suggestion of any such influence exerted or attempted to be exerted by Civil Aviation Division,

and indeed the chief inspector levelled against the division a series of detailed allegations that the statutory duties of the division were not complied with. Further, there was no evidence before me to suggest that there has ever been any interference in the past by any Government agency aimed at deflecting the chief inspector or his staff from the proper discharge of their duties. I have had to consider in this respect the distinctive qualities of ability and independence which characterise the current holder of the office of chief inspector, and the possibility that a successor might not be cast in exactly the same mould. Nevertheless I see nothing to suggest that the Civil Aviation Division would ever depart from its strict compliance with the statutory role which preserves the independence of the Office of Air Accidents Investigation, and in my opinion no alteration is required to the status and administrative position of the chief inspector or his office.

(4) The Civil Aviation (Accidents Investigation) Regulations 1978 do not prescribe detailed procedures or methods of air accidents investigation. The practice of the Office of Air Accidents Investigation is to follow the investigatory procedures summarised in Annex 13 of the Convention on International Civil Aviation. The methods used to implement these procedures are set out in an International Civil Aviation Organisation (ICAO) document entitled *Manual of Aircraft Accident Investigation.* These procedures are the result of international experience and have been adopted by 168 countries. The chief inspector takes the view that the ICAO rules ought to be implemented in New Zealand by enactment of appropriate regulations to form part of the present 1978 regulations. In my opinion it is desirable that the powers and functions of the chief inspector and his staff in the carrying out of their statutory duty ought to be defined by law in terms which will impose a legal obligation on all persons to comply with the chief inspector's authorised statutory directions. In other words, it is my opinion that the investigative procedures entrusted to the Office of Air Accidents Investigation by the regulations ought themselves to be particularised and disclosed in the regulations so as to give public notice of the rights and responsibilities of the chief inspector and his staff.

(j) Any other facts or matters arising out of the crash that, in the interests of public safety, should be known to the authorities charged with the administration of civil aviation in order that appropriate measures may be taken for the safety of persons engaged in aviation or carried as passengers in aircraft:

— There are no facts or matters within the context of this term of reference to which reference has not already been made in this report.