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INQUIRY INTO THE MATTER OF A CRASH OF A
PANARCTIC ELECTRA AIRCRAFT AT REA POINT,
NORTHWEST TERRITORIES, OCTOBER 30, 1974.

before His Honour Judge W. A. Stevenson.

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Delivered by M of Justice
Aug 13/76
Delivered to Governor General
Nov 4/76
PC 1976-2753

His Excellency, The Right
Honourable Jules Léger,
Governor General of Canada,
In Council

Your Excellency:

I have the honour to present my report made pursuant
to the Commission issued to me under P.C. 1975-~~2276~~, dated the
20th day of November, A.D. 1975. 2726

I have the honour to be, Sir,
Your obedient servant,



WILLIAM A. STEVENSON
Commissioner

DATED at the City of Edmonton,
in the Province of Alberta,
this 27th day of June, A.D. 1976.

INTRODUCTION

This Inquiry was held under Part I of the *Inquiries Act*, R.S.C. 1970, C. I-13 pursuant to a Commission issued in accordance with a Direction of the Governor General in Council dated the 20th of November, 1975. The Privy Council minute recording the Direction is Appendix I and I am in custody of the Commission.

Pursuant to the Direction and the Commission I appointed a staff comprising counsel, technical advisers, reporters, clerks and assistants. Details of these appointments are recorded in the acknowledgement. The staff undertook investigation of the matters set out in the terms of reference contained in the Direction.

Evidence touching these matters was duly presented in public hearings held at Yellowknife, N.W.T. from the 4th to the 20th of February, and in Edmonton, Alberta from the 5th to 9th of April, 1976. The public was invited by newspaper advertisements and public invitation at the hearings to put forward information that might assist in the fulfillment of the Inquiry. A specimen of the advertisement was filed as Exhibit 2 and is included in Appendix II with details of publication. A notice of the reconvening of the adjourned hearings in Edmonton was also published and filed as Exhibit 102 and its details of its publications are also included in Appendix II. The Ministry of Transport and Panarctic Oils Ltd. were invited to participate in the hearings and they were represented by counsel. A list of counsel, witnesses and exhibits appears in Appendix III. Some information was obtained from members of the public and this was investigated by Commission staff. Members of the public who contacted

the staff were invited to give evidence if they wished and except for one witness, a brother of the late Captain Thomson, they declined to do so.

As a result of the investigations of Commission staff, subpoenas were issued for the attendance of persons who appeared to have information and, in addition, the documents in the possession of the Ministry of Transport and Panarctic Oils Ltd. were examined and also subjected to subpoena. I record that a claim of privilege for certain documents in the hands of the Ministry of Transport was put forward but I rejected this claim and required the production of the documents. Commission staff also examined material and information in the hands of the Coroner of the Northwest Territories and the Royal Canadian Mounted Police and relevant information in their hands was incorporated into the evidence. The evidence before me included oral testimony and documentary material. The testimony was transcribed and comprises 19 volumes (2,500 pages) of testimony and 116 exhibits (totalling over 2,500 pages). The evidence was extensively reported. I do not propose reviewing it in detail. This report contains my findings based on that evidence.

SUMMARY OF THE FACTS

On October 30, 1974 a Lockheed Electra aircraft registered as CF-PAB crashed into the sea ice at a point approximately 2.5 nautical miles southeast of its destination, Rea Point, Melville Island, N.W.T. The time of the crash was determined by evidence which I accept at 12:27:15, plus or minus one minute.* For the purposes of this report I have taken the time of impact as 12:27 a.m.

* All references to time are to Mountain Standard Time and to "miles" is to nautical miles.

The aircraft was registered in the name of, and owned and operated by, Panarctic Oils Ltd. (in this report Panarctic). It was flying a flight designated as Flight 416 and its immediate destination was the airport at Rea Point, a facility provided and maintained by Panarctic in support of its oil and gas exploration operations in the high Arctic. The flight departed from Edmonton International Airport at 20:04 and was scheduled to proceed to Rea Point, and then to a company site at Bjorne Peninsula, before returning to Edmonton. The same flight crew were expected to handle the flight throughout. The particular flight was engaged in supply of materials and transfer of personnel for operations by or on behalf of Panarctic in the Arctic Islands, Rea Point being a staging or distribution centre for much of the Company's operations. The flight carried 30 passengers, all of whom died as a result of the crash and four crew members, two of whom died.

At a point approximately three miles from its destination the aircraft, which had then been travelling at about 300 feet above sea level (250 feet above the Rea Point Airport), went into an abrupt descent and struck the sea ice. It broke on impact with the bulk of the craft ultimately breaking through the ice. The resultant deaths are all attributable to the crash, although in some cases exposure, shock and drowning would be described as the immediate cause.

The circumstances were the subject of two official investigations; the Ministry of Transport's accident investigation and an inquest conducted under the *Coroners Ordinance of the Northwest Territories*. The results of these two studies were put before the Commission. I did not consider it any part of my function to criticize or evaluate the other investigations but the evidence before them was examined and, where relevant, independently introduced before this Inquiry.

This report examines the circumstances and the cause or causes and, for convenience, is divided into the following headings:

1. The Aircraft
2. The Aviation Operations of Panarctic
3. The Crew
4. The Rea Point Landing Facility
5. Flight 416
6. Events on The Ground
7. The Cause or Causes
8. Summary of Conclusions

The Aircraft

The aircraft was a four engined turbo-propeller Lockheed aircraft described as an Electra L188. It had been converted for use as a combined passenger and freighter prior to its entry into Canada from the United States under importation authority issued December 30, 1969. It was acquired by Panarctic and registered in its name on January 2, 1972.

At the time of the flight under consideration it was subject to a valid certificate of airworthiness issued by the Minister of Transport. It had 29,245 hours of air frame time since its manufacture. Evidence as to its performance during the flight was given by the two surviving crew members. There was also evidence as to its mechanical condition from the maintenance personnel and records of Panarctic. After the crash the number one engine was recovered and examined by Ministry of Transport investigators. They also recovered and examined the flight crew's instrument panels. Investigators examined the portions of the aircraft that remained under water and video-taped

the wreckage. The aircraft was equipped with adequate radio and navigational aids for the facilities used. A thorough investigation was undertaken by the Ministry and from that investigation, as well as the evidence of the survivors, I conclude that the crash was not caused by the failure of the aircraft or the navigation or radio systems. It was, with one minor and irrelevant discrepancy (which was explained by the Flight Engineer), at all material times an airworthy aircraft.

Neither the Flight Data Recorder nor the cockpit voice recorder was in proper operating condition. The voice recorder was not functioning because the recording tape was broken as a result of an improper splice. While the unavailability of the tape has impaired the investigation it could not, of course, be a cause of the crash. It is also fair to say that there is no evidence that anyone in the company had any reason to know of the defect.

The Flight Data Recorder, designed to record certain functions of the aircraft's operation, was improperly connected as the static and pitot air pressure lines were "crossed" within the aircraft. It is also fair to record that this condition was not known to the crew, nor so far as I am able to say, to the Company. The defect did not impair the aircraft's function in any way as the particular lines supplied only the recorder with pressure readings. Through very careful analysis and reconstruction carried out by the witness Caiger, essential elements of the information which should have been recorded were made available. There is some impairment of the quality in the result, notably, in bare altitude figures but air speed and variations in altitude during the critical period of the flight were sufficiently reliable to be used in the analysis of the flight which I later give.

The Aviation Operations of Panarctic

Panarctic is a corporation engaged in petroleum exploration and development, primarily in the Arctic.

It initially supplied its Arctic bases with crews and material through air services provided by charter carriers. It developed its own services with comparatively light aircraft for much of its transportation within the Arctic but relied on charters for vertical service from the south and heavy carriage within the Arctic.

In 1971 it decided to provide the bulk of its own service to the Arctic. It purchased the Electra aircraft CF-PAB and subsequently established an air division. As a private operation this air division was not subject to the regulations applicable to commercial air carriers although its crews are subject to the same licensing provisions and requirements (but not training requirements) as commercial carriers and the aircraft itself had to be maintained in compliance with the requirements for obtaining and maintaining a certificate of airworthiness.

It also provided its own private airport facilities which are similarly not subject to inspection or regulation. The absence of governmental regulation or control of the various aspects of these operations was the subject of comment before me. For the purpose of this report I have considered whether or not there were any situations in which the absence of regulation allowed a departure from a recognized standard of care.

Panarctic personnel handled the operation of the aircraft including loading and expediting. From the point of view of the passengers the operation was conducted in a fashion similar to that of a commercial carrier in the sense that there was a reservation system, a counter type of "check in" and baggage handling, and flights were operated on a "scheduled" or prescribed basis.

In the training of its crews Panarctic used methods appropriate to a small carrier, namely, training offered by a commercial training service and limited in-flight training. This was supplemented by periodic or recurrent training on a commercially provided simulator. It is extremely difficult to compare the quality of pilots trained by the company with those trained by larger carriers. A pilot that Panarctic classifies as "average" may be above or below the industry average. The Company did not have a sufficiently large operation to sustain its own initial or recurrent training program. It also recruited many of its pilots from within its own organization by upgrading pilots of smaller aircraft. In the initial stages of such operations there must, of necessity, be a high proportion of relatively inexperienced flight personnel. The Electra aircraft as a multi-engine high performance aircraft demands a co-ordinated crew and deficiencies in what is called "cockpit or crew discipline", could result from the difficulties inherent in a comparatively small operation.

Evidence before me showed that the Company was in the process of preparing a flight operations manual (required of a commercial carrier under Air Navigation Order, Series VII, No. 2) (Exhibit 21). Evidence was also led before me to show that the Company was in the process of updating but had not updated its flight manual for the aircraft. There were discrepancies between

the flight manual and the practice employed by pilots operating Company aircraft. The only one of possible significance to this Inquiry was the change of a crew briefing originally given during the approach check, which had been changed to part of the descent check. I am satisfied that no crew member was misled by any of the discrepancies. I am also satisfied that there was nothing that would appear in a flight operations manual that would have prevented the crash.

The Company gave no training or instruction on the appreciation and recognition of crew incapacitation. I discuss this subject further in reference to the actual flight and its cause.

There was evidence that the radio operator at Rea Point was unlicensed, and that there was no adequate flight watch system. I discuss the radio operations insofar as communications prior to or at the time of the crash are concerned later. Insofar as there were any deficiencies in the flight watch, radio licensing or other aspects of the radio operations there is no need to discuss them or make determinations because they cannot be said to be or have been a cause of the crash.

The Crew

Flight Engineer Garry Douglas Weyman

Weyman, age 26 at the time of the crash, was a qualified Flight Engineer. He had held a license as a Flight Engineer for the Electra since June of 1973. In some Electra operations the third man in the crew is a pilot, or Second Officer. This is not mandatory even for commercial carriers. Weyman had in fact obtained a private pilot's license in 1969 but did not perform any pilot

functions in the operation of the aircraft and the license was superfluous to his duties and responsibilities. All of his Electra experience, 975 hours, was with Panarctic and he was one of the more senior Flight Engineers. Weyman was not, under Panarctic's operations, a party to flight deck decisions unless they involved mechanical matters. While one of his responsibilities was the handling of the power, that was subject to the direction of the pilots. His other responsibilities, insofar as relevant to this Inquiry, are best described as monitoring the mechanical function of the aircraft. He had previously flown with this Captain whom he considered to be "very proficient". He was in good health at the time of the crash and was not suffering from any undue fatigue or other temporary or permanent physical disability which might affect his function. He also did not suffer any emotional or psychological disability that affected his function. He was qualified to hold the appropriate license at the time of the crash although there had been a minor technical defect in the maintenance of the license.

First Officer David Wayne Hatton

Hatton was 32 at the time of the accident. He began flying in March of 1966, obtaining a private pilot's license in July of that year and his commercial license in December of 1967. He had just under 5,000 hours in light aircraft: single and twin engine. He joined Panarctic in August of 1973 as a Captain on the twin-Otter aircraft. In July, 1974 he took training as an Electra pilot at a commercial training school and was "checked out" by Panarctic's authorized personnel in August of 1974. He had approximately 160 hours experience in the Electra, as a First Officer, at the time of the accident.

He had never flown into the Arctic with Captain Thomson before.

His training and experience were reviewed in detail. It is difficult to assess the effect of his training since he could only be reliably compared with other Panarctic First Officers. By those standards he was above average. I am satisfied that he was qualified to handle the First Officer's function on the Electra. He was, of course, comparatively inexperienced. He was in good health at the time of the crash and was not suffering from undue fatigue or any other temporary or permanent physical disability which might affect his function. He did not suffer any emotional or psychological disability that would affect his function. He held a valid license at the time of the crash and was qualified to hold that license.

Captain Brian Thomson

Thomson was age 30 at the time of the crash. He began flying in 1963, obtaining a commercial pilot's license in August, 1964. His experience prior to joining Panarctic in January of 1970 was with light aircraft. He flew twin-Otters with Panarctic prior to selection for conversion to Electra aircraft. He took training at a commercial training school to qualify as an Electra First Officer. In December of 1971 and in January of 1972 he obtained the appropriate licensing for the Electra. In June of 1973 he took further commercial training for upgrading to Captain. He had 8,143 flying hours, of which 1,792 were on the Electra (907 as Captain) while the balance of experience was with light aircraft.

His training and experience were reviewed in detail. He, as all other pilots are, was subject to periodic check flights with pilots approved by the Ministry of Transport. He was validly licensed at the time of the crash. It is also difficult to assess his competency because he could only be compared with other Panarctic Captains. By this standard he was average or better than average. Much of his experience was in light single crew aircraft. I am satisfied that he was qualified to discharge the function of an Electra Captain.

The Captain was killed in the crash. Extensive pathological investigations were undertaken. In addition, efforts were made to assess his emotional and psychological state. Since he was the pilot controlling the aircraft at the time of the crash this investigation was necessary and the evidence in relation to these matters was extensive. I will deal with this subject further in my analysis of the cause. The only evidence of any ill health discovered by these investigations was to be found in the presence of a severe degree of fat infiltration of the liver, with the result that the liver was more than twice the anticipated normal weight. The cause of this condition cannot be identified with certainty. It ordinarily is diet related and not infrequently associated with alcohol consumption. It is a benign and ordinarily reversible condition. Even if it were alcohol related it could develop within a person who is accurately described as merely a social drinker. I am satisfied that Thomson could not be described as an abuser of alcohol. It is clear that he was conscientious about abstaining from alcohol prior to the flight and that there was no alcohol in his system at the time of the crash, nor had he consumed any for at least 36 hours prior to the flight. The liver condition is one which usually does not manifest itself in any abnormality. Had there been any manifestation it is

most likely it would have been noticed by others, particularly his wife (who is a nurse) or that Thomson would have mentioned it to her. I am satisfied that Thomson was not aware of the condition. All of the manifestations that might have occurred (with the possible exception of incapacitation) have been ruled out by the evidence of Mrs. Thomson and that of the crew as to Thomson's actions and conditions up until the last few moments of the flight. I shall deal with the sole remaining question, that of incapacitation, later.

Thomson, in preparing for the night flight, scheduled to leave Edmonton in the early evening, retired late the night before the flight, arising around noon. He spent a quiet afternoon and had a light meal prior to going to the Edmonton International Airport around 5:00 p.m. the day of the flight. He was, therefore, reasonably well rested and prepared for the night flight. Difficulties may arise in the course of changing from day to night operations since the body's Circadian rhythm, reflecting normal patterns of eating and sleeping, adjusts rather slowly to changes in working hours. The effect of such a change is perhaps best described as producing a measure of fatigue. In any event, I am satisfied that Thomson consciously prepared for the night flight and had no reason to expect any significant degree of fatigue.

In the course of the Ministry of Transport investigations, consideration was given to the hypothesis that Thomson might have been under some psychological strain that contributed to the crash. I heard evidence from his widow as well as from members of the Ministry's Human Factors Committee who were primarily concerned in investigating this aspect. It is not suggested that Thomson was under any strain or pressure from factors external to flying, and the evidence

is clearly the other way. I am also satisfied that Thomson did not suffer from any significant degree of frustration in, dissatisfaction with, or fear of, his flying duties. His attitude, I am satisfied, was on the whole a positive one. I am satisfied that he was an emotionally stable individual. Shortly before the crash Thomson had a sharp discussion with the ground at Rea Point over what he saw as certain deficiencies in their operations. I am satisfied from the testimony of the survivors coupled with the general evidence as to his personality that this incident did nothing to affect that stability.

Apart from the liver condition, and its effects, I am satisfied that at the time the trip commenced Thomson was in good health and was not suffering from fatigue (chronic or otherwise) or any other temporary or permanent disability which might affect his function. He also was not suffering from any emotional or psychological disability. There is no evidence of any physical or mental malfunction at any point prior to the descent from cruising altitude. His condition from that point on is the subject of further discussion.

Rea Point Landing Facility

The airport at Rea Point is constructed, maintained and operated by Panarctic. Its physical attributes and location are described in the Company's approach plate (Exhibit A to this Report). The runway is sand and gravel 6,300 feet long and 200 feet wide. It is lighted with runway lights and approach lights and there are two lighted navigational beacons. All the lights were operating on the night in question. There had also been a "vasis" system, a set of lights which, when functioning, enable a pilot to establish a proper

glide path by visual means. It was not operating at this time. Since no one aboard Flight 416 expected the system to be in use at the time, and it would not have been visible at any relevant time, its absence is of no significance.

There were two beacons. One is described as an NDB, or non-directional beacon designated as OX-NDB (OX being the Rea Point designation), situate .79 mile from the threshold of runway 30. There is a second beacon described as a VOR-DME. It transmits a radio signal which by the selection of proper settings on the aircraft's radio navigational equipment enables the crew to track to or away from the beacon along any one of 360 radials. The aircraft could, therefore, be directed towards Rea Point, and by intersecting and then following the 153⁰ radial given a heading of 333⁰ and then be positioned directly in line with the runway itself. The "DME" indicates the presence of Distance Measuring Equipment, enabling the aircraft crew to determine its distance from the beacon continuously from approximately 60 miles distant from Rea Point. The pilot of CF-PAB was thus able to determine his distance from the threshold of the runway with a very substantial degree of accuracy, and to bring his aircraft in line with the runway.

Rea Point also possessed radio facilities for ground to ground, and ground to air transmissions in both VHF and HF ranges, as well as telephone communication to points outside the Arctic. There were ordinarily two radio operators on duty. These radio operators handled aircraft transmissions (including reports to Air Traffic Control at Resolute Bay), weather transmissions, and transmissions with ground equipment and other Panarctic stations. Transmissions to and from the aircraft were handled by one of the two operators whose responsibilities included communication with air traffic, transmission of

weather and Company transmissions. The volume of radio transmissions was high. As a staging point for Panarctic, Rea Point was, from time to time, a very active facility with as many as a hundred or more aircraft movements having been recorded in a single shift.

The facilities in the way of navigational aids and direct radio communication appeared, insofar as relevant to this Inquiry, to be adequate. While more sophisticated navigational aids are found at other airports (particularly public facilities) the Rea Point facility can be classed as reasonably well equipped for an airport facility meant to accommodate a single user in the Arctic.

Rea Point was a weather reporting facility using Department of the Environment equipment and Panarctic personnel. Other Panarctic sites using their own equipment also reported to Rea Point. Rea Point, in turn, provided weather information to Resolute Bay, a facility operated by the Ministry of Transport and then the information was provided to the authorities responsible for Arctic records and forecasting in Edmonton. While other Panarctic sites may have suffered from the infrequency of their reports and lack of sophisticated weather equipment, the quality of reports from Rea Point was generally good and considered reliable by the Department of the Environment officials. Following the crash a defect in the instrument measuring wind velocity was discovered but the defect did not, in any way, contribute to the crash.

Flight 416

On October 29, CF-PAB was undergoing maintenance in Calgary prior to it being positioned in Edmonton for Flight 416. The maintenance was of a

comparatively routine nature. The aircraft was in all respects airworthy when it left Calgary. It was flown from Calgary to Edmonton by another crew (of which Hatton was a member). A minor but irrelevant problem developed during the flight after it left Edmonton and it is clear from the evidence of Weyman that the problem (a defective temperature datum valve in the number 1 engine system) was easily compensated for and caused no difficulty in the operation of the aircraft.

In preparation for the flight to the Arctic, Panarctic's duty pilot in Calgary, Silvester, prepared a tentative flight plan. It was one of his functions to consider the proposed flight, likely alternative landing sites, fuel and freight requirements, and provide preliminary information to the Company's operations in Edmonton. The actual flight plan for the flight, Edmonton to Rea Point, was the responsibility of the Captain, in this case, Captain Thomson.

In fact, Thomson had one week earlier, as duty pilot, prepared some preliminary data. Silvester suggested Resolute Bay as an alternate: as a well equipped Ministry of Transport operated facility it was a suitable and desirable alternate.

Considerable evidence was given as to weather information and forecasts available to the crew. The Arctic weather office at Edmonton issued forecasts and terminal advisories. The difference between the two is one of reliability; the latter were issued when the reports given from surface monitoring equipment were considered somewhat lacking in adequacy or reliability. It is terminal advisories which were given for company bases other than Rea Point. There were

available forecasts for Rea Point and Resolute Bay, but only advisories for other bases which might be considered as alternates. There were also available actual weather reports from time to time.

The forecast for Rea Point issued at 3:30 on October 29, valid for 12 hours, commencing at 4:00 was: "Scattered clouds at 1,500 feet, with a broken ceiling at 8,000 feet, conditions variable, visibility of three miles obstructed in ice crystals and ice fog, variable to 3/4 mile in light snow and ice fog, wind 300° at 25 m.p.h., with gusts".

The Company's "minimums" or "limits" for Rea Point are described as 450 feet above sea level, one mile. This means that the minimum descent altitude is 450 feet and the forward visibility for landing should be one mile. In assessing the suitability of Rea Point as a destination, a pilot would require a ceiling of more than 450 feet, and visibility of at least one mile. It is to be noted that there was some risk of visibility dropping below the minimums or limits for Rea Point but the forecast was still such that it was reasonable to proceed with the flight.

In order to use Resolute Bay as an alternate the prescribed requirements were 1,200 feet and three miles visibility. The forecasts for Resolute Bay at this point indicated visibility of one mile in snow or blowing snow.

Silvester spoke with Thomson at the Edmonton airport at about 5:30. Thomson had already received his weather briefing at Edmonton. This consisted of the delivery to him of a package of meteorological information (outlined and detailed in Exhibit 85) coupled with some discussion with the officer on duty. The information included forecasts, actual weather, weather maps and wind

conditions, as well as actual and forecast information of a more general and regional nature. It was clear to both Silvester and Thomson that the weather at Resolute Bay was deteriorating and it was no longer a suitable alternate. There was available from Pedder Point a terminal advisory showing visibility two miles and no overcast. Pedder Point could, apparently, not have been selected as an alternate by a commercial carrier because of the comparative unreliability of an "advisory" as compared to a "forecast". It is also clear that Pedder Point did not have the degree of sophisticated equipment available for a landing at Rea Point; it did not have a VOR-DME beacon, although it had an NDB. The Captain, in planning his flight at Edmonton, actually made his calculations of fuel based on Pedder Point as an alternate and then allowed additional fuel to cruise to Resolute Bay plus another three quarters of an hour. It seems clear to me that the comparative unreliability of the weather forecast at the alternate airport would exert some pressure, perhaps subconscious, to get into Rea Point when the flight reached that base.

The choice of alternate was discussed with Hatton but the decision was Thomson's. Thomson had the responsibility and Hatton was a very junior pilot. Hatton concurred in the decision. Hatton and Thomson computed the fuel that would be required and then advised the loadmaster (a company employee) as to the freight that could be taken having regard to the number of passengers expected, the capacity of the aircraft, estimated fuel requirements and the maximum allowable landing weight of some 96,000 pounds. There is no indication of any direct pressure on Thomson to minimize the fuel load for freight considerations. The initial planning in Edmonton was for 27,050 pounds of fuel to be on the aircraft prior to departure. At a comparatively late point Thomson added another 1,350 pounds for a total "ramp fuel" of 28,400 pounds. A weight

and balance sheet reflecting the quantity and distribution of fuel and cargo was prepared. It is necessary that the distribution be made within certain limits in relation to the aircraft's calculated centre of gravity. It is clear to me, particularly having regard to the evidence of the accident investigation personnel, that the loading of cargo and fuel, and the actual fuel consumption, played no part in the crash as all figures were within the established limits of tolerance. The weight and balance played no part in the crash.

A flight plan was filed with the Air Traffic Control Centre in Edmonton showing the flight destination to be Rea Point with Pedder Point as the alternate.

The airplane departed from Edmonton at 8:04 p.m., estimating Rea Point at 12:30 midnight. It is not necessary to examine the flight in any detail prior to the start of the descent into Rea Point. Up to that point the trip was uneventful and accurately described as normal. There was no malfunction of aircraft nor any deficiencies in the functions of the crew.

The aircraft had been cruising at about 25,000 feet above sea level prior to descent. It had made radio contact with Byron Bay at 11:04 p.m. and was subsequently cleared to that altitude.

I propose to set out a narrative of the events that took place from immediately prior to descent, until the crash. In the margin I have inserted time and altitudes. The relative time and altitude is based on the analysis of the Flight Data Recorder by Mr. Caiger. Exhibit B is Mr. Caiger's analysis over the last ten minutes of flight and Exhibit C is his analysis over the last 100 seconds. There is a margin of error in the altitudes of plus or minus 190

feet so that the whole graph provided by Mr. Caiger is subject to recalibration. Having regard to the evidence that the plane made a sharp descent at 300 feet and crashed at sea level, I have recalibrated the graph of the last 100 seconds. The altitudes I have given in the margin are taken from the recalibrated graph. The Flight Data Recorder is not so precise that great reliance can be put on minor movements but I am satisfied that the general trend of the graph is reasonably reliable. Mr. Caiger's efforts in eliciting the information as to altitude were impressive and highly commendable and, having regard to the other evidence which serves as a check, reliable.

Mr. Caiger reconstructed the time of the impact at 12:27:15 plus or minus one minute, which I have taken as 12:27 because there is a margin of error in his figure and the important consideration is the last 20 minutes or so of the flight, regardless of the precise instant of impact. It is clear that impact was around 12:27, and this reflects adversely on the times given by the radio operator at Rea Point. I do not fault the operator, Brooks, as he made the diary entries some time later. Having regard to his responsibilities and the confusion that followed the loss of radio contact I must prefer the mechanically calculated time which is verified by other evidence in important respects as the narrative shows.

I also note that I have accepted the evidence of Hatton and Weyman as being their true and honest recollection of events. Their recollection is not necessarily precise but I believe they told me the truth as they recalled or perceived events on the night in question. There was reason to suspect their evidence as they refused to testify before the Coroner, and the Ministry

of Transport experienced some difficulty in getting statements at various times. Counsel for Panarctic's insurer told the Commission that the decision that these two men not testify before the Coroner was his. The objections with respect to Ministry interviews were also the objections of counsel. I scrutinized the evidence and I am satisfied these witnesses were not deliberately trying to hide anything on these previous occasions. In fact, their evidence before me was basically consistent with statements given very soon after the accident, at a time when they had every reason to believe that both the voice and data recorder were functioning. It is inconceivable to me that these two men, who had an incredible brush with death, injured, with uncertain prospects of rescue, collaborated on the sea ice to correlate their stories to cover up some error or mistake on their part or that of the Captain. I have examined the testimony of Captain Thomson's brother who gave evidence as to a conversation with Weyman. Making some allowances for imperfections in recollection of both parties on an occasion where emotion might colour reason and for the fact that Weyman was anxious to be kind to the memory of Thomson, whom he respected, the evidence as to what Weyman said after Captain Thomson's funeral could not be said to be inconsistent with his testimony before me.

I now set out an analysis of the last portion of the flight. In the margin I have noted times and altitudes. It is not always possible, nor necessary, to establish precise times or altitudes, so that times and figures during the early part of the analysis are established with more tolerance than would be reasonable over the last ten minutes of the flight. Altitude is given in feet above sea level, which for the critical portions of the flight, is feet above terrain.

11:55
25,000'

Approximately 100 miles out of Rea Point, Hatton contacted the operator at Rea Point. He got a weather report based on the 11:00 p.m. weather. That weather was "partially obscured, visibility one mile in blowing snow, winds gusting 30 to 37 m.p.h.". Discussion with Rea Point about the ongoing load was initiated. Brooks, the radio operator at Rea Point, had to get someone to come and speak to Thomson about the subject. Storvold, who was Panarctic's drilling superintendent, and in general supervision of all Arctic operations, was at Rea Point and he was asked to come to the radio room to speak to the crew about the ongoing load.

12:05
25,000'

Storvold had come into the radio room at Rea Point. Captain Thomson called for a descent check. This check should take two minutes or less. It is set out on a check list which is Exhibit D to this report (part of Exhibit 37). It consists of challenges and responses, which reflect some act or observation on the part of the responding party. As part of this process the Captain and First Officer checked their altimeter readings and set their radio altimeter settings for an initial 1,500 feet warning. The radio altimeter only operates at below 2,500 feet and measures height above ground as distinct from the height above sea level given by the standard pressure altimeter (this point is irrelevant in the critical stages of this flight as it was over the sea or sea ice). This was followed by a crew briefing. The Flight Engineer is not expected to contribute to the briefing as he is not, in Panarctic's operations, a qualified pilot. Weyman naturally did not pay particular attention to the briefing. The briefing, conducted by Thomson and related by Hatton, was, in essence, advice that they would be using a standard approach to runway 33 at Rea Point. standard procedures would apply on overshoot; minimums were 450 feet, all ADF

and VOR equipment was tuned and identified to Rea Point VOR. What was said to Weyman was, "We will be landing at Rea Point". While the weather was hovering around limits Thomson decided to initiate the descent. I do not fault this decision as he could overshoot and proceed to his alternate if the weather deteriorated further. Weyman was instructed to reduce horsepower to 1,000, thus initiating descent. The descent was initiated and the plane left cruising altitude.

12:11 The aircraft crew heard a transmission between a twin-Otter aircraft, the radio being operated by one Penikett, and the Rea Point radio facility. Penikett gave a "pirep" or pilot report on the weather. His aircraft had just taken off from Rea Point. He called the weather "1200 and 5" meaning ceiling and visibility (in feet and miles) respectively. There was an added remark, namely, something to the effect that there was a fog bank to the south of Rea Point that looked to be just on or off the shoreline. This phenomenon had been observed much earlier by a Panarctic pilot, Mitchell, who landed about 7:30 p.m. He came through the bank. It appeared to him to be a rolling cloud and he decided to try to descend below it but was unable to do so and landed under visual flight conditions as soon as he passed through it. He assumed it was blowing snow. He did not think it was sea smoke. Sea smoke is a reasonably well-known condition resulting from condensation or freezing of moisture evaporating from the relatively warm sea which, I gather, is particularly prevalent when cold offshore winds develop. Penikett assumed the conditions to be attributable to sea smoke, although it was unusual in appearance and differed from his previous experiences with sea smoke because it had definite boundaries or limits. Mitchell who flew through it believed it to be blowing snow. It appears to me that it was largely blowing snow, perhaps given some definition

by the fact that it met the internal boundary layer created by the warmer air over the water. This condition of cold offshore winds meeting the warmer air creates particularly heavy turbulence. I conclude it was not sea smoke because the phenomenon did not have the usual wispy appearance of sea smoke; it appeared to be over the land, and Mitchell, who flew through it, believed it to be snow. Both Penikett and Hatton recall the phenomenon to have been described as fog. In light of what Thomson said at this point and later, and Mitchell's evidence, I think it likely the word "cloud" was used either in the pilot report or in the ensuing conversation between Penikett and Hatton on the Rea Point frequency. I note that PAB's crew were not using earphones but relying on loudspeaker reception which could, I expect, have been distorted or interrupted by extraneous sounds in the cabin. Hatton reported to Rea Point that he had heard the pilot report and reported further that PAB was descending at 60-65 miles DME. There is some confusion as to whether this transmission was at 60 or 65 miles DME and nothing hinges on the difference. It appears to me that Hatton got the Rea Point weather of "visibility one mile in blowing snow", being the midnight weather observation at Rea Point. Hatton then engaged in a brief conversation with Penikett, who confirmed the pilot report of weather and there was some brief irrelevant conversation between the two who were friends.

Following this transmission with Penikett, Thomson said something to the effect that it sounded as though they may have to get under or penetrate a layer of cloud. It must have been Penikett's transmission that prompted this observation.

There then commenced a conversation between Storvold and the aircraft. It lasted for some time. There were a number of exchanges. They concerned the

situation with respect to the off and on loading for the second leg of the flight. The crew needed information in order to plan the second leg and did not want to waste time on the ground. The information requested was not available, or not all available. Hatton put this as having occurred before descent and Weyman is not certain. Storvold's and Brook's evidence is that it was after and Penikett heard it after he had transmitted his pilot report which was given about the time descent was initiated. I conclude that it was during descent and any doubt is resolved by Penikett's evidence. Storvold said the exchange was with Hatton. Hatton and Penikett say it was with Thomson who was perturbed. Weyman, who believed that Hatton handled the radio after descent, seems clear that the exchange did perturb Thomson. I conclude that the exchange was primarily between Thomson and Storvold although Hatton would have been on the radio at some point. I note there is absolutely no suggestion from any of the people who were in contact with PAB that anything was amiss aboard the aircraft. The conversation between Storvold and Thomson then continued intermittently from this point until just before six miles DME. I do not refer again to this conversation as we do not have precise details nor the number of exchanges or communications. Storvold puts this at somewhere around a dozen exchanges. The important point is that the discussions continued from time to time until the point I have mentioned and that there was no suggestion of any problem in the aircraft.

20,000'

Hatton called 20,000 feet, Thomson acknowledged.

15,000'

Hatton called 15,000 feet, Thomson acknowledged.

10,000'

Hatton called 10,000 feet, Thomson acknowledged. Landing lights were extended but extinguished because of glare. The aircraft was slowed to 250 knots.

5,000'

Hatton called 5,000 feet, Thomson acknowledged.

2,500'

Hatton called radio altimeter alive, Thomson acknowledged that his was also alive. They were both "set" for 1,500 feet so that when the plane reached 1,500 feet a warning light would come on.

2,100' -

2,000'

12:19:30

The aircraft levelled for almost two minutes. It intercepted the VOR radial for the runway at Rea Point. Hatton puts this at 15 to 16 miles DME. At this point the Captain called for "flaps 78" and the approach check. The levelling off is confirmed by the Flight Data Recorder information at just about 2,100 feet, at the time I have indicated. The approach check which was initiated here was carried out. It is set out in Exhibit C. It is very brief. Descent continued.

1,500'

12:22:15

During the approach check the radio altimeter warning light set for 1,500 feet came on. The radio altimeters were reset. In the case of Hatton it was set to 450 feet being the minimum descent altitude for Rea Point. Hatton is not clear as to Thomson's setting at this point but Weyman says that Thomson's was set at 300 feet. The usual procedure would have been to set them both at 450 feet.

12:23

12:24

1,200'

The aircraft descended a little more slowly during this interval of time.

12:24:15

1,000'

One thousand feet called by Hatton, Thomson acknowledged.

900'

Nine hundred feet was called by Hatton, Thomson acknowledged. Hatton called six miles DME and contacted Rea Point by radio. He estimates it was at the 900 foot altitude when this was done. He told Thomson he was going to call six miles DME and Thomson acknowledged. Hatton got the weather. This was

really a wind check and there was no significant change reported. In his statement Hatton says that fog banks were mentioned in the report from Rea Point but in light of the fact that it was mentioned earlier and that both Storvold and Brooks confirm only a wind check at this point I believe that he is in error. The assessment of six miles DME at 900 feet, having regard to the air speed, appears to be a reasonably accurate approximation. Weyman says the Captain, at about this point, said words to the effect "I believe we are on top of a layer of cloud". At this point neither of the other crew members could see a layer of clouds and had no visual contact with the ground. The surface below was obscured, probably by ice crystals, at this stage. Hatton does not recall there being such a statement at this point. Having regard to Weyman's statement of November 13 I believe that there was no such reference until 450 feet or 350 feet.

800' Thomson then called for "Flaps 100" and the landing check. The landing check is set out in Exhibit D. It is very brief, consisting of four items - one of which is the lowering of the gear and confirmation that the three green pilot lights indicating the gear has been lowered are visible.

12:25:20 Hatton testified that he called 800 feet, 700 feet and 600 feet
700' -
600' with acknowledgment by Thomson. At 700 feet the Flight Engineer put his hands on the First Officer's set of power levers where he kept them for the remainder of the flight. It was usual practice for the Flight Engineer to keep his hands on the power levers not in use, that is those opposite from the pilot actually flying, during the final approach. This set is coupled to the power levers operated by the Captain. Weyman believes that they were in landing configuration at six miles DME which I am satisfied would be before the 550 foot altitude.

550'
2:25:45

Hatton called 100 feet above minimum. This was acknowledged by Thomson.

450'
2:25:05
to
12:26:20

Hatton called minimum. His radio altimeter warning light illuminated. The plane levelled at the minimum for approximately 15 seconds. Hatton set his radio altimeter for 300 feet and advised Thomson who responded, just as they were descending out of 450 feet. Four hundred and fifty feet is the Minimum Descent Altitude. At this time neither Hatton nor Weyman had any visual contact with the earth's surface nor did Thomson say that he had visual contact with the ground. The plane descended towards 300 feet.

Hatton called 300 feet and it was acknowledged by Thomson, "Check 300".

12:35

300'
3 DME

As the plane reached 300 feet Hatton called, "Vertical contact." He could see the sea below but had little forward vision. He saw the sea ice line approaching and said, "It looks like we are approaching the edge of the ice line." At this point he saw the DME to be at three miles. Thomson had his hands on the power. Cloud was mentioned again at this point. Weyman recalls Thomson as saying, "I believe we are on top of a layer of cloud and must get below." He believes that it was also said at 450 feet and that Thomson looked out at that earlier point. It appears clear to me that cloud was mentioned at least once by Thomson and possibly twice; around 450 feet and around 300 feet. On one of these occasions Thomson looked out, according to Weyman. Both Hatton and Weyman agree there was a statement made when Hatton announced vertical contact and I think it likely that Thomson looked out at this point, which was while the plane was at 300 feet and before the sudden descent was initiated.

300'
12:26:45

A sudden descent from 300 feet was initiated. It was sufficiently abrupt that both Hatton and Weyman felt a sensation which they thought to be "negative G". A fairly rapid fall is in fact reflected in the altitude trace occurring about 15 seconds before impact. It was presumably initiated in the moment before the descent registered, in the less than five seconds in which the plane was at 300 feet. It was initiated by the Captain after the statement about cloud was made. There is no explanation for the initiation. Hatton says the Captain pulled back the power and pushed forward, in an abrupt controlled motion on the control wheel. Weyman does not recall the power being pulled off and since he had his hands on the power levers which were coupled with those of Thomson he should have felt the change. About this time a sudden squall was observed at Rea Point. The wind gusted to 40 m.p.h. and the visibility dropped to one-eighth of a mile. Brooks tried to reach PAB with the information but made no contact. While this condition may have affected visibility I am satisfied that it played no part in initiating the descent. Hatton says that Thomson initiated the descent in the manner indicated and I accept his evidence as being the only rational explanation for the descent. I am satisfied that neither Weyman nor Hatton initiated that descent and it required a reduction in power and a movement of the control wheel since the air speed did not change abruptly. The air speed, I believe, would have been affected if only one of these manoeuvres had occurred. At the instant of the discomfort he felt upon the initiation of descent Weyman swore audibly. There was no response from Thomson who was described, from that point on, as staring straight ahead with both hands on the control wheel. Hatton called, saying words to the effect, "We are descending out of 300 feet, air speed 150, vertical rate of descent 1,750".

200'

Hatton saw the vertical rate indicate 2,000 feet and at the 200 foot altitude mark called, "Brian, we are through 200 feet, vertical rate is 2,000 feet a minute and we are still 2 DME."

150' -
400'

Weyman shouted, "Dave, he is going to kill us." Hatton shouted "100 feet" and, as he explained, "I put my hand on the left side power levers and Mr. Weyman's hand was already there and I pushed up the power lever. I don't recall if we called for power or not. My right hand was on the wheel and I tried to pull back the wheel but we were finished: at 100 feet above the ground and descending at 2,000 feet a minute. Maximum landing weight of 50 tons and it was all over". Both he and Weyman called 50 feet and Weyman recalls someone saying, "blowing snow" and the aircraft struck the sea ice.

EVENTS ON THE GROUND

Storvold had left the radio room after talking to the aircraft. At that point the aircraft was six miles DME. There was a marked deterioration in the weather which I have already mentioned and Brooks tried to reach PAB but was unsuccessful in doing so. I am satisfied that this transmission occurred about 12:27 a.m. and that he was unable to reach PAB because it had already crashed. Shortly thereafter he initiated a radio search which took approximately five minutes. In the interim Storvold had gone to the lower radio room and was engaged in a conversation with the operator in that room. He completely dismissed the aircraft from his mind. Brooks called him and Storvold said he thought that the plane had been 60 miles out. Brooks continued to try to make radio contact and at 12:40 a.m. he called another base and asked them to try to raise PAB.

Five minutes later they replied that they were unable to do so. At 12:50 a.m. Brooks called Storvold and stated that whether it was six miles or 60 miles the plane was overdue. The problem was left with Storvold. He called the Rea Point foreman and they decided to awaken a twin-Otter pilot, Morris. They had no clear plan of action. They returned to the radio room with the senior radio operator, Sherlow, and there were joined by Morris. This was around 1:00 a.m. Sherlow suggested they try the emergency locator transmitter frequency. There was some sound but it could not be identified as an emergency locator transmission.

Morris suggested they start a search and he readied his plane. He was in the air at 1:35 a.m. with Storvold as a passenger. This was more than an hour after the aircraft had reported on final and contact had been lost. He was in the air only a minute or two, turning his aircraft to trace PAB's intended approach, when he spotted a fire. He flew over and saw wreckage, reported the same, and noticed Weyman. He returned to the base where a ground party was established. Hatton, Weyman and a passenger were all taken to Rea Point. The passenger died en route to Edmonton.

Hatton, Weyman and the passenger were the only survivors but it is clear from the Ministry of Transport investigation and Weyman's evidence that some other passengers survived the impact. Nothing done or omitted on the ground can be said to have been a cause of the crash and for that reason I do not propose to comment further on the actions there or the Company's policies and instructions in that regard.

THE CAUSE OR CAUSES

The immediate cause of the crash was the action of the crew when at an altitude of 300 feet above sea level and approximately three miles DME the plane was put into a nose down position and power reduced, thus increasing the rate of descent and making impact with the sea ice, far short of the runway, virtually inevitable.

I have used the term "action of the crew" because I am satisfied that there was no mechanical malfunction which initiated or in any way contributed to that action. I am also satisfied that no natural phenomenon caused or contributed to the movement. I am satisfied that it was the Captain who initiated the descent by pushing forward on the control wheel and probably reducing power.

The movement of the control wheel was a deliberate motion in the sense that it was not caused by his body falling or slumping.

I am also satisfied that from that point until impact the Captain was incapacitated in that his mind was not properly functioning and the incapacitation was extremely severe as is evidenced by the total absence of any kind of response to the other crew members. Had he not been suffering some major degree of incapacitation there would, in my mind, have been a reaction of some kind. There was none. The circumstances demanded a reaction, however slight it might be. There is a suggestion in one place in Weyman's evidence that the Captain may have pulled back on the wheel but I am satisfied that he was mistaken in what he said because the statement is inconsistent with his earlier statements, his other evidence and that of Hatton.

It is necessary to consider what prompted that initial manoeuvre of pushing forward on the control wheel. The descent had been shallow and low. In the light of fact that there was clear evidence of an unusual phenomenon in the nature of fog or cloud at a low level, and the Captain remarked about this fact, I am satisfied that he was anticipating meeting a cloud condition in the last stages of the approach. He had mentioned this prospect at the top of descent. Until he reached the 300 foot altitude his responses had been normal. It is true he had descended below the minimum of 450 feet without having the runway in sight. Were the shallow approach and the descent below minimum evidence of some defect in his mental process? I conclude not. It is perfectly clear that a pilot in control should not descend below the minimum until the runway environment is in sight. I am completely satisfied that Panarctic pilots did not strictly adhere to that principle of aircraft operation. I also cannot class the shallow descent as evidence of a defect in mental processes. In the light of the evidence as to the responses, his capable handling of the aircraft up to this point, his knowledge of and concern over a "cloud", I conclude it was a deliberate decision to make a somewhat shallow and low approach so that the condition could be observed. The statement "I believe we are on top of a layer of cloud", made at this point, even if erroneous is the product of a conscious mind.

Why was the descent initiated? The only real clue we have is the remark that I have just quoted. It followed upon Hatton's advice that there was visibility, "vertical", i.e. that the surface of the earth (but not the runway environment) was in view. I conclude that the Captain looked out at that point. There is no doubt in my mind that there was blowing snow below him and at the angle of the aircraft he might have become disorientated. He

might have mistaken the sea ice edge for a cloud edge or he might have taken the blowing snow to be a cloud under which he could penetrate. Alternatively, he could have executed that act in a state of automatism produced by incapacitation.

Any assessment of the evidence of the last few seconds of the flight points strongly to incapacitation. What kind of incapacitation? The post-mortem examinations and extensive investigations carried out rule out cardiovascular failure, chronic brain disease, or any other identifiable disorder that would cause the degree of incapacitation which must have been present. Only one physical disorder could be found: the fatty liver. The evidence before me indicated that if the fatty liver played a role here it did so by producing a brain impairment. Virtually every other manifestation was ruled out during the course of the examinations of Drs. Fisher and Skjenna. The question of whether or not the liver caused a brain malfunction is essentially one for determination by a neurologist. The Inquiry's specialist consultant is a neurologist and was called to give evidence. He, Dr. Jacobs, did not believe that brain malfunction would result from the liver condition in the absence of hypoglycemia and both he and Dr. Fisher excluded hypoglycemia as a contributing factor. The only medical explanation left, if there was incapacitation, was Dr. Jacob's view that there may have been a cerebral seizure. By that I mean an abrupt brain dysfunction, associated with a loss of consciousness. In a clouded mental state a victim can perform automatic seemingly purposeful movements that are irrational. These are not unknown in aviation. In an useful compilation of material prepared by Dr. Skjenna, there is an extract of a study showing that of 36 causes of in flight loss of consciousness in a 10 year period, 8 were cases of seizure with no past medical history. In a study of 32 instances in the

U.S.A.F. between 1966 and 1971, 5 were caused by seizure disorder totally incapacitating the crew man. This does not indicate a significant degree of probability: it only supports the possibility.

In the condition of cerebral seizure a victim might perform physical functions without any real appreciation of the consequences. It would, of course, be remarkable that such a condition should manifest itself at such a critical point in the flight. Nonetheless, it is the only rational medical explanation for the incapacitation of the degree involved. I think the only other explanation is that the degree of disorientation was so great, the stress so great, that the pilot "froze". While it is not too reliable, lactate studies showed an absence of fear and I find it almost inconceivable that a mental overload would manifest itself in the way the survivors described, again, there being no response or reaction at all.

It was suggested that the Captain might have been fatigued to the extent that the stress of making the landing overtaxed his ability. If he were fatigued, I do not believe that it would manifest itself in the way in which the survivors described the Captain's reactions here. Outside of the fatty liver or the change in flying hours from daytime to nighttime operations there were no extraordinary conditions to create that degree of fatigue. The medical evidence did not satisfy me that the liver condition would so manifest itself. I do not believe that the change in working hours could have had such an extraordinary effect on an experienced pilot. There is also no evidence of fatigue manifesting itself at any other time.

To initiate such a rapid descent at three miles DME at a height of 300 feet is a totally irrational act. It would be charitable to describe a conscious decision to take that step as a gross pilot error. Even if the Captain thought that he was on a layer of cloud below which he chose to descend he would not have undertaken such an extreme course of action. In view of the remarks he made I conclude he did look out and did have the impression he should descend, but what he did was not a rational response. The descent that was initiated was, in these circumstances, the consequences of either a marked degree of disorientation or some cerebral malfunction, and as between the two I would have to choose the latter.

I must say that if one were in a situation in which some interested party bore the onus of proof I do not think I could go as far as to say that cerebral malfunction was a probability, the most I could say is that it is the best of the possible explanations. I note that such a condition occurs frequently without warning and can only be predicted by tests not normally made, namely, electro-encephelograms, and then only with very sophisticated interpretation. I do not think it is possible to say whether the incapacitation described in the last moments of flight had its onset just before or just at the initiation of descent.

I reject physical fatigue. I reject suicide or any psychological disturbance. I reject any suggestion of alcoholism or the consumption of alcohol or other drugs.

A contributing factor was the Captain's attempt to obtain a visual reference himself while otherwise relying on his instruments. This is unsound

flying practice. Another contributing factor was the decision to descend below the minimum. Once the aircraft descended below the minimum the margin of safety was substantially reduced. It was not possible to recover from that descent. While the minimums are designed on the basis of ensuring an area free of obstruction there is included a margin of safety. The evidence of Panarctic's interpretation of the pilot's role in going below the minimum leads me to believe that company crews were not adequately instructed, and if instructed, not adequately disciplined in their responsibilities in this regard.

Pilots operating under Instrument Flight Rules must ordinarily not descend below the prescribed minimum altitudes unless the runway environment is in sight. If they choose to do so, that decision should be communicated to the rest of the flight crew. They (at least the other pilot) should be consulted and even if not consulted at least advised. If advised they can respond, or at least sensibly anticipate and monitor the pilot flying.

The Company's responsibility extends not only to instruction but also to ongoing observation and training. I believe its responsibility here to be heightened by the fact that so many of its crew members had long experience in single crew aircraft. They were unused to collaboration and co-ordination. The result is that decisions were not infrequently made without consultation or advice and the other crew members would be unable to respond adequately.

I have considered whether or not the other crew members should have been trained to respond to the Captain's apparent incapacity. They are not so trained and I cannot say that such training could have been expected. I appreciate that there are grave problems inherent in suggesting that another pilot should have authority to take over the control of an aircraft in conditions

fraught with peril. I understand from the evidence before me that consideration is being given to training to recognize incapacity and the response to be made but I do not think that one could expect such training here and, in any event, it would have done no good. I am satisfied that even had Hatton recognized an incapacitation at once and responded immediately he could not possibly have prevented the crash. This is clear from the Ministry of Transport simulated experiments. It is perfectly clear that Weyman could not have been expected to act in the absence of some direction from the pilots. Neither Weyman nor Hatton can be visited with any responsibility or subject to any criticism whatsoever.

SUMMARY OF CONCLUSIONS

The immediate cause of the crash was the initiation of a rapid descent in circumstances which made impact with the surface virtually inevitable. It appears to me that this action, by the Captain, occurred almost concurrently with incapacitation of a very severe degree. His attempt, prior to the initiation of descent, to make a visual reference when the co-pilot did not have the airport environment in sight and the decision to descend below the prescribed minimum altitude were contributing factors which were attributable, if not to deficiencies in initial training, then to deficiencies in the discipline of flight crews to accept and adhere to these rules of instrument flight. Deviations from accepted practices should only occur when the grounds for that deviation are communicated to other flight crew members, and this crew, if adequately trained in that regard, were not disciplined in its application.

ACKNOWLEDGMENT

In the conduct of the Inquiry, I was assisted by the contribution of many persons. I appreciate the co-operation given to us by members of the public, the other investigative bodies, and persons who appeared as witnesses.

Peter M. Owen, Esq., acted as counsel to the Inquiry. He discharged that onerous task to my complete satisfaction. He was ably assisted by Ms. Myra Bielby. Ms. Marilyn Thomlinson was our very efficient Registrar.

I appointed as technical advisor Captain Robin Mackie, a pilot with experience both in the Arctic and with high performance aircraft, who was freed from his duties as Director of Flight Operations for Pacific Western Airlines to assist the Commission. Captain Mackie provided invaluable assistance and clearly enjoyed the confidence and respect of his professional peers.

I appointed Dr. Harold Jacobs, a leading neurologist and internist, as medical advisor. Dr. Jacobs' advice and evidence based on thorough considerations was of very great value.

I acknowledge the co-operation of The Honourable Mr. Justice W.G. Morrow in making available both the appropriate facilities and the helpful staff of the Supreme Court of the Northwest Territories for our hearings in Yellowknife.

Prouse Reporting Services provided reporting service in Yellowknife and those duties were ably discharged by the Supreme Court Reporters in Edmonton for the Edmonton hearings.

APPENDIX I

P.C. direction (Exhibit 1)



PRIVY COUNCIL

Certified to be a true copy of a Minute of a Meeting of the Committee
of the Privy Council, approved by His Excellency the Governor
General on the 20 November, 1975

CANADA
THE INQUIRIES ACT
PANARCTIC INQUIRY

Exhibit No. 1
Filed the 3 day of
February, A.D. 1976,
at Yellowknife
Ed. Hamilton
Registrar

WHEREAS on October 30, 1974, in the vicinity of Rea Point, in the Northwest Territories, a Lockheed L188 aircraft, owned and operated by Panarctic Oils Ltd., Registration CF-PAB, crashed, with the attendant loss of 32 lives;

AND WHEREAS the Government of Canada has decided that in the interest of the good government of Canada that there be an inquiry into the circumstances of the said air crash.

THEREFORE, the Committee of the Privy Council, on the recommendation of the Minister of Justice, advise that, pursuant to Part I of the Inquiries Act, His Honour Judge William Alexander Stevenson, a Judge of the District Court of Alberta, be appointed a Commissioner to inquire into and report upon the circumstances surrounding the crash of a Lockheed L188 aircraft, Registration CF-PAB, in the vicinity of Rea Point, in the Northwest Territories, on the 30th day of October, 1974, with attendant loss of life, and without restricting the generality of the foregoing, the cause or causes that occasioned or may have occasioned the crash.

The Committee further advise that

- A. the Commissioner be authorized to prescribe and adopt such practices and procedures for all purposes of the Commission as he may from time to time deem expedient for the proper conduct of the inquiry and to vary those practices from time to time;
- B. the Commissioner be authorized to sit at such times and at such places and to view such other locations as the Commissioner may from time to time decide;
- C. the Commissioner be authorized to engage the services of such accountants, engineers, technical advisers or other experts, clerks, reporters and assistants as he deems necessary or advisable and also the services of counsel to aid and

- 2 -

assist the Commissioner in the inquiry, at such rates of remuneration including transportation and living expenses, as may be approved by the Treasury Board; and

- D. the administrative costs and related costs of the Commission shall be the responsibility of the Department of Justice.

The Committee further advise that, pursuant to section 37 of the Judges Act, His Honour Judge William Alexander Stevenson be authorized to act as Commissioner for the purpose of the said inquiry.

CERTIFIED TO BE A TRUE COPY - COPIE CERTIFIÉE CONFORME

P. H. Feltz

CLERK OF THE PRIVY COUNCIL - LE GREFFIER DU CONSEIL PRIVÉ

APPENDIX II

Exhibit 2

Exhibit 102



The Inquiries Act

NOTICE OF HEARING

into

CRASH OF PANARCTIC ELECTRA AIRCRAFT AT REA POINT, N.W.T. ON OCTOBER 30, 1974

CANADA
THE INQUIRIES ACT
PANARCTIC INQUIRY

File No. 2
d the 3 day of

Feb AD. 1976,

William G. McKinnon
Registrar

NOTICE IS HEREBY GIVEN that the Commissioner appointed by the Privy Council of Canada pursuant to The Inquiries Act of Canada will hold Public Hearings commencing at the Court House, Yellowknife, N.W.T., on Tuesday, February 3rd, 1976, at 9:00 a.m. to inquire into and report upon the circumstances surrounding the crash of a Lockheed L188 aircraft, Registration CF-PAB, in the vicinity of Rea Point, in the Northwest Territories, on the 30th day of October, 1974, with attendant loss of life, and without restricting the generality of the foregoing, the cause or causes that occasioned or may have occasioned the crash.

All persons desirous of making submissions or representations at these Hearings are requested to write prior to January 20th, 1976, to:

Mr. Peter M. Owen O.C.,
Commission Counsel
P.O. Box 2024
Edmonton T5J 2P4

stating the general nature of the evidence or submissions to be made

Every effort will be made to accommodate the convenience of interested parties; however, all parties should be ready to proceed when called upon or after the above mentioned commencement date

DATED at Edmonton, Alberta, this 30th day of December, 1975

W. A. STEVENSON
COMMISSIONER

APPENDIX II



The Inquiries Act

NOTICE OF HEARING

into

CRASH OF PANARCTIC ELECTRA AIRCRAFT AT
REA POINT, N.W.T. ON OCTOBER 30, 1974.

NOTICE IS HEREBY GIVEN that the Commissioner appointed by the
Privy Council of Canada pursuant to The Inquiries Act of Canada will
resume the Public Hearings into the crash of the Lockheed L188 aircraft,
registration CF-PAB, on Monday, the 5th day of April, 1976, at 9:30 a.m.
at the Law Courts, Edmonton, Alberta.

DATED at Edmonton, Alberta, this 8th day of March, 1976.

PETER M. OWEN
Commission Counsel
P. O. Box 2024
Edmonton T5J 2P4

CANADA
THE INQUIRIES ACT
PANARCTIC INQUIRY

Exhibit No. 102
Filed 5 day of
April, A.D. 1976.
at Edmonton
W. Hemlin
Registrar

APPENDIX II

Publication of Exhibit 2

Edmonton Journal	-	December 30, 1975; January 6, 1976
Calgary Herald	-	December 30, 1975; January 6, 1976
News of the North	-	December 31, 1975; January 7, 1976
The Yellowknifer	-	January 8, 1976

Publication of Exhibit 102

Edmonton Journal	-	March 8, 1976
Calgary Herald	-	March 8, 1976
Calgary Albertan	-	March 8, 1976
News of the North	-	March 10, 1976

APPENDIX III

Appearance

Peter M. Owen, Q.C.

Myra Bielby

for the Commission

Eric Lane

for Panarctic employees

Donald I. Brenner

for Panarctic Oils Ltd.

I. G. Whitehall

for Minister of Transport

J. W. McClung, Q.C.

for Estate of Captain Thomson

WITNESSES

KOWALIK, Edward John	-	Air Transportation Manager, Panarctic Oils Ltd.
JOHNSTON, Duncan Ian	-	Panarctic Oils Ltd. Check Pilot
SILVESTER, William Warren	-	Duty Pilot, Panarctic Oils Ltd., altered flight plan
NEWNHAM, Albert Richard	-	Chief of Maintenance, Panarctic Oils Ltd.
STORVOLD, Leonard	-	Superintendent, Panarctic Oils Ltd.
BROOKS, Roderick David	-	Radio Operator, Rea Point
MORRIS, Walter Barry	-	Pilot, Panarctic Oils Ltd.
HATTON, David Wayne	-	First Officer, Flight 416
WEYMAN, Garry Douglas	-	Flight Engineer, Flight 416
FOGARTY, David James	-	R.C.M.P.
CAIGER, Bernard	-	National Research Council
THOMSON, James Mervyn	-	Brother of Captain Thomson
JACOBS, Dr. Harold	-	Medical Doctor
MITCHELL, Peter Martin	-	Pilot, Panarctic Oils Ltd.
THOMSON, Mrs. Lou Annabelle	-	Widow of Captain Thomson
FISHER, Dr. Murray Malcolm	-	Medical Doctor
LAMBERD, Dr. Wm. Gordon	-	Medical Doctor
PENIKETT, Stephen Richard	-	Pilot, Borek Construction Ltd.
SKJENNA, Dr. Olaf Wilmot	-	Medical Doctor
CLARK, Allan Joseph	-	Ministry of Transport, Accident Investigation
UNGER, Thomas Jacob)	Ministry of Transport, Accident Investigation
LEROUX, Joseph Rene)	
GLENN, Henry Reid)	

APPENDIX III (Continued)

Exhibits

<u>Exhibit No.</u>	<u>Description of Exhibit</u>
1	Copy of Order in Council
2	Copy of Notice of Inquiry
3	November 1, 1975, Inquisition of Coroner's Jury with Recommendations
4	Aircraft Accident Report - Lockheed L188 CF-PAB
5	Panarctic Oils Ltd. Response
6	Ministry of Transport Response
7	Organization Chart of Panarctic - Executive
8	Operations Division Organization Chart - Panarctic
9	Air Transport Department - Organization Chart
10	Aircraft Technical Log s/n 1141 CF-PAB
11	Folder - Technical Data Relating to Electras, Marked "Appendix I"
12	Operating Manual
13	Electra Planning Manual
14	Radio Operator's Manual
15	Operating Log - PAB
16	Training Record of W. B. Thomson
17	Captain Thomson's Log, January 1970 to January 3, 1974
18	Captain Thomson's Log, November 10, 1962 to January 13, 1970

Exhibit No.

Description of Exhibit

- | | |
|----|---|
| 19 | Captain Thomson's Log, July 6, 1972 to May 28, 1974 |
| 20 | Captain Thomson's Log, May 31, 1964 to October 29, 1974 |
| 21 | Air Navigation Order Series VII No. 2 and Amendment No. 1 and Amendment No. 2 |
| 22 | Flight Operations Manual - Panarctic Oils Ltd.
(December 31, 1975 to January 2, 1976) |
| 23 | Updated Standard Operating Procedures |
| 24 | Crew Schedule for October 1974 for Pilots |
| 25 | Crew Schedule for October 1974 for Flight Engineers |
| 26 | Map |
| 27 | Contract for Meteorological Services between Department of Transport and Panarctic Oils Ltd. |
| 28 | Weather Report CF-PAB |
| 29 | Approach Plate for Rea Point - September 25, 1974 |
| 30 | Approach Plate Marked "Edit Print" for Rea Point
Dated March 1, 1974 |
| 31 | Approach Plate Dated July 26, 1974 |
| 32 | Passenger/Freight Manifest, October 29, 1974,
Flight #416 |
| 33 | Preflight Passenger Manifest, October 29, 1974,
Flight #416 (Passenger Reservation List) |
| 34 | Two Flight Plan Documents |
| 35 | Flight Plan Document - Edmonton to Rea Point |
| 36 | Correspondence between Panarctic and Ministry of
Transport Relating to Authorization for Renewal
of Instrument Flight Ratings |
| 37 | Final Operations Report, Lockheed Electra CF-PAB
Dated October 30, 1974 |

<u>Exhibit No.</u>	<u>Description of Exhibit</u>
38	Flight Operations Bulletin #09/72 Dated August 28, 1972
39	Signed Flight Plan
40	Two Photographs of Flight Instrument Panels
41	Photograph of Flight Engineer's Instrument Panel
42	Photograph of Right Hand Side of Pedestal
43	Photograph of Lower Part of Engineer's Pedestal - Captain's Side
44	Photograph (Close-up) of Captain's Flight Instruments
45	Copy of Weight and Balance Sheet Dated October 29, 1974 and Marked Flight #416
46	Copy of Weight and Balance Sheet Dated October 28, 1974 and Marked Flight #416
47	Weight and Balance Sheet (Yellow) - Original Recovered from the Aircraft
48	Yellow Copy of Weight and Balance Sheet - Original of Exhibit 45
49	Crew Data File re Hatton
50	Duty Pilot Check Sheet and Report
51	Operational Flight Plan, October 29, 1974 (Edmonton to Rea Point)
52	Weather Forecast - 1630 Greenwich Mean Time, October 29, 1974
53	Actual Weather Reports - 1800 Greenwich Mean Time, October 29, 1974
54	Actual Weather Reports - 0100 Greenwich Mean Time, October 30, 1974
55	Terminal Advisories or Forecasts - 2230 Greenwich Mean Time, October 29, 1974

<u>Exhibit No.</u>	<u>Description of Exhibit</u>
56	Forecast Upper Winds - 1920 Greenwich Mean Time, October 29, 1974
57	Preliminary Load Calculation
58	Two Telex Reports to Edmonton Embracing Information Contained in Exhibit 57
59	Northbound Breakdown
60	Freight List from Calgary
61	Final Dispatch for Flight #416, October 29, 1974
62	Original Final Dispatch (Source of Exhibit 61)
63	Balance of Flight #416 (Top Document - Passenger/ Freight Manifest Dated October 29, 1974) File
64	MANAIR - Manual of Standard Procedures for Aviation Weather Services
65	Compendium of Rules and Definitions
66	Definitions Effective January 29, 1976
67	IFR Supplement Effective January 29, 1976
68	File on Flight Engineer Weyman
69	Certificate of Airworthiness Dated December 30, 1969
70	Copies of Work Cards for Maintenance, October 28 - 29, 1974
71	Purchase Order Relating to Repair of Voice Recorder with Attached Invoice
72	Part of Aircraft Journey Log, October 23 - 27, 1974
73	Part of Aircraft Journey Log, October 27 - 29, 1974
74	Memorandum Dated July 4, 1974, re Rea Point Refuelling
75	Aircraft Accident Report Prepared by Mr. Brenner

<u>Exhibit No.</u>	<u>Description of Exhibit</u>
76	Drilling Department Organization Chart Dated September 1, 1974
77	Draft Emergency Procedures
78	Surface Weather Record - October 29 and 30, 1974
79	Teletyped Record (re Radio Log)
80	Radio Operator's Log (Part of)
81	E.L.T. Recording (Tape)
82	Teletype Report from Captain Morris to Mr. J.M. Strain
83	Statutory Declaration of Captain Morris Given to R.C.M.P.
84	Weather Maps
85	Balance of Weather Group Report
86	Telex from Ministry of Transport
87	Engineer's Fuel Log
86A	Affidavit - Original of Exhibit 86
88	Four Yellow Telex Reports (Received from PAB)
89	Fuel Invoices and Meter Check from Imperial Oil
90	Signed Statement of Garry Weyman Dated November 5, 1974
91	Photograph Showing Watch
92	Slides
93	Videotape
94	National Research Council Report on Flight Recorder
95	Final Report of Flight Recorder Group
96	Photograph of Voice Recorder
97	Photograph Showing Broken End of Tape (Voice Recorder Tape)

<u>Exhibit No.</u>	<u>Description of Exhibit</u>
98	Photograph of Flight Data Recorder
99	Photograph of Trace from Flight Data Recorder
100	Diagram of Flight Data Recorder
101	Human Factors Committee Report
102	Notice of Hearing
103	Sketch of Mr. Mitchell's Approach
104	Dr. Fisher's letter to Dr. Skjenna- dated March 31, 1975, together with Report
105	Human Factors Committee Initial Report - Part I
106	Minutes of Meeting held March 24, 1975
107	Dr. Lamberd's Letter to Dr. Skjenna Dated March 10, 1975, with Attached Report on Interview with Mrs. Thomson Dated March 5, 1975
108	Initial Report and Impressions of Dr. Lamberd
109	Air Regulations and Aeronautics Act (See p. 49)
110	Dr. Lamberd's Report to Dr. Skjenna on Interview with Mr. Hatton Dated June 18, 1975
111	Interview of David Hatton at University of Alberta Hospital - November 13, 1974
112	Compendium of Literature Relating to Aviation Medicine
113	Letter to Panarctic Oils Dated December 7, 1973 from Ministry of Transport
114	Letter from Aircraft Accident Investigation
115	Compendium of Literature Supplied by Operations Group
116	Statement of Garry Weyman Dated November 13, 1974



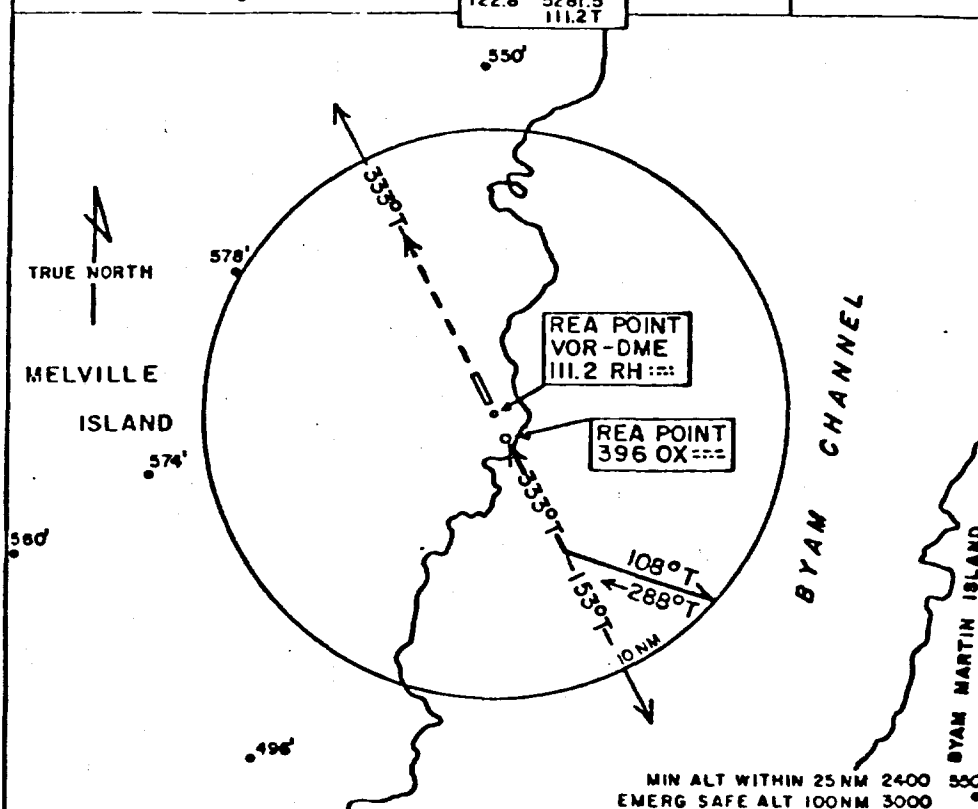
panarctic oils ltd

REA POINT

RADIO	
131.0	5411
122.8	5281.5
	111.2T

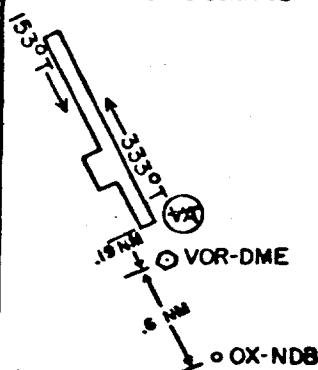
NO
TOWER

ELEV. 50'



MISSED APPROACH
CLIMB RWY HEADING
TO 2000 RIGHT TURN
TO OX NDB

6,300' x 200'
SAND SURFACE



CATEGORY	A	B	C	D
STR. IN	450 (400) 1		450 (400) 1	
CIRCLING	550 (500) 1 1/2		550 (500) 2	

NOTE: ALL CIRCLING TO THE
EAST OF AIRPORT

ALTERNATE

TAKE OFF / 300-1

VOR-ADF RWY 33

Aerodrome 75°22'N-105°42'

28 SEPT. 1974

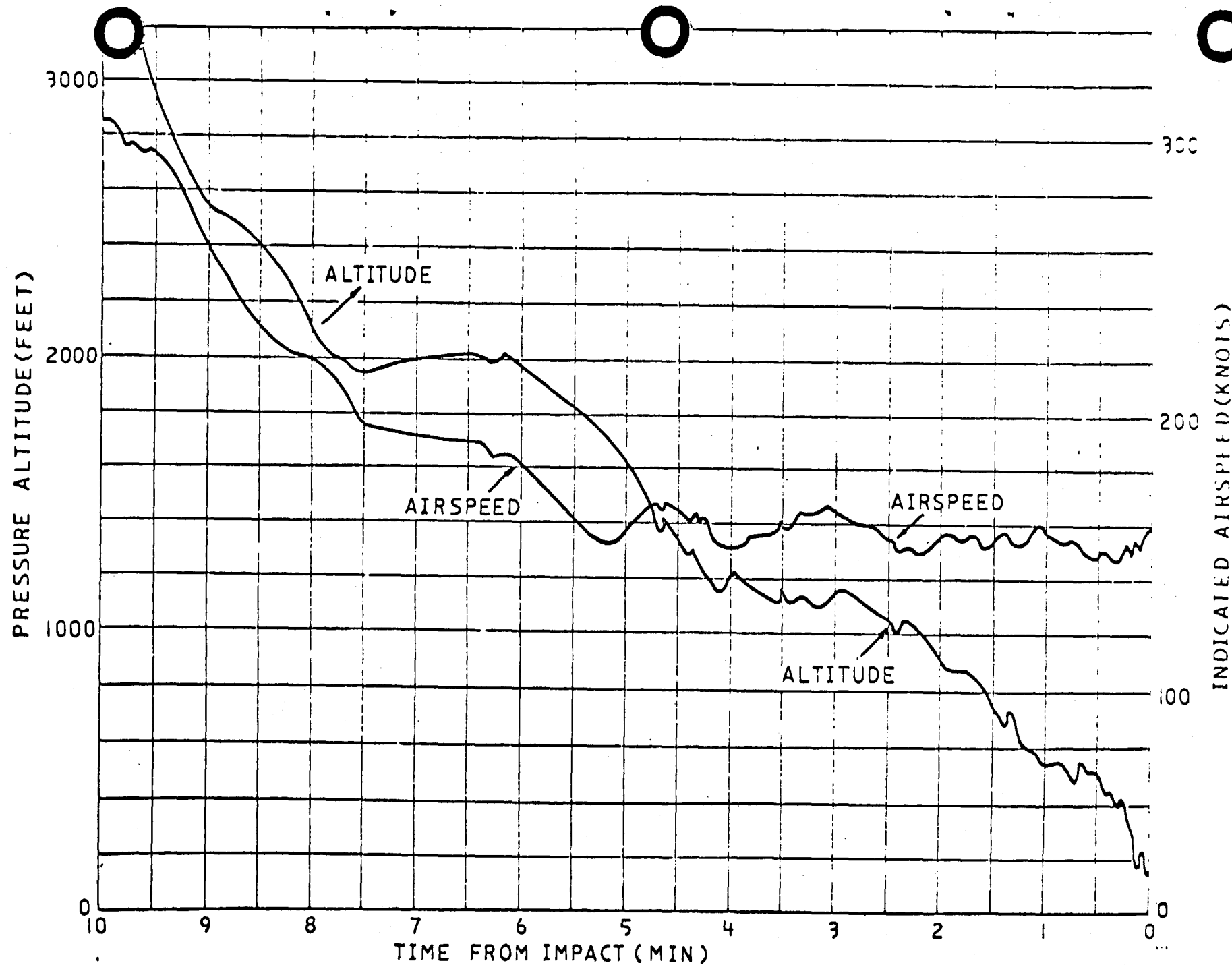
CHANGE: THRESHOLD RWY 33 MOVED

OX TO AIRPORT .79 NM					
Knots	75	105	120	130	160
Min:Sec	141	130	126	124	119

REA POINT N.W.T.

limits





ALTITUDE & AIRSPEED DATA OVER LAST 10 MINUTES OF FLIGHT

INDICATED AIRSPEED (KNOTS)

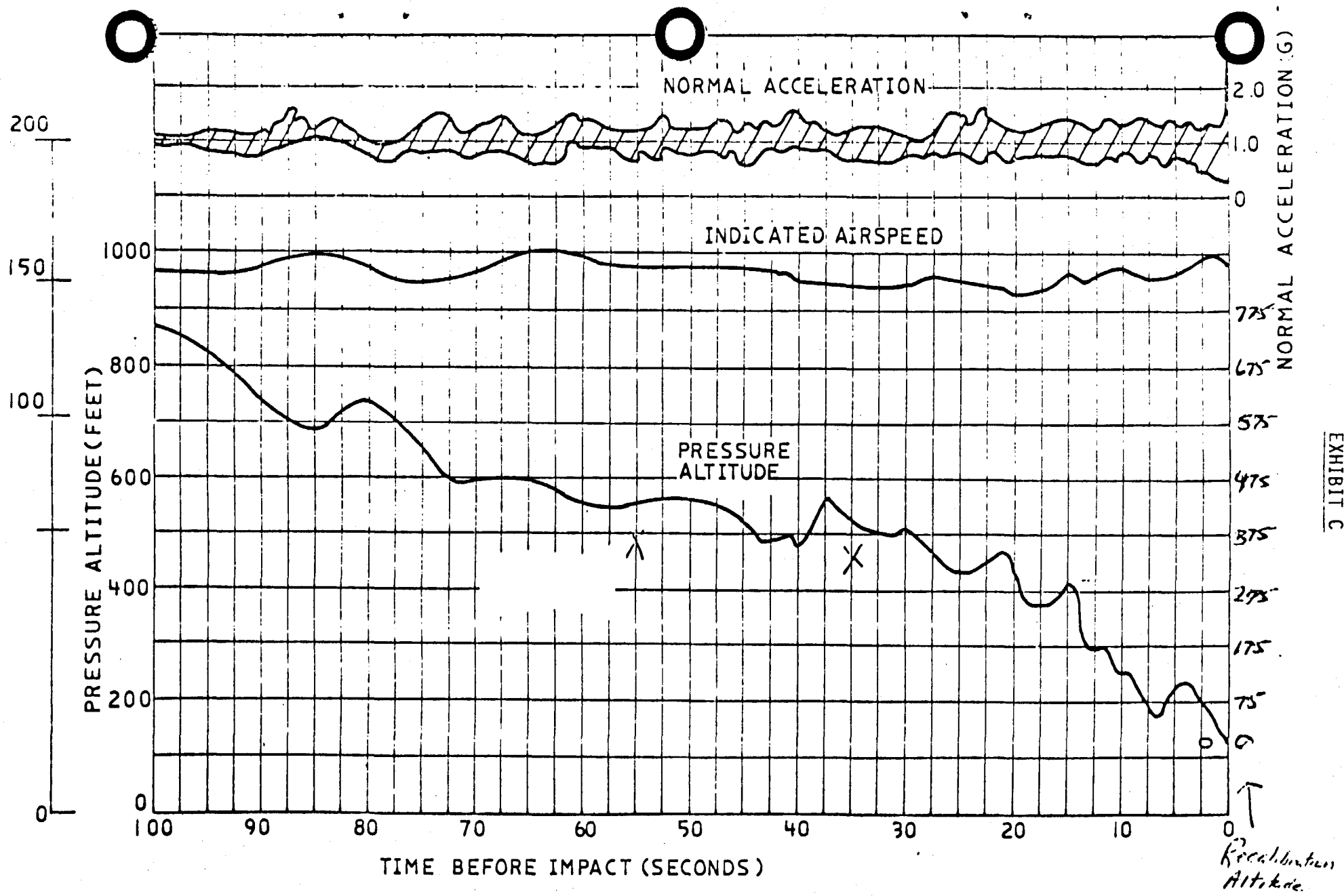


EXHIBIT C

TIME HISTORIES OF FLIGHT RECORDER DATA OVER LAST 100 SECONDS

EXHIBIT D

CLIMB CHECK

FLIGHT ENGINEER

TAXI LIGHTS.....OFF
 ICE PROTECTION.....AS REQUIRED
 CABIN SIGNS.....AS REQUIRED
 AUTO FLATHERING.....OFF
 ENGINE SYNC.....ON
 CONTROL BOOST.....DOOR CLOSED
 OIL COOLERS.....SET
 PRESSURIZATION.....SET
 RECORDER.....ENCODE
 FLAPS.....(P) CHECKED UP
 GEAR.....(P) UP, HANDLE NEUTRAL
 OFF TIME.....(P) RECORDED
 LANDING LITES..(P) OFF&RETRACTED@10,000'

CRUISE CHECK

FLIGHT ENGINEER

POWER.....SET
 HYDRAULIC PUMPS.....SET
 ALTIMETERS.....SET
 FUEL CHECK.....(FE) (FO) RECORDED

DESCENT CHECK

FLIGHT ENGINEER

FUEL CHECK.....(FO) RECORDED
 PRESSURIZATION.....SET
 ALTIMETERS.....(C) (FO) ' FEET
 RADIO ALTIMETERS.....(C) (FO) SET 1500'
 SEAT BELT SIGN.....ON
 CIRCUIT BREAKERS.....NORMAL
 CREW BRIEFING
 LANDING LITES..EXTENDED & ON @ 10,000'

APPROACH CHECK

FLIGHT ENGINEER

CONTROL BOOST DOOR.....OPEN
 SEAT BELT NO SMOKING SIGN.....ON

FIRST OFFICER

FUEL.....ON, CROSSFEED OFF, PUMPS ON
 HYDRAULIC PUMPS.3ON, PRESS QUANT NORMAL
 BR.....(C) OFF PRESS NORMAL
 ALTIMETER.....(C,FO) ' FEET
 RADIO ALTIMETER.....(C, FO) SET
 MARK BUG.....(C, FO) SET
 RADIO NAV AIDS.....SET
 OIL COOLERS.....SET
 LAR.....UP & STBY

LANDING CHECK

FLIGHT ENGINEER

FIRST OFFICER

ICE PROTECTION.....(C) AS REQUIRED
 GEAR.....DOWN, 3 GREEN
 FLAPS.....100% INDICATING
 INSTRUMENT FLAPS.....NORMAL

AFTER LANDING CHECK

FLIGHT ENGINEER

LANDING LITES.....AS REQUIRED
 ICE PROTECTION.....OFF
 PITOT HEAT.....OFF
 INVERTER.....START
 HYDRAULIC PUMP.....#2 OFF
 FUEL BOOST PUMP.....OFF
 TRANSPONDER DME.....STBY
 ENGINE SYNC.....OFF
 OIL COOLERS.....SET
 CONTROL BOOST.....DOOR CLOSED
 RADIO ALTIMETER.....OFF
 RECORDER.....OFF
 APU MASTER.....ON
 FLAPS.....(FO) UP
 DOWN TIME.....(FO) RECORDED

APPROACHING GATE

BRAKE PRESSURE.....(FE) CHECKED NORMAL

RAMP CHECK

FLIGHT ENGINEER

ANTI COLLISION LIGHT.....OFF
 HYDRAULIC PUMP.....OFF
 TOW SWITCH.....AS REQUIRED
 EMERGENCY INVERTER.....OFF
 EXTERIOR LITES.....AS REQUIRED
 EXVACUATION LITES.....DISARMED
 WINDSHIELD HEAT.....AS REQUIRED
 VOICE RECORDER.....OFF
 ELECTRICAL & RADIO SWITCHES.AS REQUIRED
 OXYGEN.....OFF
 BRAKES.....(AFTER CHOCKING) OFF