COMMISSION OF INQUIRY INTO THE AIR ONTARIO CRASH AT DRYDEN, ONTARIO

Final Report

Volume I

The Honourable Virgil P. Moshansky
Commissioner

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This Final Report consists of three volumes: I (Parts One–Four), II (Part Five), and III (Parts Six–Nine and the General Appendices). The table of contents in each volume is complete for that volume and abbreviated for the other two volumes. Seven specialist studies prepared for this Commission have been published separately in a volume entitled Technical Appendices; the contents of the Technical Appendices are given at the end of this volume.

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This volume has been translated by the translation services of the Secretary of State, Canada, and is available in French.

The aerial photograph reproduced in the endpapers was taken by CASB investigators on March 11, 1989, the day following the crash of Air Ontario flight 1363. It depicts the area of the Dryden Municipal Airport (upper right), surrounding road system, and crash site. McArthur Road runs vertically up the middle of the photograph, curving to the right at about the centre of the book on the right-hand page. (The cleared straight line is a hydro right of way.) Middle Marker Road angles to the left off McArthur in the lower left-hand section. The path of Air Ontario flight 1363 through the trees begins not far from the end of runway 29, and the crash site can be seen just above Middle Marker Road. Many survivors walked out to Middle Marker Road immediately after the crash.

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Commission of Inquiry
into the Air Ontario Crash
at Dryden, Ontario

CANADA

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sur l'écrasement d'un avion
d'Air Ontario à Dryden (Ontario)

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TO HIS EXCELLENCY
THE GOVERNOR GENERAL IN COUNCIL

MAY IT PLEASE YOUR EXCELLENCY

By Order in Council PC 1989-532 dated the 29th of March, 1989, I was appointed Commissioner to inquire into the contributing factors and causes of the crash of Air Ontario Flight 1363 Fokker F-28 at Dryden, Ontario, on March 10, 1989, and report thereon, including such recommendations as I may deem appropriate in the interests of aviation safety.

Having previously submitted two Interim Reports, I now beg to submit my Final Report consisting of four volumes in each official language.

Respectfully submitted.

V.P. Moshansky

Commissioner

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CONTENTS

VOLUME I

VOLUME II

VOLUME III

PREFACE

This Report is the product of an exhaustive investigation not only of the crash of Air Ontario flight 1363, which occurred at Dryden, Ontario, on March 10, 1989, but also of the aviation system that allowed it to occur. It should be considered in conjunction with my two *Interim Reports*, which were released in December 1989 and December 1990, respectively.

My Commission staff, in the course of their investigation of the Air Ontario accident at Dryden, interviewed hundreds of potential witnesses and reviewed thousands of potential documentary exhibits. In the end the witness list was pared to 166 witnesses who were called to testify, and the exhibits were reduced to 1343 in number, most of them being documents, many containing hundreds of pages. Evidence was taken under oath in a public forum, subject to cross-examination, for a total of 168 hearing days. This Report is a synthesis of both the testimony of those 166 witnesses, contained in 168 volumes of transcript totalling some 34,000 pages, and of the contents of the documentary exhibits totalling more than 177,000 pages.

The public hearings of this Commission, held in Dryden, Thunder Bay, and Toronto over a period of 20 months, from June 1989 to January 1991 inclusive, disclosed numerous safety-related deficiencies and failings within the carrier, Air Ontario, specifically; within the aviation industry generally; and in the regulatory domain of Transport Canada. These shortcomings, their causes, and their relationship to the accident at Dryden were closely scrutinized during the hearings. They are addressed in detail in this Report, and, in accordance with the mandate given to me, recommendations for change are made.

Pursuant to an agreement reached with the chief coroner for the Province of Ontario, I conducted an investigation, during the hearings of my Commission, into matters that would normally fall within the jurisdiction of the chief coroner for Ontario. As a result of this arrangement, a substantial duplication of effort was avoided. The chief coroner for Ontario at the time,Dr Ross Bennett, and his successor, Dr James Young, shared my concern that there be an in-depth analysis of the human performance aspects of the accident at Dryden. In lieu of holding a coroner's inquest, the chief coroner for Ontario was granted full participant status in the Inquiry. I am grateful for the chief coroner's unreserved cooperation and assistance in this endeavour and for his written advice that the goals of the Office of the Chief Coroner for the Province of Ontario have been fully met by this Commission (attached as appendix F).

The Inquiry process afforded a good opportunity for the identification in a public forum of aviation safety problems within the aviation industry generally and within Air Ontario specifically. Accordingly, with respect to the air carrier, a searching investigation was conducted, not only into Air Ontario's F-28 program but also into virtually every aspect of the operations of Air Ontario, beginning with its corporate history and culminating with its management policies and practices and its relationship with its parent company, Air Canada.

In the case of the regulator, Transport Canada, this Inquiry was the vehicle for a constructive public examination of the inner workings of the Aviation Group of that department. This examination was described by the current assistant deputy minister of transport, aviation, Mr David Wightman, as probably "the most in-depth look at the operations of Transport Canada, the Aviation Group, and the Regulatory side of it specifically, that we've ever had." He further commented on the witness stand with respect to the process of this Inquiry that: "It has been an exceptionally valuable learning experience for me. I assure you." Similar sentiments, which were expressed by numerous other witnesses and by the many members of the Canadian public who communicated directly with me, have reinforced my strong belief in the value of a public Inquiry under the *Inquiries Act*. As a means of conducting an investigation – in this case, that of a major aviation accident – such an Inquiry under the *Inquiries Act* has the great advantages of virtually unlimited power to subpoena witnesses and the testing of their evidence in the crucible of cross-examination. I am convinced that, as an instrument in the search for truth, a public Inquiry, judiciously and fairly conducted, has no peer.

This Report is based exclusively on the extensive evidentiary record that has been assembled. The integrity of the evidentiary record was dependent upon the procedures that were adopted for the conduct of this Inquiry.

As discussed in my first *Interim Report*, on the first day of the public hearings of this Commission, May 26, 1989, I granted full participant status, special participant status, and observer status, respectively, to various parties. Subsequently during the hearings, other parties were granted status for limited purposes only. All parties granted status are listed in appendix C. On May 26, 1989, I stated my intention that the concept of procedural fairness would be the basic tenet of this Inquiry, and I made the following statement with respect to the rights which would be accorded to all parties granted full participant status before the Commission:

> Parties who are granted the status of a full participant will be permitted representation by counsel. Their counsel will be able to

> cross-examine Commission witnesses, submit written briefs to the Commission and, if necessary, to recommend to the Commissioner the calling of certain witnesses.
>
> In the course of any commission of inquiry, allegations will be made at public hearings which will reflect adversely on certain parties. It is my position that any party adversely implicated by testimony at the public hearings of the Commission shall be given a full opportunity to be heard.
>
> (Transcript, vol. 1, p. 9)

Similar rights were accorded the representative counsel granted special participant status on behalf of the survivors and the families of victims of the crash of flight 1363. It was my intention from the outset that the process of this Inquiry would, in the interests of fairness to those who might be affected by the process, mirror as closely as possible the proceedings of a court of law.

On the second day of the public hearings I elaborated upon the procedures that would govern the conduct of the proceedings of this Commission as follows:

> I will now deal with the question of the procedures which I propose to be followed during the hearings of this Commission. It is intended that the procedures will be those already outlined by me at the status hearings and as amplified by correspondence from Commission counsel, Mr von Veh, to the interested parties dated June 2, 1989.

In addition, I propose that the following rules of procedure will apply:

- Firstly, with respect to **Opinion Evidence**, the Commission will only receive opinion evidence of a witness where it is indicated that the witness possesses a special skill by reason of experience or study in respect of the particular subjects on which he or she intends to express an opinion.
- Secondly, with respect to **Rebuttal Evidence**, the Commission at its discretion may allow reply evidence to rebut evidence given by another witness or witnesses, such evidence to be limited exclusively to rebuttal.
- Thirdly, Commission counsel shall have discretion to select one or more persons from among a group of persons who have similar evidence to give on a matter under consideration, to give such evidence for the benefit of the persons having similar evidence.
- Fourthly, while recognizing that a commission of inquiry has a somewhat different role than a court of law and that evidentiary and procedural rules applicable in a court of law are not necessarily automatically applicable to a commission of inquiry,

> it is my intention, in the interests of fairness, that the inquiry hearings shall be conducted in such a manner so as to adhere as closely as possible to the commonly accepted evidentiary rules as to relevance, to the admission of hearsay evidence, and as to the putting of leading questions to witnesses.
> - Fifthly, every party shall have the right to cross-examine any witness whom he or she believes to be in error or to be suppressing facts. This right is not to be abused by irrelevant or repetitive questioning.
> - Sixthly, the Commissioner, in the absence of agreement between counsel, will determine the order in which counsel for the participants will be entitled to cross-examine witnesses.
>
> (Transcript, vol. 2, pp. 51–53)

In addition to the adoption of these procedures (which were outlined previously in my first *Interim Report*), the following specific procedures were implemented to give practical effect to the proposition that any individual who might be adversely implicated before this Commission had the full right to be heard:

- Virtually all interviews undertaken by Commission staff of potential witnesses who were affiliated with any of the parties granted full participant status were conducted in the presence of counsel. In all cases when a prospective witness or his or her counsel requested copies of interview transcripts, such were promptly provided by Commission staff.
- Before any witness testified, synopses of the anticipated testimony of all witnesses intended to be called, based on preliminary witness interviews by Commission staff, were forwarded to all participating parties.
- Before any witness testified, photocopies of all exhibits proposed to be introduced through a given witness were forwarded to all participating parties.
- All counsel appearing before the Commission were afforded broad rights of cross-examination of all witnesses.
- All participating parties were afforded the right to file written briefs as they saw fit, for my consideration.
- All hearings were conducted in such a manner so as to adhere as closely as possible to commonly accepted evidentiary rules.
- All counsel appearing before me were afforded the opportunity to call such further evidence as they saw fit.
- All counsel appearing before me were afforded the opportunity to present closing arguments.

To the extent that any party perceived that there were any inaccuracies or misstatements by any witness on the record, that party, directly or through counsel, was able to take steps to clarify the record – by

cross-examining a witness, by adducing new evidence, or by submitting oral or written argument to me. Throughout this process, all parties availed themselves of these rights from time to time as they saw fit.

The mandate of this Commission was to investigate a specific air crash and to make recommendations in the interests of aviation safety. In carrying out this mandate, it was necessary to conduct a critical analysis of the aircraft crew, of Air Ontario Inc., of Transport Canada, and of the environment in which these elements interacted. As will be explained in the Introduction, I have adopted a system-analysis approach, with emphasis on an examination of human performance.

Following the completion of the hearings of this Inquiry, in late January 1991, my staff and I began reviewing both the voluminous transcripts of evidence and the great mass of documentary exhibits, prior to commencement of the task of writing this Report. This preliminary work was completed in March 1991. At that time my counsel staff and technical advisers were assigned to several research teams charged with the responsibility of preparing draft material in specific areas, according to their expertise and interests. I was personally involved with each such team, meeting regularly with team members and directing the course that I wished to be taken by the researchers. The enormous amount of evidentiary material that had to be reviewed and distilled into this Report, and the severe time constraints imposed for its production, required a dedicated team effort. The various drafts of every chapter of this Report were subjected by me to numerous reviews and revisions. My writing of this Report was basically completed in early November 1991, approximately seven months after the initial drafting began.

This Final Report consists of nine Parts (divided into 44 chapters) and general appendices in volumes I, II, and III, and a separate volume of seven Technical Appendices. Part One sets out the terms of reference for this Commission and includes a description of the duties imposed upon me by Order in Council and a description of the system-analysis approach of accident investigation utilized by this Commission of Inquiry. This Part includes a brief description of the air transportation system components pertinent to the crash of Air Ontario flight 1363, namely:

- the aircraft, C-FONF
- the aircraft crew of C-FONF
- the operational environment affecting the flight crew
- the air carrier, Air Ontario
- the regulator, Transport Canada.

Part Two of the Report includes synopses of the facts leading to the crash of Air Ontario flight 1363, of the crash itself, and of the Dryden

area response to the crash. Part Three deals with an important area in the context of airline passenger safety: the airport crash, fire-fighting, and rescue services. This issue was thoroughly examined during the hearings.

Part Four describes the technical investigation of the accident and deals with the issue of crash survivability and the highly technical areas of aircraft performance and flight dynamics.

Part Five represents an in-depth examination of Air Ontario's history: the carrier's corporate mergers and management organization, and its program for the acquisition, implementation, and operation of F-28 aircraft. Numerous shortcomings in the F-28 program, discovered during this Inquiry, are dealt with in detail in the eight chapters devoted to this subject. This Part concludes with an assessment of Air Ontario management performance and of the role of the parent corporation, Air Canada.

Part Six of this Report is the product of an intensive examination by this Commission of the role of the regulator, Transport Canada, in assuring a safe air transportation system generally and a safe operation by Air Ontario specifically. The results of this examination were such that Transport Canada was found wanting in a number of areas critical to aviation safety. I thought it insufficient simply to expose regulatory shortcomings without discovering the reason for their existence. In this Part, I examine in considerable detail the effects upon aviation safety of the policy of economic regulatory reform (ERR), which was put in place in conjunction with a concurrent governmental policy of fiscal restraint. As well, the performance of senior Transport Canada management in responding to the resource needs of its front-line air carrier inspectors is critically assessed. This Part also specifically assesses how Transport Canada discharges its responsibilities in the areas of aviation regulation and legislation, air carrier audits, monitoring and surveillance, operating rules and legislation, company check pilots, spot-checks, and safety management, to list a few.

Part Seven contains a systemic analysis of the human performance aspects of this accident. The flight crew of Air Ontario flight 1363 erred in deciding to commence the takeoff at Dryden with contaminated wings. The finding of human error on the part of the flight crew is the reason for an analysis of the human performance aspects of this crash. If effective preventive measures are to be found, then the reasons for and the underlying causes of the human error must be fully understood. This Part, which represents a synthesis of the findings of the entire investigation of this accident, is a departure from the usual format for aviation accident investigations in that the role of air carrier management in the events leading to a breakdown in the air transportation system is closely scrutinized. I was greatly assisted in this area by those internationally

recognized experts in the field of human performance who were special advisers to this Commission.

Part Eight represents my analysis, views, and recommendations with respect to certain legal and other issues concerning the aviation accident investigation process in Canada; the reporting of aviation incidents and accidents and the issue of pilot confidentiality; the matter of the objection to production of documents based on a confidence of the Queen's Privy Council, pursuant to section 39 of the *Canada Evidence Act*, R.S.C. 1985, c.C-5; and the matter of section 13 of the *Inquiries Act*, R.S.C. 1985, c.I-11.

In the later stages of the preparation of my Final Report it became clear that I would be making comments which might be perceived to be adverse to certain individuals. Section 13 of the *Inquiries Act* requires that reasonable notice be given to a person against whom a charge of misconduct is alleged in a report and that the person be allowed full opportunity to be heard in person or by counsel. Although my intended comments did not, in my view, constitute a "charge of misconduct" against any individual within the meaning of section 13 of the *Inquiries Act*, in the interests of fairness I instructed Commission counsel to send written notice to all of these individuals, advising of the substance of the intended adverse findings and inviting them to make written or oral submissions to me in response thereto. Such notices were delivered in the latter part of August 1991. In a number of instances individuals responded to the notice given to them under section 13. In all instances, the responses were carefully considered by me. The procedures adopted by this Commission with respect to section 13 of the *Inquiries Act*, the provisions of section 13 itself, and the proceedings brought by Air Ontario and certain unnamed individuals in the Federal Court of Appeal, after receipt of notice under section 13, and the subsequent withdrawal of those proceedings are discussed in Part 8 of this Report.

I have made numerous recommendations in my first and second *Interim Reports* and throughout the body of this Final Report. All these recommendations are consolidated in Part Nine for the convenience of readers. During the course of the Inquiry I was called upon to make a number of rulings involving points of law or procedure. These rulings are reproduced as appendix M among the general appendices to this Report. The volume of Technical Appendices is published to disseminate specialized research gathered by the Commission.

This Report is, in certain instances, critical of individuals and institutions where criticism, in my view, is warranted. Such criticism is an unavoidable result flowing from the nature of this Inquiry and the evidence. It is intended to be constructive, the objective being the prevention of similar accidents in the future. At the same time, acknowledgement is made in the Report of aviation safety–related improvements

that have already been made by the air carriers and by the regulator, Transport Canada, to the aviation system, in response to deficiencies discovered in the course of the hearings. In particular, the air carriers and Transport Canada are commended for the implementation of new inspection and de-icing procedures at Pearson International Airport in Toronto during weather conditions when aircraft surface contamination due to freezing rain, snow, and ice is likely. The recently announced intention of Transport Canada to construct at Pearson a remote touch-up de-icing spray facility and a major de-icing/anti-icing facility with provision for fluid recycling, estimated to cost $45 million, is a welcome response to the safety concerns and recommendations outlined in my *Second Interim Report*.

What was also discovered during the hearings was the fact that, generally speaking, Transport Canada is staffed at all levels by competent and dedicated persons who are sincerely doing their best to ensure a safe air transportation system for the public, at times under trying and frustrating circumstances.

The many air carrier pilots and others involved in the aviation industry who testified before this Inquiry impressed me with their general professionalism and with their commitment to aviation safety. I must mention in particular the valuable contribution of the Canadian Air Line Pilots Association throughout the investigative stage and the hearings of this Inquiry.

It is my hope that the work of this Commission will have served as a catalyst for change. In my view, one of the lasting benefits from this Inquiry is to be found in the greatly heightened awareness that has been generated not only among those involved in the aviation industry, but also among the members of the public, in matters of aviation safety generally, and particularly as to the dangers presented by aircraft surface contamination and the need to ensure clean wings on takeoff. The Canadian media deserve a great deal of credit for this heightened public awareness. There can be no doubt that the widespread and responsible coverage of the public hearings of this Commission by members of the media has had a beneficial effect.

I am confident that, if the contents of this Report are carefully considered and the recommendations made herein are accepted and implemented in a timely manner, an important contribution to aviation safety in Canada will have been made.

The readers of this Final Report should view the critical nature of the analysis contained in it as this Commission's contribution towards enhancing the safety of the travelling public. Transport Canada and the Canadian aviation industry will ultimately have to strike the delicate balance between maintaining an adequate level of aviation safety and dealing with realistic economic considerations.

ACKNOWLEDGEMENTS

This Report could not have been written without the help of a great many people. I am grateful to all of my counsel and my technical staff for joining me in working, without respite, through the summer and fall of 1991 to complete an enormous task in the shortest time possible. They have earned my deep respect.

I believe it to have been a distinct advantage that virtually everyone involved in an official capacity with this Commission had an aviation background, either in the military or in civil aviation, or in both. The result was a compatible working group, knowledgeable in aviation matters, possessing an understanding of the principles of flight and a command of the terminology and the language of aviation.

No Commission can function effectively without the assistance of a highly competent, dedicated, and motivated Commission counsel. I was most fortunate to have such a counsel in the person of Mr Frederick von Veh, QC, of Toronto. A veteran of several Commissions of Inquiry, Mr von Veh's previous Commission experience and his background in administrative and transportation law proved invaluable to me not only in the initial organization and staffing of this Commission, in the assembly of my Commission team of investigators and technical experts, and in the prompt startup of the Commission process, but also throughout the conduct of this Inquiry. In addition to being deeply involved in the planning of the basic direction that the Inquiry was to take, Mr von Veh had the heavy responsibility of organizing and overseeing the work of my entire Commission staff throughout the life of this Commission. He also very ably served as counsel during a number of important phases of the hearings of this Inquiry. Upon the conclusion of the hearings he assisted me greatly in the onerous day-to-day management of the research, drafting, and revision activities for this Final Report. His drive and perseverance contributed much to its timely production. He was also responsible for all matters pertaining to section 13 of the *Inquiries Act*. Mr von Veh has discharged his multiple and weighty responsibilities as Commission counsel in a most professional manner. I am greatly indebted to him.

I was very well served also by my associate Commission counsel, Mr Gregory L. Wells of Calgary. His experience and unique background as a former military pilot, as an air carrier pilot, and as a counsel involved in aviation law enabled him to make a very important contribution to this Inquiry. Mr Wells did much of the counsel work at the Inquiry hearings, acquitting himself admirably. He was heavily involved in the

research and draft writing of the highly technical sections of this Report, and he participated in the numerous reviews of its various sections. I am most appreciative of the total commitment that he made to the work of this Commission and for the thorough and professional job that he has done.

The other members of my counsel staff, Mr Adam Albright, Mr William Cottick, Mr Laurence Goldberg, Mr William McIntosh, and Mr Douglas Worndl, all worked very hard throughout the investigative phase, the hearings phase – during which they appeared as counsel – and the research and report-writing phase of this Inquiry. I thank them for their dedication and tireless efforts. Mr Worndl, who has been a member of my counsel staff from the inception of this Commission, was my director of research. He assisted me in the drafting, revising, and refining of many of the sections of this Report and has rendered exemplary service to this Commission.

I wish to express my appreciation also to my outside counsel, Mr Ian Binnie and Mr Peter Griffin of Toronto, for their advice and counsel at various times and for so capably representing me in the Federal Court of Appeal proceedings taken under section 13 of the *Inquiries Act*.

The investigation of an aviation accident requires specialized investigation teams under the direction of an experienced and knowledgeable team leader. It was my good fortune to obtain the secondment to my Commission, from the Canadian Aviation Safety Board (now the Transportation Safety Board of Canada), of an outstanding aviation accident investigator, Mr Joseph Jackson of Ottawa, for the position of investigator in charge. I express my deep appreciation to him and to his corps of investigators for their total dedication to this investigation. Mr Jackson, a skilled writer, was also involved in the research and preparation of drafts of several highly technical sections of this Report and made important contributions to other areas of this Report.

My senior technical adviser, Mr Frank Black of Manotick, Ontario, a private aviation consultant and the former chief of aeronautical licensing for Transport Canada, was the driving force behind the complex and difficult Transport Canada phase of the Inquiry. As well, Mr Black assisted me greatly in the aircraft ground de-icing/anti-icing phase that culminated in my *Second Interim Report*. He was ably assisted by Mr James Fitzsimmons, a former regional director of aviation regulation, Ontario Region, for Transport Canada, and both were instrumental in the research and preparation of drafts of the Transport Canada sections of this Report. In addition, Mr Black, along with Mr Jackson and Mr Worndl, assisted me greatly in the drafting of the Human Performance chapter of this Report. I am grateful to Mr Black for his sage advice and counsel.

My technical advisers, Captain Robert MacWilliam, Mr David Rohrer, Mr David Adams, and Mr Reg Lanthier, made important contributions throughout the investigative and hearing phases of the Inquiry, with Captain MacWilliam also being involved in research and drafting of the various operational chapters and the Human Performance chapter of this Report and as a valued adviser during the Final Report review committee meetings.

My special advisers, internationally known in the field of aviation accident investigation, Dr Charles O. Miller, Mr Gerard Bruggink, and Dr Robert Helmreich, gave me the benefit of their expert knowledge and experience in aviation accident investigation both throughout the investigative and the hearing stages of this Commission and in their critiques of various drafts of this Report. It was a great privilege to associate and work with such outstanding individuals.

My thanks go to Detective Inspector Dennis Olinyk and Detective Sergeant Donald MacNeil of the Ontario Provincial Police and to those other members of the force who were seconded to this Commission as full-time investigators and served so diligently and professionally. My thanks also to the communications adviser for the Commission, Mr Gordon Haugh, for his ongoing rapport with all branches of the media and for his research and contributions to the section on the Dryden area response to the crash.

On the administrative side I wish to express my appreciation to Commission administrator Mr Robert McBey, also a veteran of previous Commissions and a former military pilot, who assumed the position early in the life of this Commission and has skilfully guided the administrative and financial side of the Commission to an under-budget conclusion. He has been ably assisted by Mrs Sylvia Cannon, assistant administrator to the Commission. My thanks also to Mr William Pratt, assistant deputy minister of management services; to Ms Hélène Langlois, Commission coordinator; and to Mr Peter Brennae of the Inquiries Secretariat, Transport Canada, for their valued advice and assistance so willingly given.

The Commission registrars, Mr Norman Savage and his successor Mr Sidney Smith, and the hearing room officers, Mrs Karen Roche, Mr William Channon, and Mr Ernest Garnham, contributed much to the decorum and orderly conduct of the hearings. For their dedication and valuable service beyond the call of duty I express my sincere appreciation to the Commission records and exhibits manager, Mr Clifford Collier, to his assistant, Mr Christopher Perkins, and to the secretarial, clerical, and computer operations members of the Commission office staff: Pauline Cheeks, Roberta Grant, Mitchell Klein, Louise Madore-Payer, Margaret Mason, Elizabeth Nagata, Savita Patil, Sonja Thomason, Jenifer Williams, and my personal secretary Arlene Walker. I also

express my appreciation to other members of my secretarial and clerical staff who served the Commission most diligently for shorter periods of time: Joe Anile, Sheila Brown, Lisa Buxton, Florence Guttierez, Janet Hinton, Debbie McBurnie, Patricia McIntosh, Sheila Moore, and Diane Risteen.

I wish also to acknowledge the outstanding contribution made to the Inquiry by all of the counsel who represented interested parties throughout the hearings of this Commission. A large number of these counsel also had backgrounds in aviation. All of them acquitted themselves in an exemplary manner, and I hesitate to single out any one of them for specific mention. However, I feel that I should acknowledge the outstanding service rendered by Mr Paul Bailey, counsel to the chief coroner for Ontario. Mr Bailey bore the brunt of the cross-examination of witnesses, and his efforts have in fact been acknowledged by his own peers. He also made an important contribution in his reviewing, on behalf of the chief coroner, of certain draft sections of this Report, for which I offer my thanks. In addition, I will also mention Mr Kristopher H. Knutsen and Mr S. Alexander Zaitzeff, who ably represented the survivors and the families of victims of the Dryden crash as a result of my decision to grant to this group unprecedented special participant status.

Those parties who were granted full participant status, and who seconded to the various investigative groups of this Commission highly experienced experts as participants, are to be commended for the valuable contributions that they made to the process of this Inquiry. I acknowledge the cooperation of the counsel for and the officials of Transport Canada with the officials of my Commission, and I express my appreciation to the assistant deputy minister of transport for his direction to all Transport Canada officials who appeared before this Commission that they were to do so freely and with no sense of inhibition.

Crucial to the writing of a report of this nature are the services of professional editors. It has been my good fortune to have secured the services of three of the best, Mary McDougall Maude, Rosemary Shipton, and Daniel Liebman. They have been involved since the early stages of the writing of this Report and have given to me and my staff the benefit of their valuable advice and guidance. Besides carrying out their editorial work, they have also acted as the liaison between the Commission and the translators and printers, and they have looked after the myriad of details involved in the publication of this Report. I express to them my thanks for the total dedication that they have brought to this task and for their consummate professionalism. My appreciation and thanks are extended as well to the editors of the French edition, Mrs Margot Côté and Mr Paul Ollivier, QC.

Finally, I wish to thank all of the witnesses who testified, including the many expert witnesses, for their valuable contribution to this Inquiry. To the many pilots from across the country and the numerous members of the public who have personally contacted me or who have written to me with expressions of interest, suggestions, and encouragement during the life of this Commission, I express my sincere appreciation for their interest. On a personal note, to my wife June, for her understanding and tolerance of my prolonged absences from home, my thanks.

GLOSSARY OF TERMS AND ACRONYMS

Symbols and Units of Measure

°	degree(s) – applies to latitude and longitude
′	minute(s) – applies to latitude and longitude
″	second(s) – applies to latitude and longitude
BTU	British Thermal Unit
fpm	feet per minute
G *or* **g**	a symbol used to denote the force of gravity (load factor)
in Hg	inches of mercury
KHz	kilohertz
knot	a nautical mile per hour or 1.15 statute miles per hour
°M	degrees magnetic
mb	millibar(s)
MHz	megahertz
pph	pounds per hour
psi	pounds per square inch
rpm	revolutions per minute
°T	degrees true

Glossary of Terms and Acronyms

The terms and acronyms contained herein are general in nature and are not intended to provide complete and/or technical definitions. Rather, they are included as references to assist the reader. Many of the terms and acronyms are more completely defined and described in specific sections of this Report.

AAG	Transport Canada Airports Authority Group
A-base review	A systemic review of the Canadian Air Transport Administration, initiated in November 1982 for the purpose of determining an appropriate level of resources
above ground level	Height measured from the surface of the earth
AC	Air Canada
ACA	Aircraft certification authority
ACC	Area control centre (air traffic control)
accelerate stop distance available	The length of takeoff run available plus the length of stopway if provided
accident	An aviation occurrence in which: (a) a person sustains a serious or fatal injury; (b) the aircraft sustains damage or failure normally requiring major repair (with exceptions); or (c) the aircraft is missing or completely inaccessible
ACM	Air cycle machine
ACN	Aircraft classification number (ICAO)
AD	*See* airworthiness directive
ADF	Automatic direction finder
adiabatic cooling	The process by which air is cooled solely through expansion as it ascends

ADM	Assistant deputy minister
ADMA	Assistant deputy minister, aviation
ADMR	Assistant deputy minister, review
AEA	Association of European Airlines
aerodrome	Any area of land or water designed, prepared, and equipped for use in arrival and departure or servicing of aircraft. The aerodrome includes all runways and taxiways and any buildings and fixed equipment.
Aeronautical Information Publication	A document produced by Transport Canada to provide pilots with a single source of information concerning rules of the air and procedures for aircraft operations in Canada
AES	Atmospheric Environment Service
AFM	*See* aircraft flight manual
A/G	Air/ground
agl	*See* above ground level
AIC	Aeronautical information circular
ailerons	Pairs of control surfaces, normally hinged along the wing span, designed to control an aircraft in roll
A.I.P.	*See* Aeronautical Information Publication
air bottle	A device used to store air under pressure for use in producing rotation in a jet engine for starting

air brake — A device attached to an aircraft for the purpose of reducing lift and/or increasing drag while the aircraft is airborne. It is normally controlled by the pilot and used in flight to reduce air speed or increase the rate of descent. Also referred to as speed brake.

air carrier — Any person or organization operating a commercial air service

Aircraft Flight Manual — Sometimes referred to as flight manual/flight handbook. It sets out operating limitations, emergency procedures, abnormal procedures, normal operating procedures, and flight and ground-handling and performance data. Produced by the aircraft manufacturer, the Aircraft Flight Manual forms part of the type certification of the aircraft.

Aircraft Operating Manual — Sometimes referred to as a flight manual or standard operating procedures (SOPs) manual. It is developed by the carrier to set out standard operating procedures for a specific aircraft type. It is based on and is no less restrictive than the approved Aircraft Flight Manual. Examples are the Piedmont Airlines F-28 Operations Manual and the USAir F-28 Pilot's Handbook.

Aircraft Operations Groups Association — The bargaining agent that represents Transport Canada civil aviation inspectors

airflow — Movement of air around a moving object. Airflow generally refers to a moving aircraft.

airfoil — A structure designed to produce a useful reaction of itself in its motion through the air. It generally refers to an aircraft wing.

airframe — The assembled structural and aerodynamic components of an aircraft

airline transport rating	A certificate of competency issued by Transport Canada to a pilot meeting the requirements. This is the highest rating available in Canada to a commercial pilot.
Air Navigation Order	An order having the force of law that finds its origins in the *Aeronautics Act* and the Air Regulations
airport	An aerodrome that has been inspected by Transport Canada inspectors, has met specific standards, and has been issued an aerodrome certificate
airport surveillance radar	A relatively short-range radar intended primarily for surveillance of airport and terminal areas
air route	A prescribed track between specified radio aids to navigation, along which air traffic control service is not provided
air traffic control clearance	Authorization by an air traffic control unit for an aircraft to proceed within controlled airspace under specified conditions
air traffic control instruction	A directive issued by an air traffic control unit for air traffic control purposes
air start unit	A machine that provides pressurized air to a jet engine for the purpose of starting it
airway	A prescribed track between specified radio aids to navigation in controlled airspace
airworthiness	In respect of an aeronautical product, being in a fit and safe state for flight and in conformity with applicable standards
airworthiness directive	Instruction that specifies the modification, replacement, or special inspection required to preserve the continuing airworthiness of an aircraft

alternate airport An aerodrome specified in an IFR flight plan to which a flight may proceed when a landing at the intended destination becomes inadvisable

altimeter An instrument that uses barometric pressure to measure height above a reference datum

AME Aircraft maintenance engineer

AMO Approved maintenance organization

angle of attack The angle between the chord line of an airfoil and the relative airflow

ANO *See* Air Navigation Order

ANS The national Air Navigation System

anti-ice Prevention of the buildup of ice

anti-skid With reference to braking, a system that provides for maximum brake effectiveness by not allowing the wheels to stop turning completely

AOGA *See* Aircraft Operations Groups Association

AOM *See* Aircraft Operating Manual

APM Airport manager

APU *See* auxiliary power unit

aquaplane *See* hydroplane

ARASS *See* aviation regulation activity standards system

ASDA *See* accelerate stop distance available

ASE Aviation safety engineering

asl Above sea level, height in feet measured from sea level

ASP	Aviation safety programs
ASR	*See* airport surveillance radar
ATAC	Air Transport Association of Canada
ATC	Air traffic control
ATF	Aerodrome traffic frequency
ATIS	Automatic terminal information service
ATPL	Airline transport pilot licence (replaces ATR)
ATR	Airline transport rating
ATS	Air traffic services
ATZ	Aerodrome traffic zone
audit (regulatory)	An in-depth review of the activities and facilities of an organization such as an air carrier or a manufacturing, repair, or overhaul facility to verify conformance with regulatory standards and practices
audit manager	An individual, designated by the convening authority, who is responsible for planning and overall conduct of the audit, up to and including the production of the final audit report
automatic direction finder	A radio direction finder that automatically and continuously provides an indication of the direction to a tuned radio beacon
automatic terminal information service	The continuous broadcast of recorded non-control information in selected busy terminal areas
autopilot	Equipment that automatically controls an aircraft as directed by the pilot(s)
autothrottle	Equipment that automatically adjusts aircraft power to maintain a selected airspeed

auxiliary power unit	A small turbine engine installed in some aircraft to provide pressurized air and electrical power
aviation regulation activity standards system	A staffing standard developed by and used within Transport Canada's Aviation Group
AWIS	Aviation weather information service
BASI	Australian Bureau of Aviation Safety Investigation
bleed air	Air taken from the compressor section of a turbine engine, used to operate some aircraft systems
button	The point on a runway in the immediate vicinity of the threshold from which takeoff normally begins
C	The symbol added to designators of Canadian airports for international flights
CA	*See* convening authority
CADORS	Civil aviation daily occurrence reporting system
CAF	Canadian Armed Forces
CAI	Civil aviation inspector
CALDA	Canadian Air Line Dispatchers Association
CALPA	Canadian Air Line Pilots Association
CAMU	Civil aviation medical unit
CAP	*Canada Air Pilot*, a Transport Canada publication depicting instrument approach procedure at Canadian airports. Operating weather minima are given for each airport.

CASB	Canadian Aviation Safety Board
CAT	Clear air turbulence
CATCA	Canadian Air Traffic Controllers Association
CCFR	Chief, crash, fire-fighting, and rescue services
CCI	Condition conformity inspection
CCP	*See* company (carrier) check pilot
CDL	(1) Central datum line; (2) configuration deviation list
ceiling	The lowest height above ground at which a broken or overcast sky condition exists
centre line	A line running the length of a runway, depicting the centre
certificate of airworthiness	A conditional certificate of fitness for flight, issued in respect of a particular aircraft under the Air Regulations or under the laws of the state in which the aircraft is registered
certificate of registration	A certificate issued to an aircraft owner when the aircraft is registered under the Air Regulations
certification	The process of determining competence, qualification, or quality on which issuance of a Canadian aviation document is based, in accordance with the procedures approved by the minister. This process includes original issuance, denial renewal, or revision of that document.
C/F	Carried forward
CFB	Canadian Forces Base
CFR	Crash, fire-fighting, and rescue (services); crash fire rescue (services)

CFS	*Canada Flight Supplement*, a Transport Canada publication that provides aerodrome and related information for use during flight planning and in flight
checklist	A consolidation, in checklist form for ready reference, of the procedures and limited essential information set out in the Aircraft Operating Manual
checkout	Attaining individual competency in a specific aircraft
check pilot	A pilot appointed by an airline to carry out competency evaluations on company pilots
chief pilot	In the case of Air Navigation Order Series VII, No. 2, a management position required of an air carrier. Air carriers operating a number of large aircraft may have a chief pilot for each aircraft type.
chord	A datum line connecting the leading and trailing edges of an airfoil, and from which the angles of the airfoil are measured
circuit	A rectangular pattern flown by an aircraft from takeoff to landing
clearance (air traffic control)	Authorization by an air traffic control unit for an aircraft to proceed within controlled airspace under specified conditions
clearway	A defined rectangular area over the ground, selected or prepared as a suitable area over which an aircraft may make a portion of its initial climb to a specified height
cockpit (or crew) resource management	The enhancement of air crew knowledge, management skills, and attitudes to promote effective management of all available resources, both human and technical, to maintain a safe flying operation

cockpit voice recorder

A recording device used to record all sounds in the cockpit during flight, including all transmissions and receptions on the radios

coefficient of lift (C_L)

Dimensionless measure of aerodynamic lift, where lift is the aerodynamic force generated perpendicular to the relative airflow. Expressed as aerodynamic lift force divided by the product of the free stream dynamic pressure and the surface area.

$$C_L = \frac{L}{\frac{1}{2}\rho V^2 S}$$

$$\text{Free stream dynamic pressure} = \frac{1}{2}\rho V^2$$

where L = lift, ρ = air density, V = velocity, S = surface area

C of A

See certificate of airworthiness

C of G

Centre of gravity

C of R

See certificate of registration

cold soaking

The process which occurs when an aircraft is subjected to cold temperatures so that all or part of the aircraft is cooled to ambient temperature

company (carrier) check pilot

A check pilot employed by an air carrier who has delegated authority to carry out certain check pilot functions on behalf of Transport Canada

confirmation request form

The form issued to the auditee by a TCAG inspector requesting information that was not readily available. The auditee must respond within a specified time period.

conformance

The state of meeting the requirements of a standard, a specification, or a regulation

controlled airspace — Airspace of defined dimensions within which air traffic control service is provided

controlled VFR (CVFR) flight — A flight conducted under the visual flight rules within Class B airspace surrounding an airport and in accordance with an air traffic control clearance

control zone — Controlled airspace of defined dimensions extending upwards from the surface of the earth up to 3000 feet above the airport elevation, unless otherwise specified

convening authority — The manager within Transport Canada Aviation Regulation responsible for authorizing a regulatory audit

COPA — Canadian Owners and Pilots Association

Corrective Action Plan — A plan submitted to the convening authority or his or her delegate by the auditee, following receipt of the audit report. This plan details the action to be taken to correct the deficiencies identified by the audit findings. It is intended to bring the auditee into full conformance with regulatory standards.

CRFAA (CRFFAA) — Critical rescue and fire-fighting access area

CRM — *See* cockpit (or crew) resource management

cross-country (flight) — Flying an aircraft from one geographical location to another over a distance great enough to require some form of navigation

cross-feed — A system by which fuel may be fed from fuel tanks to the engines in a non-standard manner, often required in situations where a fuel-pump or aircraft engine is inoperative or when a fuel imbalance occurs

cross-wind — A wind that is blowing from any direction except directly down a runway

CSD	Constant speed drive
CSN	Cycles since new
CTAISB	Canadian Transportation Accident Investigation and Safety Board. *See* Transportation Safety Board of Canada (TSB)
CUPE	Canadian Union of Public Employees. Flight attendants of Air Ontario belong to this union.
CVFR	Controlled VFR
CVR	*See* cockpit voice recorder
CZ	Control zone
decision height	A specified height at which a missed approach must be initiated during a precision instrument approach, if the required visual reference to continue the approach to land has not been established
deferral	Postponing the rectification of a malfunction or unserviceability noted in an aircraft journey log, normally with reference to the aircraft's minimum equipment list
de-ice	The removal of ice, snow, or frost (from an aircraft)
de-icing pad	Designated area on an aerodrome where aircraft de-icing and anti-icing are carried out
DFC	Dryden Flight Centre
DFDR	Digital flight data recorder
DFO	Director of flight operations
DFTE	Designated flight test examiner
DH	Decision height

digital flight data recorder	A device that automatically records, in digital form, certain elements related to the performance of an aircraft such as engine performance and flight control position. It is used as a tool for accident investigation and, recently, aircraft maintenance
distance measuring equipment	On-board electronic equipment that provides continuous readout of the distance of an aircraft from a selected ground radio station
DM	Deputy minister
DME	*See* distance measuring equipment
DND	Department of National Defence
DOT	Department of Transport
downdraft	A localized area of descending air
E&I	Engineering and Inspection Manual
ECC	Emergency Coordination Centre
Elephant Beta	A vehicle developed in Sweden for the de-icing and anti-icing of an aircraft
elevation	The vertical distance of a point on the earth surface, measured from mean sea level
elevator	A hinged horizontal control surface connected to the horizontal stabilizer and connected to the control column to allow the pilot to control the pitch attitude of the aircraft
ELT	Emergency locator transmitter

emergency locator transmitter — A radio transmitter, attached to the aircraft structure, that operates from its own power source. It is designed to commence transmitting, without human action, following an accident. It transmits a distinctive signal on emergency frequencies for homing purposes.

empennage — An arrangement of stabilizing surfaces at the tail of an aircraft

ERR — Economic regulatory reform

ETA — Estimated time of arrival

ETD — Estimated time of departure

ETE — Estimated time en route

EWD — Equivalent water depth

FA — Flight attendant, described in the Air Navigation Orders as a cabin attendant, who is a member of the aircraft crew

FA — Area (weather) forecast

FAA — Federal Aviation Administration, the U.S. government agency responsible for safety regulations pertaining to aircraft

FACN — Area forecasts (Canadian)

FAR — Federal Aviation Regulation

FDR — Flight data recorder

final approach — The segment of the approach from the final approach fix to the point where the aircraft touches down on the runway or commences a missed approach. The final approach fix is normally three to four miles from the runway end.

FIR Flight information region

FL Flight level

flame-out To cease burning in the combustion chamber of a turbine engine from a cause other than deliberate shutdown

flaps Appendages to the wing of an aircraft that change its lift characteristics to permit slower landing and takeoff speeds

flare Decreasing the rate of descent and airspeed by raising the nose of the aircraft just prior to landing

flashover The spontaneous combustion of heated gases

flight data recorder A device that automatically records certain elements related to the performance of an aircraft, such as engine performance and flight control position. It is used as a tool for accident investigation and, recently, aircraft maintenance.

flight following A system, described in the Flight Operations Manual of an air carrier, for monitoring the progress of each flight from its point of origin to final destination, including intermediate stops and diversions. Also referred to as flight watch.

flight handbook The title used by the aircraft manufacturer, Fokker Aircraft B.V., to describe the F-28 Mk1000 Aircraft Flight Manual; in this case, it is set out in three volumes

Flight Operations Manual A manual produced by an air carrier for its own use and approved by the regulatory agency. It sets out the air carrier's flight operations organization, operating policies, and practices.

flight plan — Specified information related to the intended flight of an aircraft and filed with an air traffic control facility

flight release — Documentation produced by an air carrier that authorizes a given flight, including specific circumstances of such flight

flight service station — A facility operated by Transport Canada to provide information and assistance to flights. This is an advisory service only, and no traffic control is provided except as may be relayed from an air traffic control unit.

flight simulator — A flight-training device that simulates most modes of flight of a specific aircraft. It is used by air carriers to train and requalify flight crews to fly a specific aircraft.

flight watch — *See* flight following

flow control — An air traffic procedure designed to restrict the flow of aircraft during periods of excessive traffic congestion

FO *or* F/O — First officer

FOD — Foreign object damage (to an aircraft)

FOM — *See* Flight Operations Manual

forced landing — A landing that is made when it is impossible for an aircraft to remain airborne as a result of mechanical failure, such as loss of propulsion

FSO — Flight safety officer

FSS — *See* flight service station

FT — Terminal forecast

FTCN — Terminal forecast (Canadian)

GCA	Ground controlled approach
gearbox	A system of gears that transfers power from an engine to drive specific systems
GEN	Generator
g forces	Acceleration forces acting on an aircraft in flight expressed in multiples of the force of gravity
glide path (glide slope)	The vertical flight path followed by an aircraft on final approach; at times it is electronically generated by an instrument landing system
glycol	Chemical used in anti-freeze. Forms of glycol are used to de-ice and anti-ice aircraft.
GPU	*See* ground-power unit
GPWS	Ground proximity warning system
ground effect	The temporary increase in lift at very low altitudes due to compression of the air between the aircraft's wings and the ground
ground-power unit	A unit that is used to provide electrical power to an aircraft while it is on the ground
ground speed	The rate of motion of an aircraft over the ground, usually expressed in nautical miles per hour. It is the sum of the true airspeed plus or minus the effect of wind.
GS	Glide slope
Gx	International designation for Air Ontario
hard wing	A wing that has no high lift devices on the leading edge
head wind	That portion of the wind that acts to reduce the ground speed of an aircraft

holdover chart — A chart setting out guidance information as to the length of time de-icing and anti-icing fluids will protect an aircraft from contamination due to precipitation

holdover time — The time during which a de-icing or anti-icing fluid is considered to offer protection against the formation or accumulation of contaminants (frost, ice, etc.) on an aircraft

hot de-icing — De-icing of an aircraft while one or more of its main engines is running

hot refuelling — Refuelling of an aircraft while one or more of its main engines is running

HP — High pressure

HS — Hawker Siddeley (aircraft manufacturer)

HYD — Hydraulic

hydroplane — A condition in which moving aircraft tires are separated from the runway surface by a film of water, resulting in almost complete loss of brake effectiveness. Also referred to as aqua-plane.

IAS — Indicated airspeed

IATA — International Air Transport Association

ICAO — International Civil Aviation Organization

IFALPA — International Federation of Air Line Pilots Associations

IFR — *See* instrument flight rules

IIC — *See* investigator in charge

ILS — *See* instrument landing system

IMC	*See* instrument meteorological conditions
incident	An aviation occurrence, other than an accident, that affects or could affect the safe operation of an aircraft
instrument flight rules	Rules for the conduct of a flight in weather conditions below those required for visual flight
instrument landing system	A ground-based electronic system designed to provide guidance in both the horizontal and vertical planes for an aircraft to follow to a runway
instrument meteorological conditions	Weather conditions expressed in terms of visibility and distance from cloud and ceiling less than the minimum required to maintain visual flight
investigator in charge	An investigator appointed by the TSB to investigate or to lead the investigation into the circumstances surrounding an aviation occurrence
ISA	International standard atmosphere
JAA	Joint Aviation Authorities
JAR	Joint Aviation Requirement
JBI	James Brake Index. It is used in indicating the coefficient of friction of a runway surface.
Jet A fuel	Jet fuel with a relatively low volatility
Jet B fuel	Jet fuel with a relatively high volatility
journey log	A log required to be carried in an aircraft. Specified information on each flight, including crew names, flying times, defects, and rectification, must be entered in this log.

Kallax De-icing System — A computer-controlled gantry-type structure, developed in Sweden and similar to a giant automobile car wash, that has the capability to de-ice and anti-ice aircraft quickly. It is normally located near the departure end of a runway.

landing gear — The components of an aircraft that support and provide mobility for an aircraft on the ground. It consists of wheels and all supporting structures.

landing roll — The segment of a landing from touchdown until the aircraft either stops or taxis off the runway

LDA — Landing distance available

leading edge — The forward edge of an airfoil

leg — A single flight from one airport to another that is part of a series of flights by the same aircraft/crew combination

LF — Low frequency

lift-dumpers — Mechanical devices installed on the wings of some aircraft, including the F-28, that, when deployed, reduce lift and increase drag on the ground in order to reduce the stopping distance

liftoff — The time during the takeoff when the wheels of an aircraft leave the runway

line indoctrination — That portion of pilot training which is carried out during normal flying operations

line pilot — An airline pilot who has no supervisory or management status

load factor — The ratio of the acceleration load on an aircraft to the weight of the aircraft

LOC	Localizer (for non-precision approach procedures predicated on a localizer facility)
localizer	An electronic component of an instrument landing system that provides the pilot with guidance to the runway centre line
logbook	*See* journey log
LP	Low pressure
M *or* Mag	Magnetic
MAC	*See* mean aerodynamic chord
Mach	Mach number: speed relative to the speed of sound, with the speed of sound being designated as 1
master caution (or warning) light(s)	A light or lights, normally on the instrument panel of an aircraft, designed to draw the pilot's attention to a malfunction in one of a number of systems connected to the warning system
master minimum equipment list	A document, produced by the manufacturer and approved by the certification authority, that establishes the essential aircraft equipment allowed to be inoperative, under specified conditions, for a specific type of aircraft
MCM	Maintenance control manual
MEA	*See* minimum en route altitude
Mean aerodynamic chord	Chord of imaginary wing of constant section having same force vectors under all conditions as those of actual wing
MEC	Master Executive Council (CALPA)

MEDEVAC Medical evacuation, a term used to request air traffic services priority handling based on a medical emergency in the air transport of patients, organ donors, or organs or other urgently needed life-saving medical material. The term is to be used on flight plans and in radio-telephony communications if a pilot determines that a priority is required.

MEL *See* minimum equipment list

MEL Multi-engine land (endorsement of pilot's licence, referring to land-based, multi-engined aircraft)

minima, minimums A short form for minimum descent altitude or decision height

minimum en route altitude The published minimum altitude above sea level between specified fixes on airways or air routes which assures acceptable navigational signal coverage and meets the IFR obstruction clearance requirements

minimum equipment list An approved document that authorizes an air carrier to operate a specific type of aircraft with essential equipment inoperative under the conditions specified

MM (1) Middle Marker; (2) maintenance manual

MMEL *See* master minimum equipment list

MNR Ministry of Natural Resources

MRA Manual of regulatory audits

msg Message

msl Mean sea level

MTC Maintenance

NACIS	National Air Carrier Information System
NAMEO	Notice to Aircraft Maintenance Engineers
NASA	National Aeronautics and Space Administration (U.S.)
National Audit Program	The program of activities that measures the level of an organization's regulatory compliance with current legislation
nautical mile	A term used in navigation; it is equal to 6076 feet or 1.15 statute miles
NCATS	National Civil Air Transportation System
NDB	*See* non-directional beacon
non-compliance	The state of not meeting regulatory requirements
non-conformance	A deficiency in characteristics, documentation, or procedure that renders the quality of a product or service unacceptable or indeterminate
non-directional beacon	A low frequency radio beacon that transmits non-directional radio signals which a pilot of an aircraft with compatible receivers can use to determine his or her relative bearing
NOTAM	Notice to airmen
notice to airmen	A notice disseminated throughout the air traffic control system containing information concerning the establishment, condition, or change in any component of the National Airspace System
NTA	National Transportation Agency

NTSB	National Transport Safety Board, the United States government agency responsible for investigating and reporting on aircraft accidents
OAT	Outside air temperature
OC	*See* operating certificate
occurrence (aviation)	Any accident or incident associated with the operation of an aircraft; and/or any situation or condition that the Transportation Safety Board of Canada has reasonable grounds to believe could, if left unattended, induce an accident or incident
OFP	*See* operational flight plan
O/H	Overhaul
ojt	On-the-job training
ONF	C-FONF
ONG	C-FONG
operating certificate	A certificate issued by Transport Canada, certifying that the holder is adequately equipped and able to conduct a safe operation as an air carrier
operational flight plan	The operator's plan for the safe conduct of a flight, based on consideration of aircraft performance, other operating limitations, and relevant expected conditions on the route and at the aerodromes concerned
OPI	Office (or officer) of primary interest
OPP	Ontario Provincial Police
Ops	Operations

OSC	Onsite coordinator
out-of-trim	A situation in which the trimming devices on aircraft flight controls are not synchronized with the aircraft attitude
outside air temperature	Temperature of the air surrounding an aircraft at a distance far enough from the aircraft so as not to be affected by temperature rise due to aircraft speed
overshoot	To go beyond a designated mark or area. The term is often used to mean "missed approach."
participant	An individual representing an interested party, selected to take part in an accident investigation as a member of the investigating team
participant status	Status given to individuals or parties allowing full participation in an accident investigation
PATWAS	Pilot Automatic Telephone Weather Answering Service
PAX	Passenger
PCB	Program Control Board (subsequently, Resource Management Board)
pilot-in-command	A pilot who meets the requirements of the Air Navigation Orders and is designated as being in command of a flight
pilot-not-flying duties	Actions set out in the Aircraft Operating Manual or established through standard practice that are to be carried out by the pilot not flying the aircraft

pilot proficiency check — An annual check conducted on air carrier and other specified pilots to evaluate continuing competency on a specific aircraft type. This check is conducted to standards set out in Air Navigation Orders and may be conducted by an approved company check pilot or a Transport Canada inspector.

pilot's handbook — *See* Aircraft Operating Manual

PIP — Preliminary investigation procedures

PIREP — Pilot report of weather conditions in flight

pitch — The rotation of an aircraft around its horizontal axis. Pitch is controlled by elevators and often refers to the attitude of the aircraft in relation to the horizontal plane.

PNF — Pilot-not-flying

PPC — *See* pilot proficiency check

Program Control Board — An agency set up within Transport Canada to examine resource requests from within the department and to allocate resources to the highest-priority tasks

purser — A title often used to refer to the flight attendant who has been designated as being in charge of the cabin crew; sometimes referred to as the "in-charge"

pushback — The moving back of an aircraft from a gate by a ground vehicle

P/Y *or* PY — Person years

QRH — Quick reference handbook; same as checklist. It may have more or less information than a checklist, depending on the operating philosophy of the carrier.

Quality Assurance Review	A review of regional compliance with national policies, standards, and procedures in either operations or airworthiness
ramp	A defined area on an airport used by aircraft for loading and unloading passengers or cargo, for refuelling, for parking, or for maintenance
RASO	Transport Canada regional aviation safety officer
RCAF	Royal Canadian Air Force
RCC	Rescue Coordination Centre
RCMP	Royal Canadian Mounted Police
RCR	Runway condition report
RDAR	Transport Canada regional director, aviation regulation
Red 1, 2, and 3	Radio call signs of the three CFR vehicles at Dryden Airport
RLD	Rijksluchtvaartdienst (Netherlands equivalent to Transport Canada)
RMAS	Transport Canada regional manager, aviation safety programs
roll	The rotation of an aircraft around its longitudinal axis. Roll is controlled through use of ailerons or control-spoilers on the wings.
rotables	Aircraft parts that can be repaired or overhauled for re-use
rotation	During takeoff, the act of rotating the aircraft by a rearward movement of the control column in order to position the aircraft in the takeoff attitude

route bulletins	Information placed in bulletin books by Air Ontario flight operations management in order to keep pilots apprised of changes in policy or standard operating procedures
route manual	A manual provided by Air Ontario to its pilots that contains information on specific routes and aerodromes
rpm	Revolutions per minute
RSC	Runway surface condition
runup	Operation of an aircraft's engine prior to takeoff to confirm engine condition
runway designations	Runways are designated according to their orientation to the nearest 5° magnetic (or true). Where two parallel runways exist, they are further designated left and right.
runway threshold	The beginning of that portion of the runway which is usable for takeoff or landing
runway visual range	An instrumentally derived value, expressed in hundreds of feet, which represents the horizontal distance the pilot would be able to see down the runway at the point where the instrument is located
RVR	Runway visual range
SA	Station actual weather (weather report)
SAE	Society of Automotive Engineers
SAR	Search and rescue
self-dispatch	The planning and execution of a flight or series of flights, being the sole responsibility of the captain
SID	Standard instrument departure

side-slip The controlled flight of an aircraft in a direction not in line with its longitudinal axis. It requires cross controlling by the pilot; that is, application of aileron in one direction and rudder in the opposite direction.

SIGMET Significant meteorological report

simulator *See* flight simulator

slats Devices that can be extended from the leading edge of an airfoil in order to increase lift at low speeds

slipstream The stream of air discharged aft of a revolving propeller

slot time A time assigned to a pilot by air traffic control at which a departure clearance may be expected

SMOH Since major overhaul

snag A system or component malfunction or unserviceability entered in a journey log

SOC System operations control

SOPs Standard operating procedures

speed brake *See* air brake

Spey engines The common name for the Rolls-Royce engines installed on the F-28

spoilers *See* lift-dumpers

stall The sudden loss of lift of an airfoil when it exceeds its critical angle of attack (maximum lift coefficient)

stall fence A fence on an airfoil, its primary purpose being to improve behaviour at stall

standard operating procedures (SOPs) — The procedures reflected in a flight operations manual, an aircraft operating manual, or even a route manual that could be, and sometimes are, referred to as standard operating procedures. *See* Aircraft Operating Manual.

stick-shaker — A device that will induce rapid control column movement to warn the pilot that the airfoil is approaching the stall

STOC — Station operations control

STOL — Short takeoff and landing

stopway — A prepared surface at the end of a runway, to be used as required when stopping an aircraft. It is not built to the specifications of the runway and is not used during takeoff.

SVFR — Special VFR

swept wing — An aircraft wing that slopes in plan form so that the wing tip is further aft than the wing root. The angle formed by the fuselage and the wing leading edge is the degree of sweep.

system operations control — A group designated by an air carrier to carry out operations planning and economical utilization of aircraft and personnel. Note that operations control is distinct from operational control.

TACAN — Tactical air navigation aid (UHF omni range)

tail plane — An airfoil, located aft of the main airfoils, contributing to longitudinal control and/or stability

takeoff	(1) Procedure in which aircraft becomes airborne; (2) moment or place at which aircraft leaves ground or water; (3) net flight path from brake-release to screen height. (Note: Screen height is the height above ground of the top of screen on takeoff, normally 35 feet, which is measured at the end of the takeoff distance.)
takeoff alternate	An airport, designated as the landing airport in case of an emergency, where a takeoff is conducted in weather conditions that do not allow a landing at the airport of departure
takeoff distance available	The length of the takeoff run available plus the length of clearway, if provided
takeoff run available	The length of runway declared available and suitable for the ground run of an aircraft taking off
TAS	True airspeed
taxi	To operate an aircraft under its own power on the ground, except for takeoff or landing
taxiway	A specially prepared or designated path on an aerodrome, for use by taxiing aircraft
TBO	Time between overhaul
TC	Transport Canada
TCA	Terminal control area
TCAG	Transport Canada Aviation Group
TCU	Terminal control unit
TDZ	Touchdown zone
team leader	An individual designated by the audit manager to conduct a specific part of the audit
TGT	Turbine gas temperature

threshold	*See* runway threshold
thrust	The propulsive force developed by a jet engine, usually expressed in pounds
thrust-reverser	A device used on the ground to deflect the airflow from a turbojet engine forward in order to assist in slowing the aircraft
TI	Technical inspector
TL	Technical log
TODA	Takeoff distance available
TORA	Takeoff run available
touch-and-go	Where an aircraft touches down on the runway and the pilot deliberately takes off again. It is usually carried out in order for pilots to practise approaches and landings.
touchdown	The point where the wheels first touch the runway during a landing
touchdown zone	The first 3000 feet of runway from the threshold in the direction of landing
TP	Indicates a Transport Canada publication
transmissometer	A device used for the determination of runway visual range
trim	The positioning of flight controls and/or trim tabs so the aircraft will maintain a desired attitude in steady flight
true airspeed	Speed of the aircraft through the air corrected for air density (altitude and temperature)
trunk-feed (feeder-trunk)	Refers to the relationship between a national or international air carrier and its regional affiliate

TSB	Transportation Safety Board of Canada, the Canadian government agency responsible for investigating and reporting on transportation occurrences
TSN	Time since new
TSO	Time since overhaul
turbofan (engine)	A turbojet engine in which thrust is produced both by jet propulsion and by a fan (propeller) contained within the engine cowlings
turbojet (engine)	An engine using jet propulsion to provide forward thrust
turboprop aircraft	An aircraft driven by propellers that are powered by a turbojet engine
turn-and-bank indicator	A gyroscopic instrument for indicating the rate of turning and the degree of coordination or yaw
TWB	Transcribed weather broadcast
TWR	Control tower
Type I fluid	A de-icing fluid composed of a mixture of glycol, water, and anti-corrosive and wetting agents that is heated and sprayed on aircraft. The fluid removes contaminants and offers limited protection against icing.
Type II fluid	A glycol-based anti-icing fluid containing corrosion inhibitors, wetting agents, and polymeric thickeners. This pseudo-plastic fluid, applied at ambient temperatures, provides protection against the accumulation of ice and snow on aircraft; it is not used as a de-icing fluid.

UNICOM — A radio facility operated by agencies, other than Transport Canada, at an uncontrolled aerodrome to provide information to aircraft operating in the area. No air traffic control is provided.

unserviceable — The state of a system or component where that system or component is not capable of carrying out the function for which it is designed

updraft — A localized area of rising air

u/s — Unserviceable

UT of O — Unorganized Territories of Ontario (fire-fighters)

UTC — Coordinated Universal Time

V_1 — Takeoff decision speed: the aircraft speed during takeoff at which the pilot, having recognized the failure of the critical engine, decides whether to continue with the flight or stop the aircraft

V_2 — Takeoff safety speed: the minimum speed at which an aircraft is allowed to climb after reaching a height of 35 feet on takeoff

V_R — Takeoff rotation speed: the speed during takeoff at which the pilot initiates rotation of the aircraft to cause the aircraft to become airborne

VASIS — Visual approach slope indicating system. VASIS consists of a series of lights used to provide vertical visual guidance to pilots on final approach to a runway.

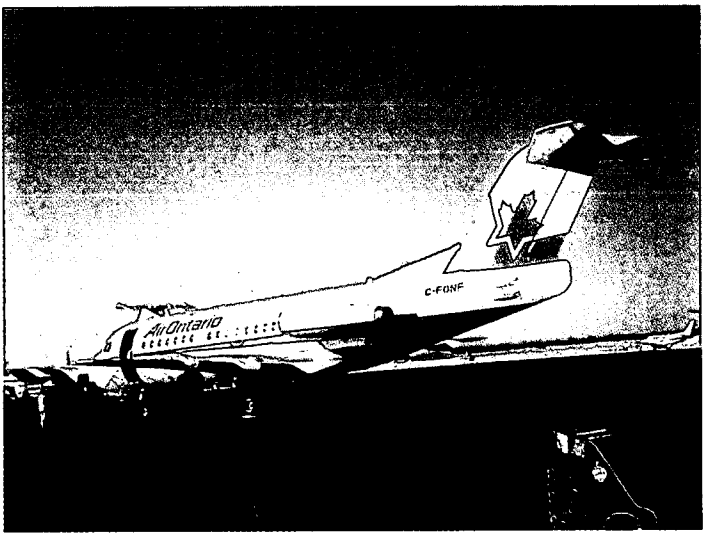
vector — A magnetic heading maintained by an aircraft at the request of air traffic control

VFR — *See* visual flight rules

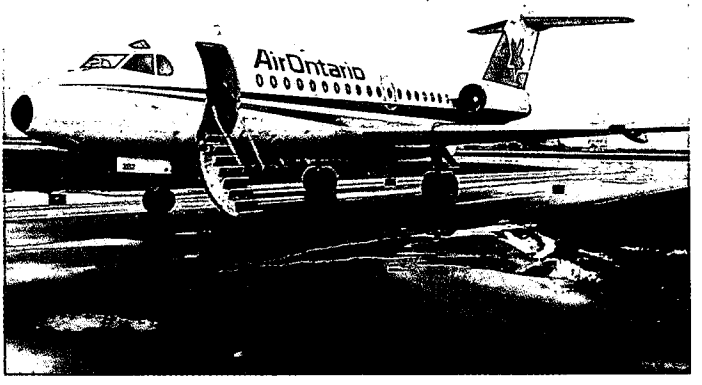
visual approach	A normal visual approach or an approach where an aircraft on an IFR flight plan, operating in VFR weather conditions and having ATC authorization, may proceed to an airport using visual references only
visual flight rules	Rules that provide for flight having continuous visual reference to the ground or water and requiring specified minimum weather conditions
visual meteorological conditions	Weather conditions expressed in terms of visibility and distance from cloud and ceiling equal to or greater than specified minima for VFR flight
VMC	Visual meteorological conditions
VNC	VFR navigation chart
VOLMET	In-flight meteorological information
VOR	Very high frequency (VHF) omni-directional range
walkaround	An external visual examination of an aircraft carried out prior to a flight
whiteout	Loss of orientation with respect to the horizon, caused by uniform light conditions from sky and snow
wind shear	A change in wind velocity along an axis at right angles to the general wind direction; usually specified as vertical or horizontal
wind sock	A cloth sleeve mounted aloft at an airport, for use in estimating wind direction and speed
WX	Weather
YAM	Sault Ste Marie airport

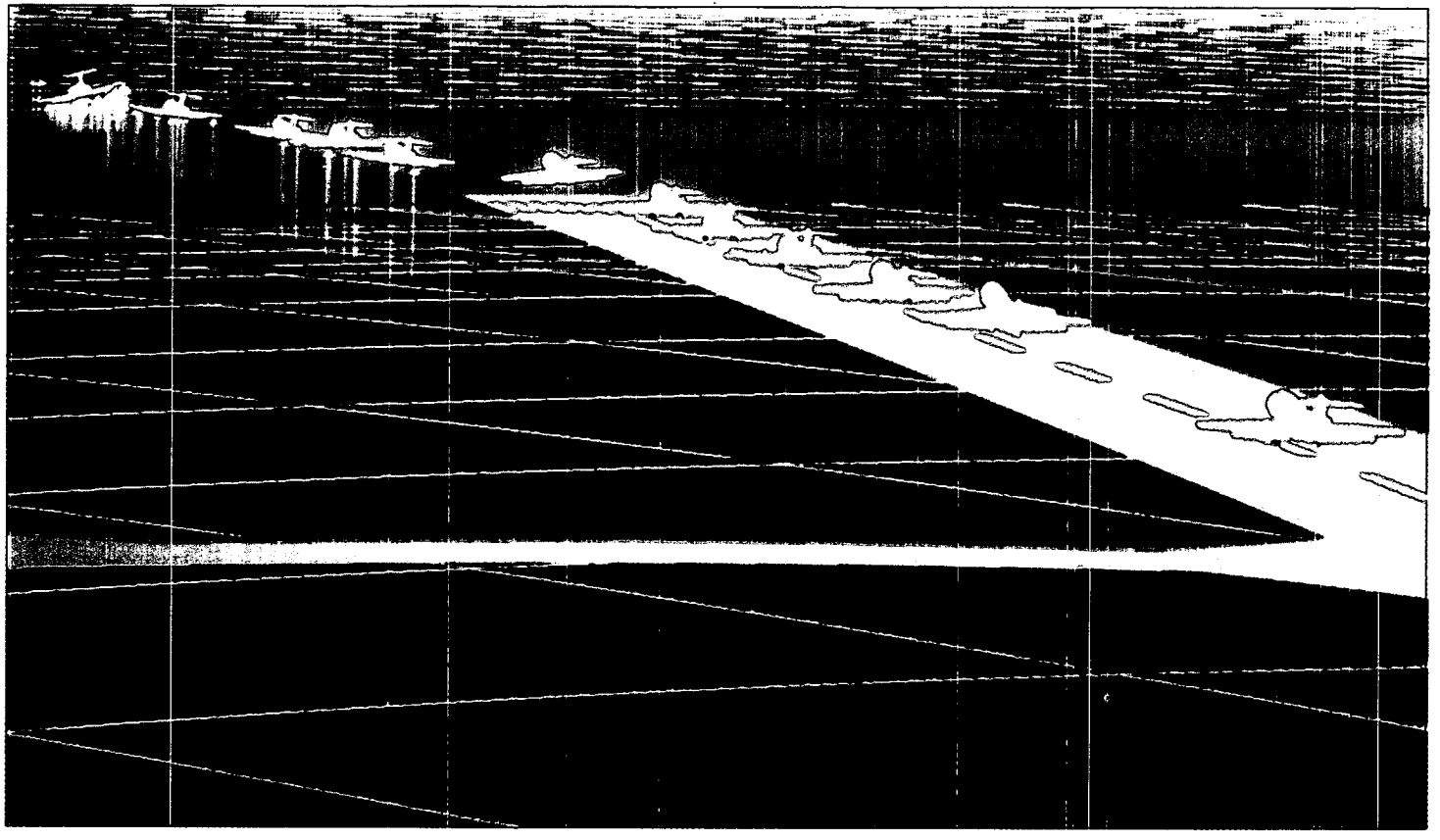
yaw	The rotation of an aircraft around its vertical axis. Yaw can be induced or corrected by use of the rudder on the vertical stabilizer.
YHD	Dryden airport
YQK	Kenora airport
YQT	Thunder Bay airport
YWG	Winnipeg airport
YXU	London airport
YYZ	Toronto/Lester B. Pearson International airport
Z	Zulu time (UTC)

Air Ontario C-FONF on the ground in Thunder Bay on February 21, 1989; this photograph was taken by a passenger boarding flight 1363 for Dryden that day.

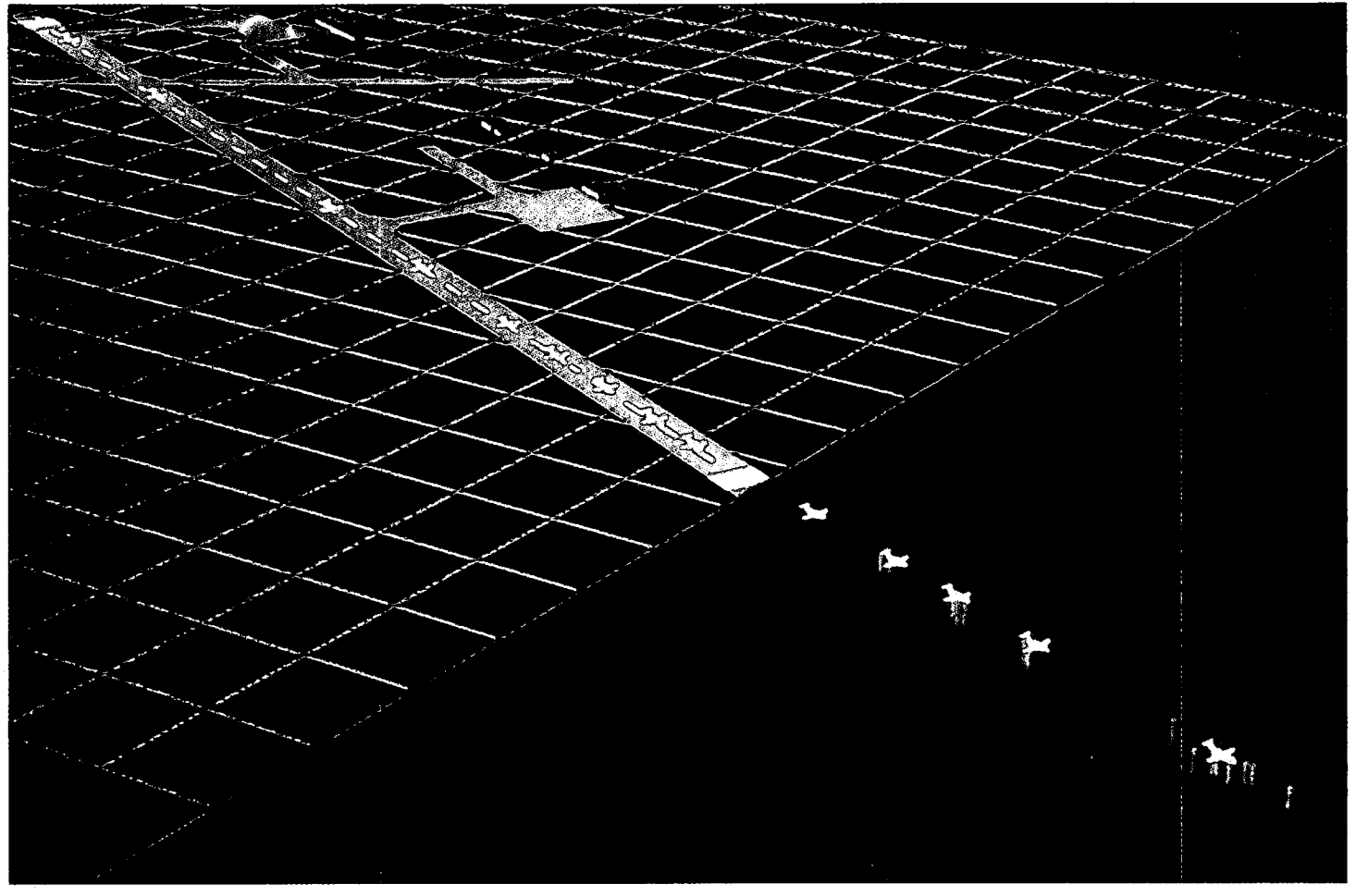


These views of Air Ontario's other F-28, C-FONG, show the exits available on this aircraft.

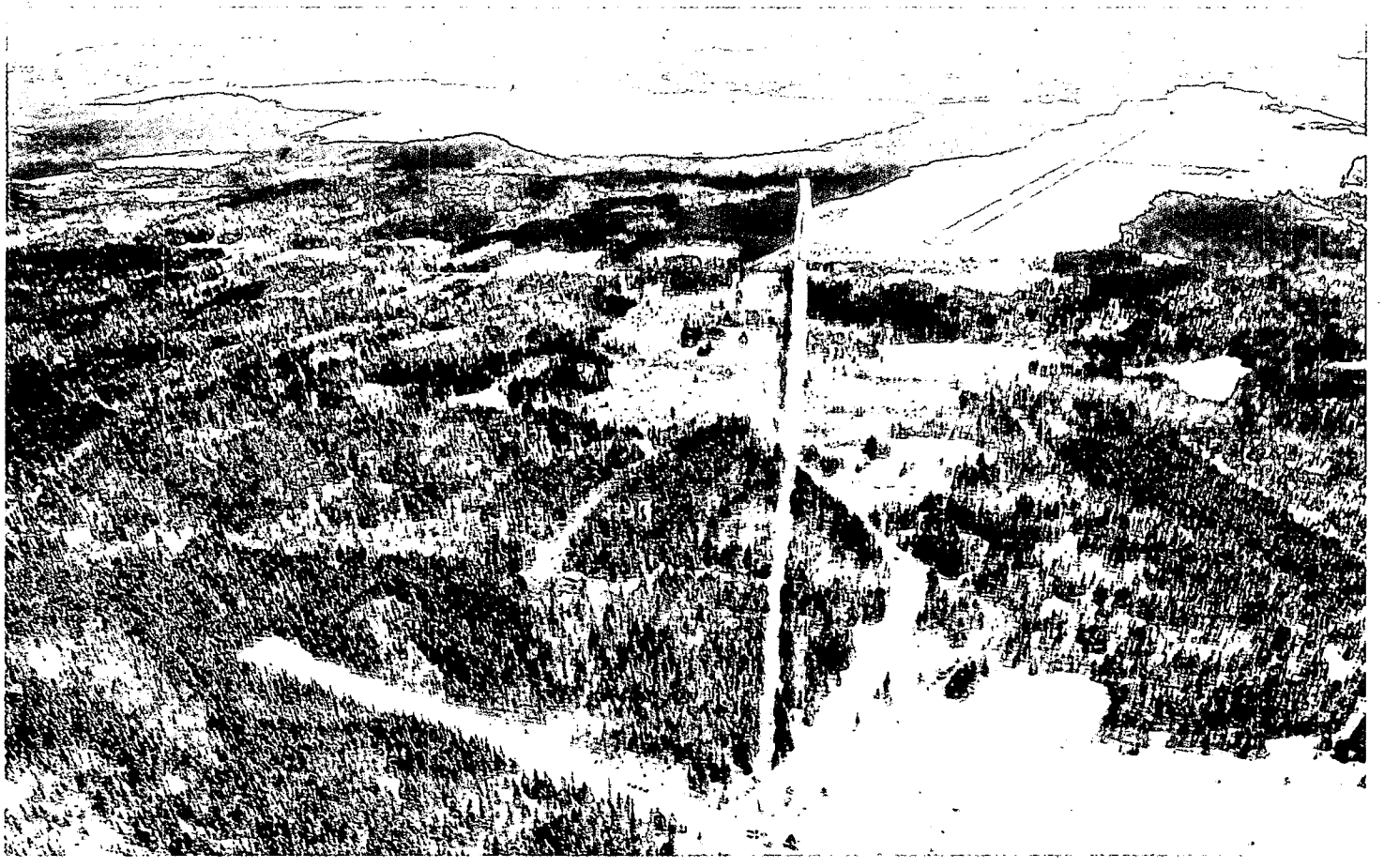




Computer-generated reconstructions of the takeoff were prepared for the Commission of Inquiry by the Canadian Aviation Safety Board (CASB) as part of the investigation of the crash. The first shows the aircraft from the perspective of the terminal: passing taxiway Alpha, attempting liftoff, settling back onto the runway, lifting off again towards the end of the runway, and contacting trees.



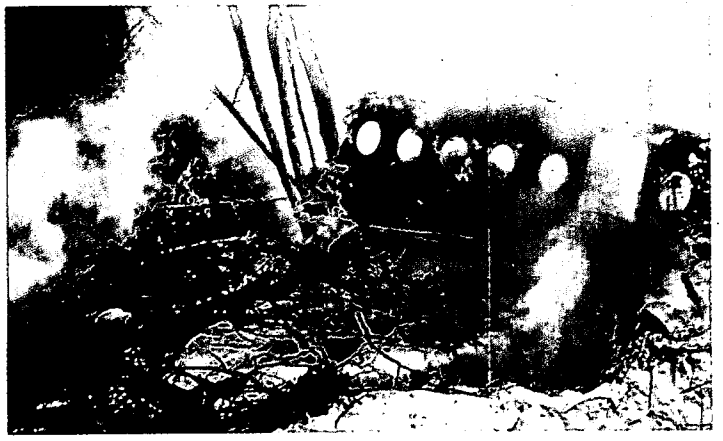
This reconstruction gives an aerial view of Dryden Municipal Airport and the takeoff attempt of flight 1363 on runway 29 on March 10, 1989.



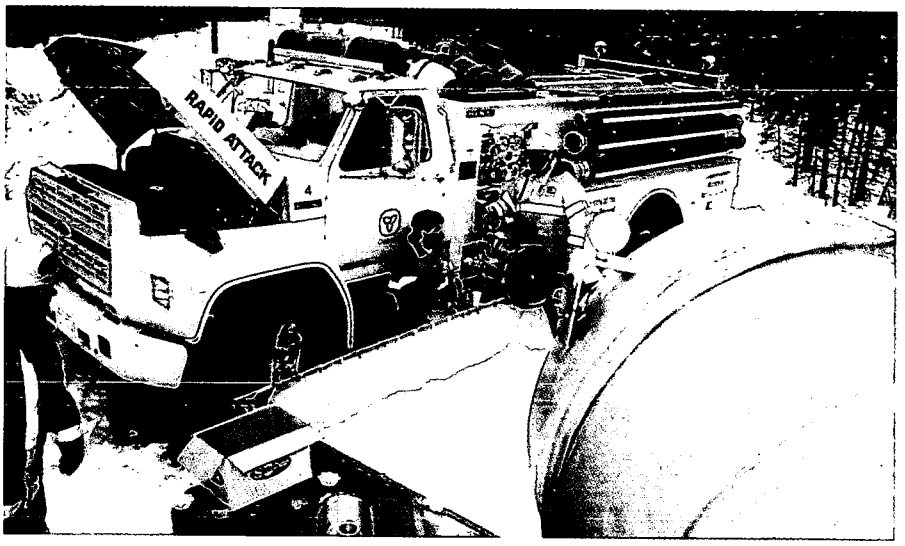
An aerial view, showing the flight path of C-FONF on March 10, 1989.

An aerial view of the wreckage of C-FONF, showing the aircraft in three pieces. The Air Ontario designator is clearly visible on the tail section.

This infrared photograph shows the extent of the fire damage to trees along the flight path.

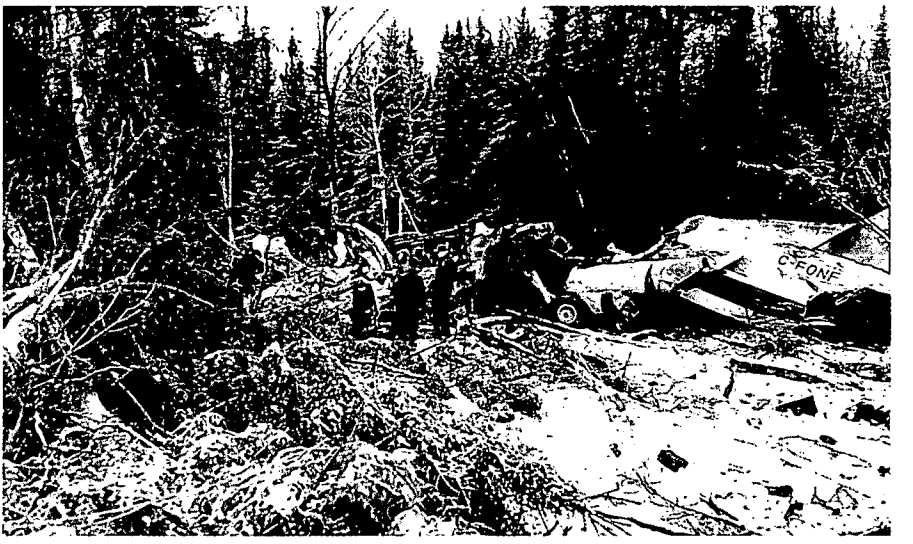


These photographs, taken by one of the fire-fighters in mid-afternoon March 10, 1989, convey the intensity of the fire which, by this time, is nearly extinguished.



By 2:00 p.m. the port-a-pond was set up on Middle Marker Road, filled from the tanker truck in the foreground, and foam was available to fight the fire.

An emergency road was bulldozed in to give access to the crash site.

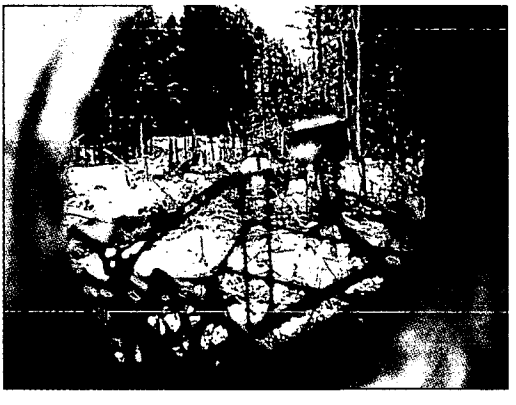


Investigators from the Canadian Aviation Safety Board (CASB) arrived at the site about noon on March 11, 1989.

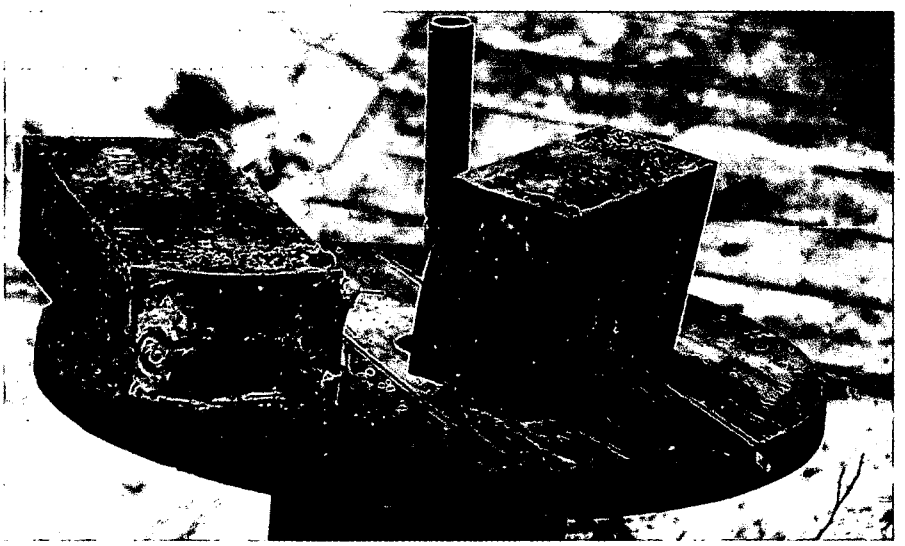
The path of flight 1363 is clear in this photograph taken by CASB investigators, looking west from runway 29 of Dryden airport.

The wreckage trail looking east from the site of the crash

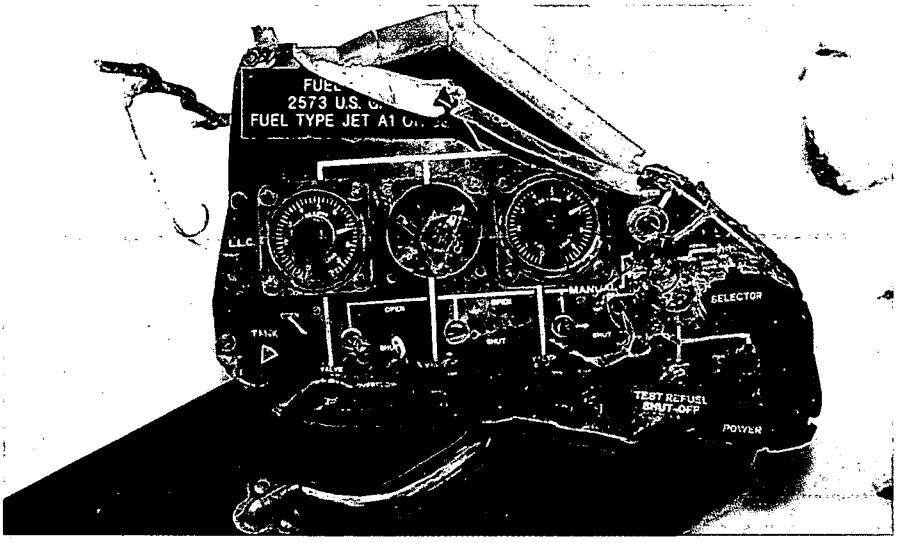
The wreckage trail looking west towards the wreckage from part way along the trail



The wreckage trail shot through the fuselage of the aircraft

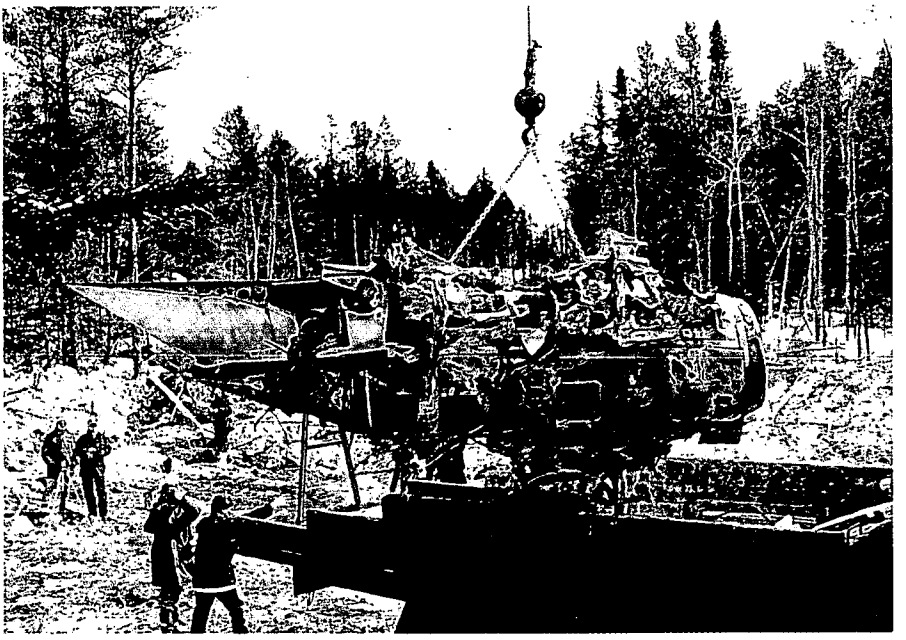


The cockpit voice recorder and flight data recorder were recovered, buried in debris, approximately 24 hours after the crash. On disassembly, it was discovered that the recording medium of both recorders had been destroyed by severe heat damage.

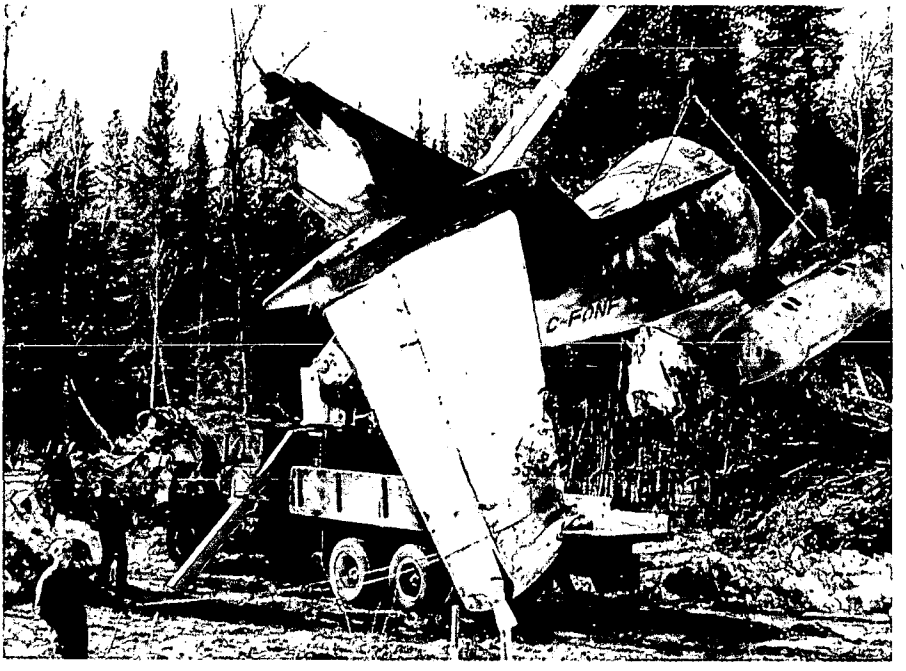


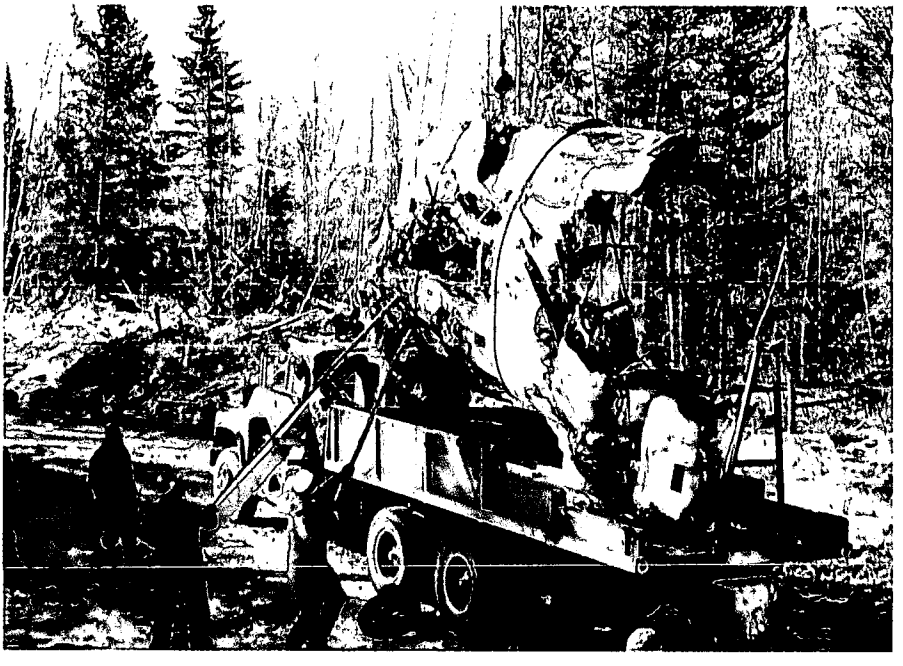
The refuelling panel, located in the wing, shows a fuel load of approximately 14,000 lbs.

The wreckage was carefully photographed in situ at the crash site by the investigators: top, right engine; bottom, rear section of the right side of the fuselage.

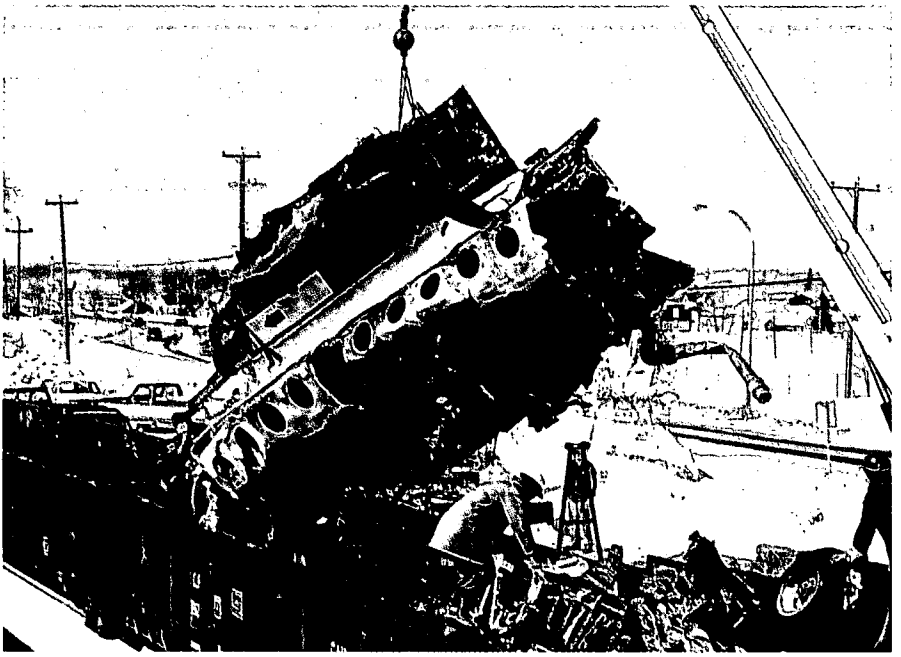


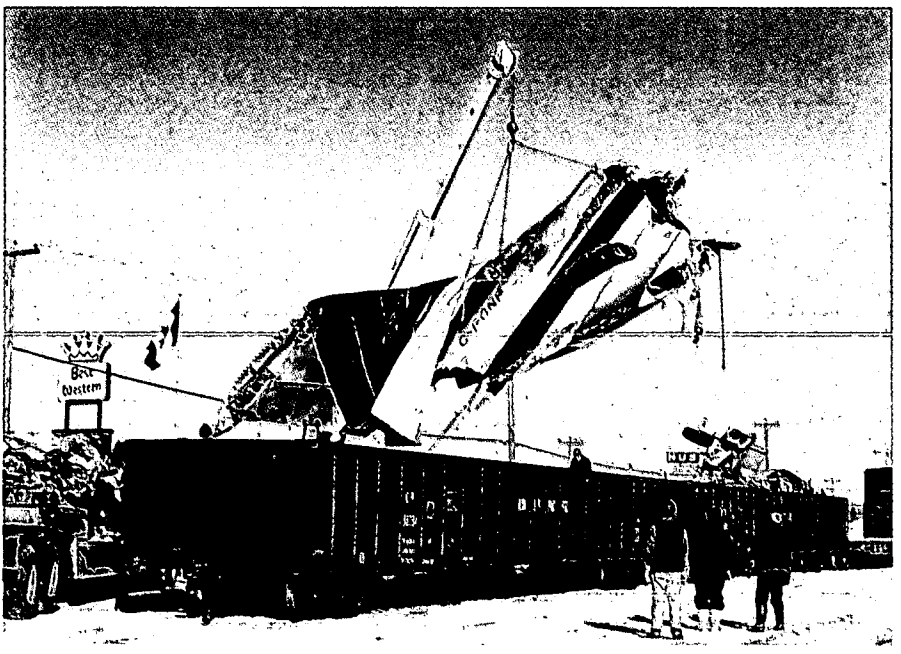
The aircraft was dismantled and transported to Ottawa for examination. These photographs show the left engine being removed and loaded onto a truck.



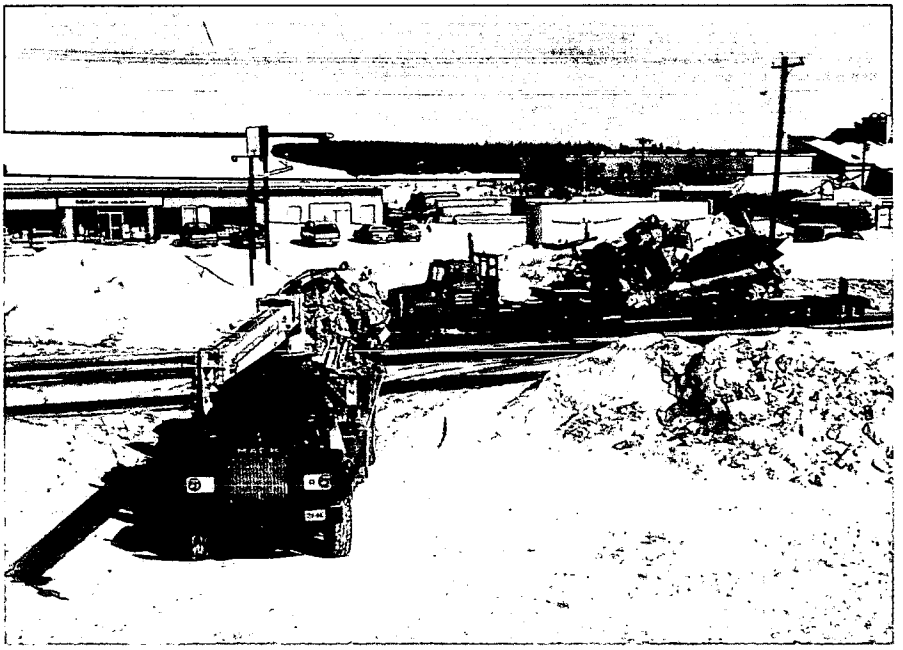


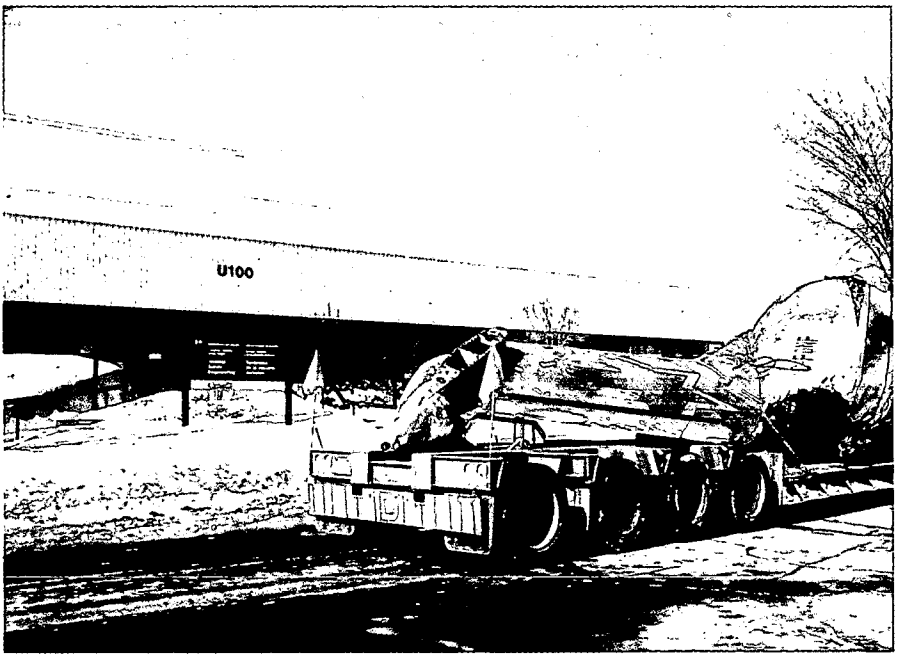
The tail section and part of the nose cone and fuselage centre section were moved from the crash site.





The aircraft sections were loaded onto gondola railway cars for transportation to Ottawa.





The aircraft wreckage was delivered to CASB's Engineering Branch in Ottawa for examination and analysis.

PART ONE

INTRODUCTION


RED LAKE
MANITOBA
ONTARIO
PICKLE LAKE
N
W
E
S
WINNIPEG
SIOUX LOOKOUT
KENORA
DRYDEN
VERMILION BAY
CANADA
FT. FRANCES
THUNDER BAY
RAINY RIVER
INT'L FALLS
LAKE SUPERIOR
SAULT STE MARIE
N. DAKOTA
MINNESOTA
DULUTH
U. S. A.
MICHIGAN
MINNEAPOLIS
WISCONSIN
LAKE MICHIGAN
MICHIGAN
MILWAUKEE
IOWA

1 INTRODUCTION

The Accident

On Friday, March 10, 1989, at approximately 12:11 p.m. Central Standard Time (CST),[1] Air Ontario flight 1363 crashed approximately 962 metres off the end of runway 29 after takeoff from the Dryden Municipal Airport. Air Ontario flight 1363 was a scheduled flight from Thunder Bay to Winnipeg via Dryden. The aircraft was a Fokker F-28 Mk1000 bearing Canadian registration C-FONF.

There were 65 passengers and a crew of four on board. The aircraft failed to gain altitude after its attempted takeoff from runway 29 and continued on a flat flight path, barely clearing a bluff approximately 700 metres from the end of the runway and crashing into a densely wooded area. In all, 21 passengers and three crew members, including the captain, the first officer, and one of the two flight attendants, died as a result of the crash and the accompanying fire.

There was extensive physical and fire damage to the aircraft, which resulted in the destruction of the flight data recorder (FDR) and the cockpit voice recorder (CVR) tapes. The loss of the FDR and the CVR data necessitated a detailed reconstruction of the crash sequence.

The Initial Investigation

An investigation into the crash of flight 1363 was immediately undertaken by the Canadian Aviation Safety Board (CASB) pursuant to the *Canadian Aviation Safety Board Act*, R.S.C. 1985, c.C-12 (the *CASB Act*). The investigator in charge (IIC), Mr Joseph Jackson of Ottawa, attended at Dryden on March 11, 1989, with a team of 21 CASB investigators. The CASB team carried on with its investigation as it would in any major accident investigation, interviewing witnesses and analysing the aircraft wreckage.

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[1] Local time will be used throughout this Report unless otherwise indicated. It should be noted that Dryden and Winnipeg are located within the Central time zone while Thunder Bay is located within the Eastern time zone. Thunder Bay time is one hour ahead of time in Dryden and Winnipeg.

On March 29, 1989, the CASB investigation was suspended and this Commission of Inquiry was established to inquire into the contributing factors and causes of the crash. I, as Commissioner, was authorized to make such recommendations as I may deem appropriate in the interests of aviation safety.

Following the formal establishment of the Commission, I took immediate steps to reactivate the accident investigation. I contacted the then chairman of CASB, Mr Ken Thorneycroft, and requested that certain CASB aviation accident investigators, including the IIC, be seconded to this Commission to assist in the conduct of the inquiry. This was done and, with the complete cooperation of CASB, the investigation of the crash of flight 1363 was transferred to this Commission.

Interpretation of Terms of Reference

In my opening statement on June 16, 1989, I commented upon my interpretation of the terms of reference of this Inquiry:

> I interpret the terms of reference to provide a broad mandate to inquire not only into the Air Ontario crash but also into any derivative matters which affect aviation safety, with respect to which I am directed to make such recommendations as I may deem appropriate. The Commission may, from time to time, enlarge, consolidate, delete, and/or modify any of the said areas of inquiry as the evidence unfolds.
>
> (Transcript, vol. 2, p. 51)

My interpretation has remained consistent throughout the life of the Commission.

I have interpreted the terms of reference to provide a broad mandate to inquire not only into the Air Ontario crash but also into any derivative matters that affect aviation safety. Essentially, the Commission was to conduct a thorough investigation in order to allow an assessment of the contributing factors and causes of the crash of flight 1363. This included the necessity to identify persons or organizations that may have contributed to the accident.

Aviation Accident Investigation: The System Approach

Modern air transportation is a complex enterprise. Similarly complex are the causes of aircraft accidents. Previous aircraft accident investigations have demonstrated that an accident or serious incident is not normally

the result of a single cause, but rather the cumulative result of oversights, shortcuts, and miscues which, considered in isolation, might have had minimal causal significance.

To assess all of the contributing factors and causes of this accident and to make recommendations in the interest of future accident prevention, this Commission adopted an analytical and a "system" approach to facilitate a methodical and thorough investigation of the accident. The system approach identifies the main components of the air transportation system and calls for an assessment of the performance of each of these components.

The components of the air transportation system are generally categorized as follows:

- the aircraft crew (including the pilots and the cabin crew)
- the aircraft
- the immediate operational infrastructure (including airport facilities, navigation aids, weather, and other communications facilities)
- the air carrier
- the regulator.

The aircraft crew, being immediately responsible for the safe carriage of the passengers, is the focal point of the entire air transportation system. The aircraft crew members must contend with the total operating environment of a given flight and any constraints placed upon them by their aircraft, their air carrier, the immediate operational infrastructure, and the regulator. The serviceability of the aircraft, the operational control of a particular flight, and the overall operational and flight safety ethic within which the crew functions are the products of air carrier management. The air carrier, in turn, operates in a highly regulated environment where the regulator is expected to establish and monitor standards for the aviation industry.

The evidence arising out of the Dryden crash has convinced me of one point above all: because of the potentially catastrophic consequences of a failure in the air transportation system, the aviation industry must operate within a regime of clearly defined and well-enforced standards. In Canada the standards of the air transportation system should be of the highest order that current technology permits.

A properly functioning air transportation system with appropriate standards operates as an ongoing check against the circumstances that can give rise to an accident. It became clear from the evidence that, when one or more of the components in the system breaks down, the probability of an accident or serious incident is increased. The accident at Dryden on March 10, 1989, was not the result of one cause but of a combination of several related factors. Had the system operated

effectively, each of the factors might have been identified and corrected before it took on significance. It will be shown that this accident was the result of a failure in the air transportation system.

The ultimate goal of this Inquiry, like that of all accident investigations, is to prevent future accidents. To this end I am of the view that a review of certain aspects of the air transportation system is most important. Accordingly, my approach has been to examine the relevant facts surrounding the accident and to assess whether the existing system reacted, or was capable of reacting, as it should have. After more than two years of intensive investigation and public hearings, I believe that this accident did not just happen by chance – it was allowed to happen.

The Components of the Commercial Air Transportation System

Having accepted an analytical framework for the investigation of this accident, I am of the view that my mandate required me to examine the components of the air transportation system and to assess reasons for the various failures in the system that, together, caused the crash of the aircraft on March 10, 1989. Accidents are, of course, often the result of several complex factors.

The Aircraft Crew

The aircraft crew is a significant component in the air transportation system. Pilots and flight attendants are trained professionals, and the travelling public has a right to expect that crew members will carry out their duties in a professional, competent manner.

As the performance of the regulator and the air carrier will be scrutinized, so too will there be an assessment of the conduct of the four crew members on flight 1363.

Captain George Morwood

Captain George Morwood, age 52, was an experienced pilot with approximately 24,100 flying hours. He received his commercial pilot's licence in 1955 and worked in a variety of flying jobs until 1973, when he joined Great Lakes Airlines, a predecessor to Air Ontario. He was employed by Air Ontario until his death in the crash on March 10, 1989.

During his career, Captain Morwood gained qualification on a number of aircraft types, including the Convair 440, a 55-passenger piston-engine propeller aircraft; the Convair 580, a 55-passenger turboprop aircraft; and the Grumman Gulfstream II, an executive jet. He received his qualification on the F-28 in January 1989 and, by the date of the accident, had

acquired 81.63 hours on that aircraft type. The F-28 was the largest jet aircraft he had flown, and the only jet aircraft he had flown in scheduled commercial service. Captain Morwood was described by his peers as a conscientious and competent pilot, who, to use the vernacular, "flew by the book."

Because Captain Morwood had fewer than 100 hours as pilot-in-command on the F-28 aircraft by March 10, 1989, he was under certain operational restrictions with regard to takeoff and landing weather limits. The determination of these limits is discussed in chapter 38 of this Report, Crew Information.

First Officer Keith Mills

First Officer Keith Mills, age 35, became a commercial pilot in 1975. In 1979 he joined Austin Airways Limited, another predecessor of Air Ontario Inc.

While at Austin Airways, he gained qualification on the Cessna 402, a seven-passenger piston aircraft; the de Havilland Twin Otter, a 19-passenger turboprop aircraft; the Hawker Siddeley HS-748, a 43-passenger turboprop aircraft; and the Cessna Citation, an executive jet.

First Officer Mills received his qualification on the F-28 in February 1989 and, by the date of the accident, he had acquired 65.7 flying hours on that aircraft type. He was described by his colleagues as an assertive pilot, and he had a satisfactory record with Transport Canada.

In spite of their considerable flying experience, neither Captain Morwood nor First Officer Mills had much experience on the F-28. "Low-time on type" crew pairings have been the subject of investigation and have been identified as causal factors in other aviation accidents, as will be discussed in chapter 40 of this Report, Human Performance.

Flight Attendant Katherine Say

Katherine Say, age 31, was a flight attendant with 10 years' experience and had been employed by Austin Airways and Air Ontario Inc. throughout that time. She was promoted to in-flight coordinator in February 1989. Mrs Say was considered by her colleagues to be an excellent crew member with a professional approach to her duties.

Flight Attendant Sonia Hartwick

Sonia Hartwick, the sole surviving crew member, was 26 years old on the day of the accident. She had two-and-a-half years' experience as a flight attendant, all with Austin Airways and Air Ontario. Along with Mrs Say, she had received the F-28 flight attendant training course

offered at Air Ontario, and was considered competent and professional in her work.

The Aircraft

The F-28 Mk1000 aircraft, C-FONF, was manufactured by Fokker Aircraft B.V. of the Netherlands. Its design and construction met the American certification criteria stated in Civil Air Regulation 4(b). It began flying in 1967 and was authorized for Canadian operation in 1972, when it received aircraft type approval from the Department of Transport.

The F-28 Mk1000 aircraft was last manufactured in 1976. It was designed for the short- to medium-range jet transport market and a brisk resale market exists for the model. A typical configuration of this aircraft will accommodate 65 passengers, requiring a crew of two pilots and two flight attendants.

The manufacture of aircraft C-FONF was completed on November 2, 1972, and from 1973 to 1987 it was part of the fleet of Turk Hava Yollari (THY), the Turkish national airline. It was powered by two Rolls-Royce Spey Model 555-15 engines manufactured in Great Britain. In 1987, after having been "mothballed" by THY in Turkey for two years, the aircraft was sold to Transport Aérien Transrégional of France and subsequently leased to Air Ontario in November 1987. It received a Canadian certificate of airworthiness on May 30, 1988, and its Canadian registration as C-FONF on June 13, 1988. Air Ontario was given a temporary amendment to its operating certificate on May 31, 1988, authorizing F-28 operations. Its operating certificate was formally amended to include the F-28 on June 10, 1988.

At the time of the accident Air Ontario was operating two F-28 Mk1000 aircraft: C-FONF and C-FONG.

The Carrier: Air Ontario Inc.

Air Ontario Inc. (Air Ontario) is the product of a functional merger[2] between Austin Airways Limited (Austin Airways) and Air Ontario Limited that occurred in June 1987. Before the merger, Austin Airways was the largest regional air carrier in Northern Ontario, with its main base of operations in Timmins. Between 1974 and the 1987 merger, this

[2] Though the terms "merger" or "functional merger" were used in testimony to describe the June 1987 union of Austin Airways Limited and Air Ontario Limited, there was never a formal amalgamation of the two companies. What actually occurred was an acquisition of the assets of Air Ontario Limited by Austin Airways. Austin Airways then changed its name to Air Ontario Inc., while Air Ontario Limited, having been stripped of its assets, was wound up. The terms "merger" and "functional merger" will be used in this Report as they were used by the witnesses who appeared before me.

largely charter and cargo operation prospered under the ownership and management of the Deluce family of Timmins, Ontario. At the time of the merger, Austin Airways had a fleet of 30 aircraft of seven different types. These aircraft ranged in size from the seven-passenger Cessna 402 to the 43-passenger Hawker Siddeley HS-748.

Air Ontario Limited, based in London, Ontario, provided scheduled service primarily in southern Ontario. At the time of the merger, Air Ontario Limited operated the 55-passenger Convair 580 aircraft exclusively.

In January 1987 Air Canada purchased a 75 per cent voting interest in both Air Ontario Limited and Austin Airways, with the Deluce family retaining a 25 per cent voting interest in the companies. In June 1987, after operating separately for five months, Air Ontario Limited and Austin Airways were functionally merged under the name Air Ontario Inc. After the merger, Air Canada and the Deluce family retained the same 75:25 ownership interests in the new Air Ontario Inc.

Air Ontario Inc. functioned as a regional "feeder" airline to Air Canada's national transportation network. Because of a common marketing, ticketing, and scheduling arrangement, Air Ontario passengers were able to benefit from the coordinated connection of their Air Ontario regional flight to a national or international Air Canada flight.

Air Ontario was one of several regional airlines across Canada that fed into Air Canada "hubs" at major airports. Air Ontario was the primary regional feeder for Air Canada at Lester B. Pearson International Airport. To a lesser extent, Air Ontario provided a regional feed into Winnipeg International Airport.

By the date of the accident, Air Ontario Inc. was a different airline from the one that existed at the time of the merger in June 1987. It had divested itself of most of its old Austin Airways northern routes and had become primarily a scheduled carrier based in London, Ontario, operating Convair 580, Dash-8, and F-28 aircraft.

The Regulator: Transport Canada

Transport Canada is the body charged with the responsibility for the promulgation and enforcement of aviation regulations and standards in Canada. Furthermore, Canada is a signatory to a number of international conventions that define additional standards under which passengers are carried by air.

The reason for this degree of regulatory involvement is straightforward. A safe and reliable air transportation industry is important to the economic well-being of Canada. Equally obvious is the proposition that the regulator owes a duty to the travelling public to keep the industry

as safe as practicable. The regulatory duty arises from the fact, which is often overlooked, that the public has given the regulator its trust.

The *Aeronautics Act*, R.S. 1985, c.A-2, and the Air Regulations, C.R.C. 1978, c.2 (Air Regulations), together with the Air Navigation Orders (ANOs), are the legislative instruments governing Canadian aviation. Operating standards for air carriers, like Air Ontario, using large aircraft[3] are set out in Air Navigation Order Series VII, No. 2, C.R.C. c.21 (ANO Series VII, No. 2).

Pursuant to section 4.2 of the *Aeronautics Act*, the minister of transport "is responsible for the development and regulation of aeronautics and the supervision of all matters connected with aeronautics" in Canada. Transport Canada is the federal department that gives effect to the minister's statutory mandate.

There are two groups within Transport Canada responsible for aviation: the Airports Authority Group and the Aviation Group. The Airports Authority Group is responsible for the development, maintenance, and operation of essential airport services throughout Canada. The Aviation Group is divided into two significant branches:

- the Air Navigation Systems Branch, which is responsible for, among other things, air traffic control and navigation and communication systems; and
- the Aviation Regulation Branch, which is responsible for the development and promulgation of regulations and standards; the certification and monitoring of aviation personnel, airlines, aircraft, and aeronautical products; and the enforcement of the *Aeronautics Act*, Air Regulations, and ANOs.

The Aviation Group is divided administratively into a national headquarters and six regions: Atlantic, Quebec, Ontario, Central, Western, and Pacific regions. Each is responsible for the regulation of aviation in Canada. The ongoing regulation of Air Ontario Inc., as a commercial air carrier based in London, Ontario, was the responsibility of the Ontario regional office.

Carriers' Obligation and Regulator's Duty

As will become clear throughout the Report, the regulator – Transport Canada – has imposed significant responsibilities in the area of flight safety on individual Canadian air carriers.

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[3] "Large aircraft" means an aircraft of more than 12,500 pounds maximum certificated takeoff weight (ANO Series VII, No. 2, s.2).

The provision of an acceptable level of flight safety is an obligation owed by both the air carrier and the regulator to the Canadian travelling public. The regulator, as an arm of government, has a duty to the public to fulfil its role in the promulgation and enforcement of legislative standards within the air transportation system. A licensed air carrier has an obligation to comply with the standards set out in the applicable legislation. As discussed in later chapters of this Report, the legislation governing Canadian commercial air carriage is not universally comprehensive or exhaustive. While in some areas the legislative requirements are detailed and well developed, in other areas the legislation is broadly worded and indefinite.

For example, air carriers are directed by the ANOs to conduct their operations "in a proper manner," leaving it up to an individual carrier and regulator to come to an agreement as to what is "proper" under the circumstances. If there is scope for interpretation, it must be emphasized that air carriers cannot simply rely on legislation to define the limits of their flight safety obligations. As is the case with any business enterprise, air carriers must conduct their affairs in a reasonable and prudent manner.

The fulfilment of flight safety obligations is part of the operating costs for air carriers. Again, as is the case with any commercial enterprise, success will be the result of the prudent balancing of commercial considerations with legislated and civil obligations.

The duty owed by a carrier to its passengers is not mitigated by inadequate or absent legislation, but rather it is independent of the regulator's obligations within the safety system. Throughout this Report, certain deficiencies within Transport Canada will receive comment. Air Ontario's corporate role in this accident is assessed against what I view to be its independent obligation to its passengers. Air Ontario, independent of regulatory requirements, is obliged to its passengers to provide the highest standard of flight safety reasonably available.

Within a regulated industry, legislation that is perceived as commercially threatening will be resisted by that industry. The Canadian air transportation industry is no different. The regulatory process in Canada, in fact, allows for discourse between the regulator and industry when such issues arise. This process ensures that the regulator will consider the economic viability of proposed legislation as well as its implications on flight safety.

When the regulator is faced with the choice between the commercial viability of an individual operator and the highest level of safety reasonably available to the travelling public, I am of the view that, for the reasons previously stated and later elaborated upon, the duty to the public must take priority.

It is against the propositions of the corporate obligation and the legislator's public duty that I have weighed the actions of Air Ontario and Transport Canada in determining their effectiveness as components of the air transportation system.

PART TWO

FACTS SURROUNDING THE CRASH OF FLIGHT 1363

2 AIR ONTARIO FLIGHTS 1362 AND 1363

Winnipeg

The four Air Ontario crew members, Captain George Morwood, First Officer Keith Mills, and flight attendants Katherine Say and Sonia Hartwick, arrived at the Air Canada counter of Winnipeg International Airport at 6:40 a.m. on March 10, 1989, to prepare for the day's flying.[1] Their scheduled flights consisted of a Winnipeg to Thunder Bay return trip, with intermediate stops at Dryden (flights 1362 and 1363), followed by another Winnipeg to Thunder Bay return trip without the Dryden station stop (flights 1364 and 1365). In all, there were six legs to their scheduled flying on March 10. Their first departure from Winnipeg was scheduled for 7:25 a.m., with the final landing at Winnipeg scheduled for 3:30 p.m. As was normal before the first flight of any day, the crew checked on the weather and the condition of the aircraft, and received the company flight authorization (flight release).

The Weather, Fuel and Passenger Loads, Aircraft Weight

The area weather forecasts for the day's operations showed generally unsettled and deteriorating weather, including lowering cloud ceilings and freezing precipitation as the day progressed. Terminal weather forecasts for Thunder Bay and Winnipeg were available to the crew before their departure. These forecasts indicated conditions that could potentially deteriorate to below the captain's landing limits at their scheduled arrival times. There was no terminal weather forecast for Dryden available at this time.

Because of these forecasts of unsettled weather, the crew had to accommodate deviations from normal flight planning. Air Regulations

[1] Air Ontario utilized Air Canada station facilities at Winnipeg and Thunder Bay. These Air Canada Station Operations Control (STOC) centres often provided communication links between Air Ontario pilots and their own System Operations Control (SOC) facilities in London. Air Ontario aircraft had no direct radio communications link with Air Ontario SOC. Air Ontario pilots could communicate with their SOC by a radio call to an Air Canada STOC, which would in turn relay messages via telephone to Air Ontario SOC.

require that an aircraft carry fuel sufficient to fly to an alternate airport (alternate) in case the crew is unable to land the aircraft at its planned destination. The crew of C-FONF had to plan for Sault Ste Marie as an alternate, and because it was a more distant alternate than usual, they had to carry a greater fuel load. Fuel and passenger loads are two significant variables in the calculation of total aircraft weight. The F-28, like all commercial aircraft, is limited by maximum takeoff and landing weights.

As it happened, March 10, 1989, was the Friday before the Ontario spring school break. A heavy passenger load from Thunder Bay to Winnipeg, which included many families commencing their vacations, combined with the extra fuel required to accommodate the longer alternate, necessitated a refuelling on the second Dryden station stop. Normally, fuel would not be taken on in Dryden.

The Flight Release

Each Air Ontario revenue flight must, in accordance with Air Regulations and the company's Flight Operations Manual, be specifically authorized before departure. Normally this is done through the issuance of a flight release by Air Ontario System Operations Control (SOC) in London. The flight release is then sent by telex to the point of departure, where it is picked up by the captain of the planned flight, and to all online stations.

The flight release contains significant operational information that governs the conduct of all flights. It is typically planned and prepared by the SOC in London before the intended flights. The flight release specifies the planned alternates, aircraft weights, fuel consumption, passenger loads, and other operational information necessary for the crew to conduct its flights in a safe and orderly manner. The flight release is a document used by Air Ontario to fulfil its fundamental obligation to exercise operational control over its aircraft (see chapter 23, Operational Control).

The flight release made available to Captain Morwood on the morning of March 10, 1989, at Air Canada Station Operations Control (STOC) in Winnipeg contained numerous errors. It was prepared and issued by an Air Ontario SOC dispatcher who was untrained and unfamiliar with the operational characteristics of the F-28 aircraft. The errors in the flight release should have been manifest to a pilot of Captain Morwood's experience and reputation and to First Officer Mills. Somewhat uncharacteristically, Captain Morwood did not contact Air Ontario SOC on the morning of March 10 to rectify the errors and have a new flight release issued.

The Unserviceable Auxiliary Power Unit

When Captain Morwood reviewed the operational state of his aircraft, he would have discovered that the auxiliary power unit (APU) was unserviceable. The APU normally provides compressed air and electrical power to various aircraft systems while the aircraft is on the ground. A flow of compressed air is required to start the F-28 main engines, and this flow is usually supplied by the APU. After one main engine is started with the APU, that engine can generate its own compressed air to start the other engine via a cross-bleed start. An independent source of compressed air such as an air compressor or an "air bottle"can be used to start the aircraft's main engines whether or not an APU is functioning.

The APU on C-FONF had not been functioning normally for the five days preceding the accident. On occasion, it was not producing enough air pressure, a deficiency that caused high engine temperatures during startup. On several occasions while in flight, an oily mist or smoke was observed in the passenger cabin and was detected by the cabin smoke alarm. Although never confirmed, this smoke was believed by maintenance personnel to have been caused by problems with the APU or the air conditioning air cycle machine.

Throughout the week preceding March 10, Air Ontario maintenance attempted, with limited success, to cure the APU problems. On the morning of March 9, the aircraft was in Toronto and was expected to be operational for a full day's flying. However, that morning Air Ontario maintenance was again trying to rectify the persistent APU problems. After several attempts, maintenance was unable to repair completely the APU, and the aircraft missed its originally scheduled morning flights. In the late afternoon, the pilot-in-command, the maintenance inspector on duty, Air Ontario SOC, and Air Ontario Maintenance Control collectively decided to dispatch the aircraft to Winnipeg and to defer the repair of the APU until the aircraft returned to Toronto on the night of March 10.

This maintenance deferral was carried out pursuant to the company's minimum equipment list (MEL), a document approved by Transport Canada that allows operators to dispatch aircraft with certain items unserviceable (see chapter 16, F-28 Program: APU, MEL, and Dilemma Facing the Crew). Because of the maintenance deferral, the APU would not be used until the problems were rectified.

On March 9, the aircraft was flown from Toronto to Winnipeg via Sault Ste Marie, Thunder Bay, and Dryden. It was parked in Winnipeg overnight, where it received a routine daily inspection by Air Ontario maintenance personnel.

A problem facing Captain Morwood on the morning of March 10 in Winnipeg was that Dryden did not have the ground-start equipment

needed to start the F-28's engines when the APU was unserviceable. As a result, Air Ontario SOC in London notified Captain Morwood in the flight release that he would have to leave one engine running during his Dryden station stops. If for any reason both engines had been shut down in Dryden, they could not have been restarted unless the APU had been started in accordance with the procedures set out in the MEL; a mechanic had been able to repair the APU; or an independent source of compressed air (such as an air bottle) had been transported to Dryden and used for engine startup.

The inability to restart the engines once they were shut down resulted in two significant operational considerations. First, since it was necessary to take on fuel in Dryden, the refuelling had to be carried out with one engine running. This procedure is described as "hot refuelling." Second, the aircraft could not be de-iced at Dryden because a proscription had been published in both a Fokker aircraft winter operations bulletin and an Air Ontario operational directive against de-icing the F-28 aircraft with one or both engine(s) running. It should be noted that Captain Morwood did not request nor was he given any dispensation from this proscription.

Departure from Winnipeg

After his weather briefing on the morning of March 10, 1989, and his receipt of the flight release and other pertinent operational information, Captain Morwood prepared for departure on flight 1362 to Thunder Bay via Dryden.

The flight attendants had noted several deficiencies in the cabin equipment throughout the week preceding the accident. On March 10 the persisting deficiencies or "snags" on C-FONF included missing oxygen equipment, a passenger door that was difficult to close properly, and emergency exit lighting that was not serviceable. The flight crew was aware of these deficiencies in the cabin equipment, and flight attendant Hartwick testified that Captain Morwood expressed frustration that the snags had not been repaired.

In addition to the usual pre-flight checks, Captain Morwood requested that Air Canada ground personnel de-ice C-FONF. The aircraft had been sitting outside overnight and there may have been some frost on the wings.

Air Ontario flight 1362 departed Winnipeg for Dryden at 7:49 a.m. with 11 passengers on board. Although the weather at Dryden was acceptable for the flight, the weather at Thunder Bay was below the captain's landing limits and did not improve during the flight from Winnipeg to Dryden.

Air Ontario SOC requested the Dryden passenger agent[2] to ask Captain Morwood to call SOC when Air Ontario 1362 arrived. The aircraft landed in Dryden at 8:19 a.m., approximately 13 minutes late. The delay was partially attributable to the de-icing in Winnipeg.

First Dryden Station Stop

After landing at Dryden, Captain Morwood left the aircraft to telephone Air Ontario SOC. First Officer Mills remained in the aircraft and, because of the unserviceable APU, the right main engine was left running. The aircraft was not refuelled during this station stop.

At about 8:30 a.m. CST the London SOC duty manager, Mr Martin Kothbauer, advised Captain Morwood by telephone that he was going to hold the aircraft in Dryden pending an improvement in the Thunder Bay weather. The captain reminded Mr Kothbauer that the aircraft engine was running and that they were consuming fuel while they waited. Mr Kothbauer instructed Captain Morwood to call back at 8:45 a.m. CST for further consultation.

At 8:00 a.m. CST Thunder Bay was reported to have an overcast cloud ceiling of 100 feet with a visibility of three-eighths of a mile in fog. When Captain Morwood telephoned Air Ontario SOC a second time, the weather at Thunder Bay was still below his landing limits. Nevertheless, based on an observed trend towards improved weather conditions, alternate fuel requirements, and the aircraft fuel consumption with one engine running, SOC agreed to have Air Ontario flight 1362 depart Dryden for Thunder Bay. It was hoped that the Thunder Bay weather would improve while the aircraft was en route. SOC notified Sault Ste Marie of a possible diversion of the flight, should the weather not improve.

Air Ontario flight 1362 with its 30 passengers departed the ramp at Dryden at 8:50 a.m. CST, 20 minutes late. While en route, the Thunder Bay weather improved, and Air Ontario flight 1362 landed uneventfully in Thunder Bay at 10:32 a.m. EST, approximately 20 minutes late. This concluded the Air Ontario 1362 flight segment. The flight number then changed to Air Ontario flight 1363 for the return trip to Winnipeg via Dryden.

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[2] Air Ontario aircraft and passenger handling in Dryden was carried out by their contract agent, the Dryden Flight Centre.

Thunder Bay Station Stop

The flight release issued by Air Ontario SOC indicated passenger loads of 55 from Thunder Bay to Dryden and 52 from Dryden to Winnipeg. The planned alternate was again Sault Ste Marie via Thunder Bay and, in accordance with the flight release, the aircraft was to be refuelled to 15,800 pounds of fuel on board (FOB) prior to departure from Thunder Bay. Altogether, 3310 litres, or about 6190 pounds, of fuel were added. At approximately 11:00 a.m., after the aircraft was refuelled, Air Canada STOC in Thunder Bay advised Air Ontario SOC in London that Air Ontario flight 1363 was overweight. The overweight resulted from Air Canada's STOC having booked 10 passengers from a Canadian Partner flight that had been cancelled earlier in the day onto flight 1363, in addition to the 55 already booked. It appears that Air Canada STOC in Thunder Bay did not inform Air Ontario SOC in London about the change in passenger load in time to allow SOC to inform the flight crew and amend the flight release for flight 1363 with regard to the passenger load and the maximum fuel load.

When faced with this overweight situation, Captain Morwood informed Air Canada STOC in Thunder Bay that he would off-load the additional 10 passengers and their baggage. However, when Air Canada STOC advised the Air Ontario SOC duty manager in London of Captain Morwood's intentions, the SOC duty manager elected to keep the extra passengers on the flight and to make the appropriate weight reduction by off-loading fuel. This defuelling procedure imposed an additional 35-minute delay on the departure of flight 1363 from Thunder Bay. The flight crew was informed of and agreed to the defuelling, and 1510 litres of fuel, or about 2823 pounds, were downloaded from the aircraft, leaving approximately 13,000 pounds FOB.

A number of the passengers on flight 1363 were to make connections out of Winnipeg. During the period from the boarding in Thunder Bay through the station stop in Dryden, many passengers were making inquiries of the flight attendants regarding their connecting flights in Winnipeg. The flight attendants made the flight crew aware of these passenger concerns. Mr Peter Shewchuk, the Air Canada radio operator in Thunder Bay through whom the flight crew was relaying its messages, testified that the flight crew expressed concern regarding the passenger connections. Flight attendant Hartwick also stated that, because of the apparent misunderstanding over passenger and fuel loads and the resulting delay during the Thunder Bay station stop, both Captain Morwood and First Officer Mills expressed anger and frustration. Mr Warren Brown, an off-duty Air Ontario dispatcher, sat in the observer's jump seat in C-FONF and spoke with Captain Morwood and First Officer Mills during the Dryden-to-Thunder Bay leg. Although Mr

Brown described the crew as having been in good spirits prior to landing in Thunder Bay and looking forward to their days off after the flying segment, it is clear from the evidence that their mood changed while they were on the ground at Thunder Bay.

Although Dryden was not a normal refuelling stop, the flight release for flight 1362/1363 anticipated a refuelling in Dryden to 15,000 pounds FOB[3], again with one engine running. This was the so-called hot refuelling procedure.

During the Thunder Bay station stop an amended terminal weather forecast for Dryden, calling for freezing precipitation, was issued. The previous Dryden terminal weather forecast did not. It is normal and prudent procedure that, prior to departure, flight crews operating in instrument meteorological conditions (IMC)[4] check the weather of their destination; and it is mandatory that they check the weather of their alternate. The crew of flight 1363 had access to the Dryden weather forecast via the Air Canada Reservac computer terminal in the Thunder Bay crew room, and they were seen in the crew room during their station stop. It is not known, however, whether in fact they checked the amended forecast.

At 11:55 a.m. EST Air Ontario flight 1363, with 65 passengers and one infant on board, departed Thunder Bay, approximately one hour late. As they approached Dryden, the crew were informed that the runways were bare and dry and that light snow grains had been reported in the previous hour to the west of Dryden. The aircraft landed in Dryden on runway 29 at 11:39 a.m. CST. The flight was approximately one hour behind schedule.

The weather conditions at Dryden on the arrival of flight 1363 were suitable for visual flight rules (VFR) flight. It began to snow lightly when the aircraft landed.

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[3] This refuelling in Dryden was planned. The defuelling which occurred in Thunder Bay had no effect on this aspect of the flight planning.

[4] Instrument meterological conditions (IMC) are cloud and visibility conditions that are lower than required to maintain visual flight. Instrument flight rules (IFR) are rules for the conduct of a flight in weather conditions below those required for visual flight. Visual flight rules (VFR) are rules that provide for flight having continuous visual reference to the ground or water and requiring specified minimum flight visibility. Both IFR and VFR are set out in the Air Regulations.

3 DRYDEN MUNICIPAL AIRPORT AND AIR ONTARIO FACILITIES MARCH 10, 1989

Dryden Municipal Airport

The Dryden Municipal Airport is owned by Transport Canada and is operated by the Dryden Airport Commission on behalf of the Town of Dryden, pursuant to a lease agreement. It is located approximately 6.5 km northeast of the town and is used by scheduled air carriers, a small number of resident aircraft, and one fixed-base operator, Dryden Flight Centre. The Dryden Municipal Airport is also a base for the Ontario Ministry of Natural Resources (MNR). The relationship among the Dryden Airport Commission, Transport Canada, and the various parties operating at the Dryden Municipal Airport will be discussed in chapter 9 of this Report, Dryden Municipal Airport Crash, Fire-fighting, and Rescue Services. A diagram of the airport appears as figure 5-1 in chapter 5, Events and Circumstances Preceding Takeoff.

The aerodrome certificate for the airport was renewed by Transport Canada on March 23, 1988. The last formal Transport Canada inspection of the airport prior to March 10, 1989, was conducted on August 25, 1987. An informal inspection was conducted by Transport Canada on October 19, 1988, and no discrepancies were noted with reference to the department's standards and recommended practices.

Equipment and On-Duty Personnel

The airport maintenance equipment available on March 10, 1989, included two half-ton trucks (one strictly for airport maintenance and one for the airport manager); two snowblower trucks; one front-end loader; two small snowblowers; two runway sweepers; one sand truck; and one chemical spreader (for urea, a chemical used to melt snow and ice on manoeuvring surfaces).

Airport crash fire rescue (CFR) vehicles available on March 10, 1989, included Red 1, a rapid intervention vehicle equipped to deliver water, foam, and dry chemical; Red 2, a crash response vehicle equipped to deliver foam; and Red 3, the fire chief's van, which contained communication radios and limited emergency equipment.

When Air Ontario flight 1363 landed in Dryden on March 10, 1989, on-duty personnel at the Dryden Municipal Airport included the airport manager, Mr Peter Louttit; the CFR chief, Mr Ernest Parry; a CFR crew chief, Mr Stanley Kruger; a fire-fighter, Mr Gary Rivard; the maintenance lead-hand, Mr Christopher Pike; and a mechanic, Mr Allan Haw.

Runways

Runway 11/29 at Dryden Municipal Airport is aligned in a general east/west direction. It is 6000 feet long and 150 feet wide with an asphalt surface. The runway has no appreciable slope. The runway elevation is approximately 1354 feet above sea level (asl). On runway 29 there is a takeoff run available (TORA) of 6000 feet and a takeoff distance available (TODA) of 6200 feet. Air Ontario flight 1363 took off in a westerly direction using runway 29.

In addition to the main runway 11/29, there is a secondary runway, 05/23. This second runway is aligned in a northeast/southwest direction, intersecting runway 11/29 approximately 1250 feet from its eastern end. It has a sand surface and is 2000 feet long and 75 feet wide. Runway 05/23 is not maintained in the winter months.

A single taxiway from the terminal ramp area (taxiway Alpha) enters runway 11/29 approximately 3500 feet from its east end. The airport's two other taxiways are designated taxiways Bravo and Charlie. Prior to March 10, 1989, runway 11/29, which was constructed in 1969, had last been resurfaced in the summer of 1988. It was informally inspected by Transport Canada on October 19, 1988.

On the day of the accident, March 10, 1989, Dryden airport field maintenance staff completed an official daily runway inspection at 4:17 a.m. The runway at that time was reported to be 100 per cent bare and dry. Maintenance was being completed on the runway lights, and various inspections were conducted throughout the morning as workers finished their tasks. The runway condition remained constant. A runway-condition report was passed to the crew of the F-28, inbound from Winnipeg, before their first arrival at Dryden on the morning of March 10.

Approved Runway Lighting

Runway lighting on runway 11/29 consisted of standard runway-identification lights (flashing strobe lights), medium-intensity threshold lights, and runway-edge lights with three intensity-level settings. In addition, runway 29 had 3000 feet of low-intensity centre-row approach lights.

Aerodrome lighting at Dryden is available on request from the Kenora Flight Service Station (FSS). The lights are remotely controlled by Kenora FSS and were available and operable at the time of the accident.

Weather Minima

Canadian domestic airspace is divided into six classes, designated by a single letter A, B, C, D, E, or F, each governed by specific rules. The airspace around the Dryden airport extending five nautical miles from the centre of the airport in every direction to a height of 3000 feet above ground level is designated Class D controlled airspace. As such, aircraft operating under both instrument flight rules (IFR) and visual flight rules (VFR) are permitted to fly in the airspace. On March 10, 1989, the VFR weather minima for the Class D airspace over and around the Dryden airport were visibility of not less than three miles; distance from cloud at least one mile horizontally and 500 feet vertically; and distance above ground level at least 500 feet (except when taking off or landing).

Navigation Aids and Landing Limits

Runway 11 is serviced by a non-directional beacon (NDB) and an instrument landing system (ILS). The NDB minimum descent altitude for runway 11 is 1760 feet above sea level (asl), which is 406 feet above the airport elevation of 1354 asl. The ILS decision height for runway 11 is 1554 feet asl.

Runway 29 is serviced by a localizer back course (LOC(BC)), which has no glide slope, and by an NDB. The LOC(BC) minimum descent altitude for runway 29 is 1780 feet asl. The NDB minimum descent altitude for runway 29 is 1820 feet asl.

Dryden Flight Centre

On December 7, 1987, Dryden Flight Centre Limited entered into an agreement with Air Ontario to provide aircraft, baggage, and passenger-handling services to Air Ontario at the Dryden Municipal Airport. This agreement, which was in effect on March 10, 1989, is silent with regard to the de-icing of aircraft.

Dryden Flight Centre provided the following services and facilities for Air Ontario's aircraft, including the F-28: aircraft marshalling; aircraft refuelling; a ticket counter; a direct-line telephone to Air Ontario System Operations Control (SOC) in London, Ontario; a reservations computer (linked with the Air Canada Reservac computer system); four baggage carts; and a VHF radio capable of communicating with company aircraft and the Kenora Flight Service Station (FSS). For each Air Ontario flight,

Dryden Flight Centre provided one ticket agent and two baggage handlers.

Dryden Flight Centre was also under contract with Imperial Oil Limited as an aviation fuel dealer, and, accordingly, it provided ESSO aviation petroleum products to all aircraft – both general and commercial aviation aircraft – at the Dryden Municipal Airport. As a term of its agreement with Imperial Oil, Dryden Flight Centre agreed to provide training to all personnel involved in fuel handling in order that they be proficient in safe operating procedures. Among the fuelling procedure manuals that Imperial Oil provided to Dryden Flight Centre were ESSO's Aviation Fuelling Guide and ESSO's Aviation Operations Standards Manual.

Mr Lawrence Beeler was the majority shareholder and president of Dryden Flight Centre, and Mr Vaughan Cochrane, a minority shareholder, was the general manager and the fuelling agent.

On March 10, 1989, Mr Cochrane was in charge of the ramp crew. The other member of the ramp crew was Mr Jerry Fillier. The ticket agent on duty was Ms Jill Brannan.

According to the evidence before this Commission, Mr Cochrane received minimal training on F-28 fuelling procedures in the autumn of 1987. Although aircraft-fuelling manuals in the possession of Dryden Flight Centre included instruction on the operation of F-28 main engines and its auxiliary power unit (APU) during fuelling, Messrs Beeler, Cochrane, and Fillier testified that they had no knowledge of such provisions until after the accident.

Further details of the aviation services agreement, particularly with reference to training and procedures related to the fuelling operation, appear in chapter 9 of this Report, Crash, Fire-fighting, and Rescue Services, and in chapter 20, F-28 Program: Flight Operations Training.

Other Services

De-icing

On March 10, 1989, de-icing at Dryden airport was available from Dryden Air Services for any aircraft. Dryden Air Services, a company owned and operated by Mrs Diane Beasant and Mr Mark Beasant, was under contract to provide passenger- and aircraft-handling services for Ontario Express[1] Airlines in much the same way that Dryden Flight ntre

[1] Ontario Express Airlines, which carried on business as Canadian Partner Airlines and was partially owned by PWA Corporation, was a regional feeder to Canadian Airlines International.

Centre serviced Air Ontario. Ontario Express owned the de-icing equipment and provided the de-icing fluid, while Dryden Air Services employees performed the de-icing.

Dryden Flight Centre did not itself have any de-icing facilities. If an Air Ontario aircraft needed to be de-iced, an employee of Dryden Flight Centre would relay the request to an employee of Dryden Air Services, who in turn would telephone Canadian Partner operations in Toronto to receive permission to de-ice the Air Ontario aircraft. Such permission was never denied. It was understood by the employees of Dryden Flight Centre and Dryden Air Services that, should an Air Ontario and a Canadian Partner aircraft both require de-icing at the same time, Canadian Partner would be given priority. There appears to have been a good working relationship between Dryden Flight Centre and Dryden Air Services, and de-icing was available on short notice.

The de-icing equipment used by Dryden Air Services was manufactured by Mid-Canada Equipment of Winnipeg, Manitoba. The equipment, an "Old Faithful" model, consisted of a spraying mechanism attached to a "bucket" suspended by an articulating arm mounted above a mobile, self-propelled, three-wheeled vehicle. An operator de-icing an aircraft would stand in the bucket and use a control panel to control the movements of the vehicle and the bucket. The spraying nozzle was manually operated.

On March 10, 1989, the average cost of de-icing an aircraft was about $360 but varied according to the amount of de-icing fluid required. Only type 1 fluid was available for de-icing at Dryden.

No one employed by Dryden Flight Centre or Dryden Air Services had ever received any advice or instruction from Air Ontario on procedures for the de-icing of the F-28 aircraft. The training of personnel handling the F-28 aircraft at Dryden is discussed in chapter 20 of this Report, F-28 Program: Flight Operations Training.

Weather Services

Until July 31, 1988, weather information was available through a weather observation facility provided by the Dryden Airport Commission, the authority set up by the town to oversee airport operations. The facility was staffed by trained observers who, in addition to making hourly and special weather observations, maintained a watch of airport activities, communicated with surface vehicles and aircraft on a two-way radio, collected landing fees, and acted as contact persons for pilots of itinerant aircraft. An approved crash alarm system was operated through this facility. Funding for these services was provided by Transport Canada through an annual renewable contract.

In 1988, a public tender was called for the provision of the weather observation services at the Dryden airport. The contract was awarded to Cloud Nine Contracting, which began service on July 31, 1988. Environment Canada's Atmospheric Environment Service personnel provided training for the owners and operators of Cloud Nine, which offered weather-related services only.

Air Traffic Control

Flight Service Station service for the Dryden aerodrome was provided by Kenora FSS via a remote communications outlet. Instrument flight rules (IFR) flights departing Dryden receive their IFR clearance through Kenora FSS. (IFR clearances originate in Winnipeg, the area control centre.) After takeoff, aircraft contact Kenora's en-route radar and other controlling agencies as directed.

In subsequent chapters I will discuss in greater detail the facilities, operations, and services in place at the Dryden Municipal Airport and their significance to the events of March 10, 1989.

4 METEOROLOGICAL INFORMATION

Aviation Weather Information

Canadian aviation weather information is gathered, produced, and distributed by the Atmospheric Environment Service (AES) of Environment Canada with the assistance of contract personnel trained to make weather observations and prepare reports. The weather information is available from a variety of sources to those who require it, primarily aviation planners and flight crew.[1]

Aviation weather information is available from 60 AES weather offices and more than 100 flight service stations (FSS), which are normally located at airports across Canada. Access to this information is available in person, by telephone, and by two-way radio. As well, organizations such as flying schools, corporate aviation departments, air charter companies, and air carriers have computer and facsimile equipment that allows easy gathering of the required weather information.

Types of Weather Information Available

Aviation weather reports (SA), based on hourly weather observations, are issued each hour from over 300 airport and en route stations in Canada. In addition, observations are made and special reports (SP) are issued when weather conditions are fluctuating, or as requested.

Aviation area forecasts (FA) are issued for Canadian domestic airspace and are distributed on a routine basis or when requested. These forecasts are prepared four times a day for 90 regions across the country.

Airport forecasts (FT) are prepared by nine weather forecast offices for 160 airports across Canada. Airport forecasts are limited to airports for which routine hourly (SA) reports are available, as well as special reports that meet AES standards for observations representative for the

[1] Weather systems are generally large and cover areas in different time zones. As well, because a person can be in one time zone discussing weather in another time zone, the time reference can be confusing. For these reasons, times in this meteorology chapter are in Coordinated Universal Time, which is abbreviated UTC or Z. Z is used in this chapter. Thunder Bay is in the Eastern time zone; EST = Z - 5 hours. Dryden is in the Central time zone; CST = Z - 6 hours. For example: 1800Z is 1:00 p.m. EST at Thunder Bay and 12:00 noon CST at Dryden. The accident occurred at approximately 1811Z.

airport. The forecasts are prepared four times a day and are valid for 12 to 24 hours.

Upper-level wind and temperature forecasts (FD) are prepared for 115 locations in Canada twice a day for three valid periods. Other aviation charts, reports, and forecasts, including weather warnings (significant in-flight weather warning messages or SIGMETS), upper-level prognostic charts, significant weather prognostic charts, radar reports, pilot reports (PIREPS), surface weather charts, and upper level analysis charts are disseminated as required for flight planning purposes.

Significance of Weather Information

All persons who plan flights require weather information for a number of reasons: to make takeoff calculations such as aircraft weight and takeoff speeds and distances; to determine if the visibility is within limits for takeoff; to determine ground speed and time estimates for the flight; to be prepared for en route weather, including turbulence, icing conditions, and storms; to determine if the destination weather is suitable; and to allow the selection of alternate airports where the weather meets regulatory requirements.

When the flight crew of a transport aircraft on a short domestic flight receives a weather package from either its operations centre or a meteorological office, the package will normally contain the following information:

- hourly reports (SA) and special reports (SP) for each en route stop and alternate and, if required, intermediate station;
- forecasts (FT) for each en route airport and alternate and other airports that could be used for an emergency landing;
- upper-level wind and temperature forecasts (FD);
- area forecasts (FA) for the area of the flight(s);
- SIGMETS, PIREPS, and radar reports if applicable; and
- other desired weather information as required or requested by individuals or organizations.

During flight and at en route stops, flight crew continually update their knowledge of the weather that is of significance to them – primarily en route, destination, and alternate weather.

Weather Information for March 10, 1989

Synopsis

The weather surface analysis (figure 4-1) for the area that included Dryden for 1200Z on March 10, 1989, indicated that an arctic cold front extended from central Manitoba to northern Ontario, with a warm front extending south to Duluth, Minnesota. An ill-defined maritime frontal system was also situated over southwestern North Dakota, with a weak centre of low pressure in southeastern Alberta. By 1800Z the arctic cold front had moved southeastward from southern Saskatchewan to the top of James Bay, with the centre of low pressure situated in southwestern Saskatchewan (figure 4-2). The maritime frontal system had moved eastward and was situated over central North Dakota, where a second centre of low pressure was located. Moist air was present over northwestern Ontario, with mid-level instability increasing owing to the overrunning maritime polar air from the northern United States.

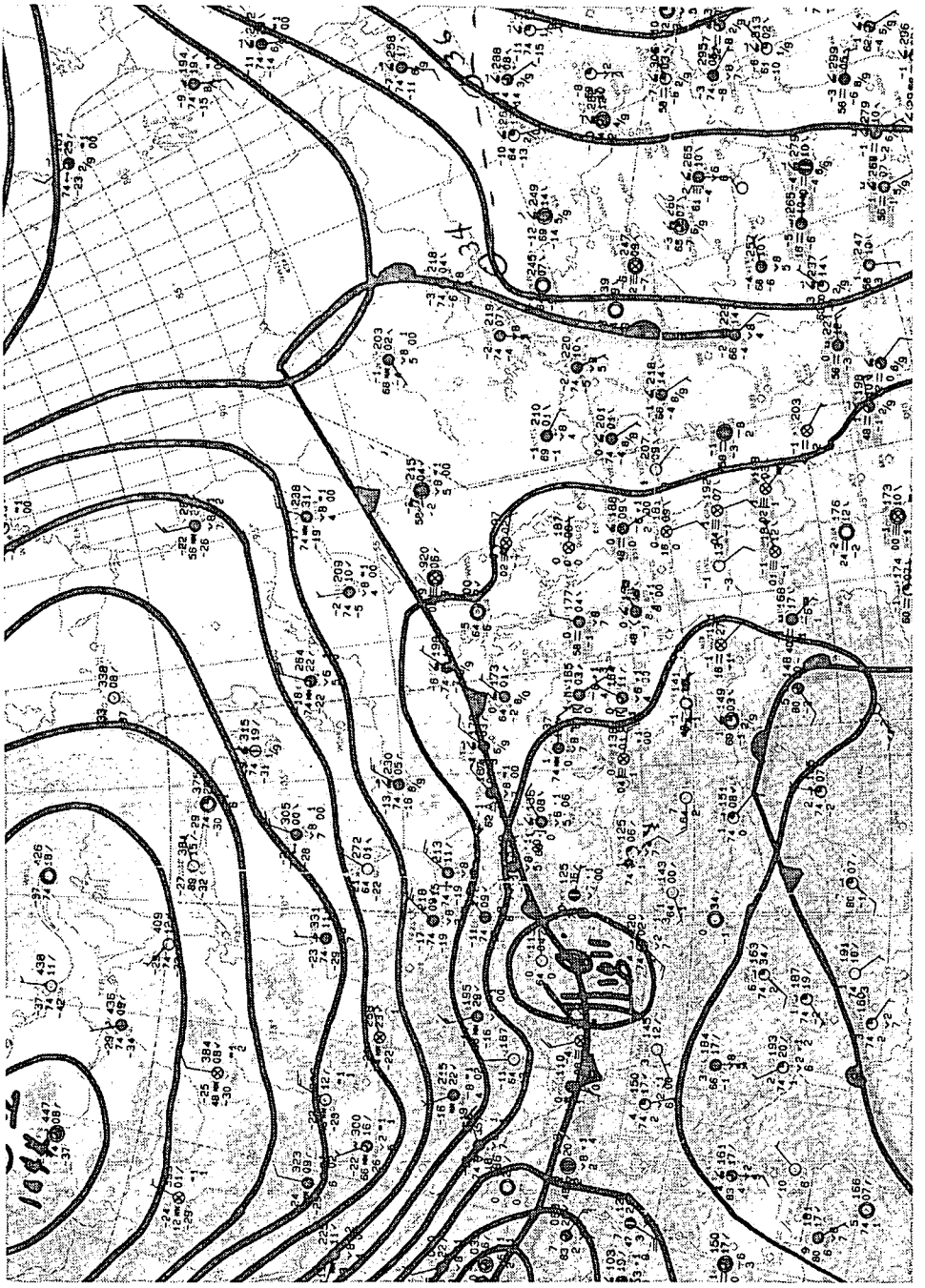
General Weather

Broken stratocumulus and altocumulus clouds were present over northwestern Ontario when the accident occurred, at 1811Z, with areas of low cloud and fog producing isolated instrument meteorological conditions (IMC). At 1200Z on March 10, 1989, there were isolated rain showers over southern Manitoba, with a line of scattered thunderstorms over southwestern Manitoba that were moving eastward at 45 knots. At 1700Z radar plots from Vivian, Manitoba, and Upsala, Ontario, showed scattered weak echoes, indicating small storm centres, moving into the Dryden, Ontario, area. SIGMETS were issued by the Winnipeg Weather Office from between 1200Z and 1605Z, valid until 2005Z, based on the radar information about the scattered line of thunderstorms. At 1805Z the Winnipeg Weather Office cancelled the last Sigmet affecting the Dryden area when the radar information indicated that the line of thunderstorms had dissipated into scattered altocumulus castellanus and towering cumulus clouds.

Area Forecast

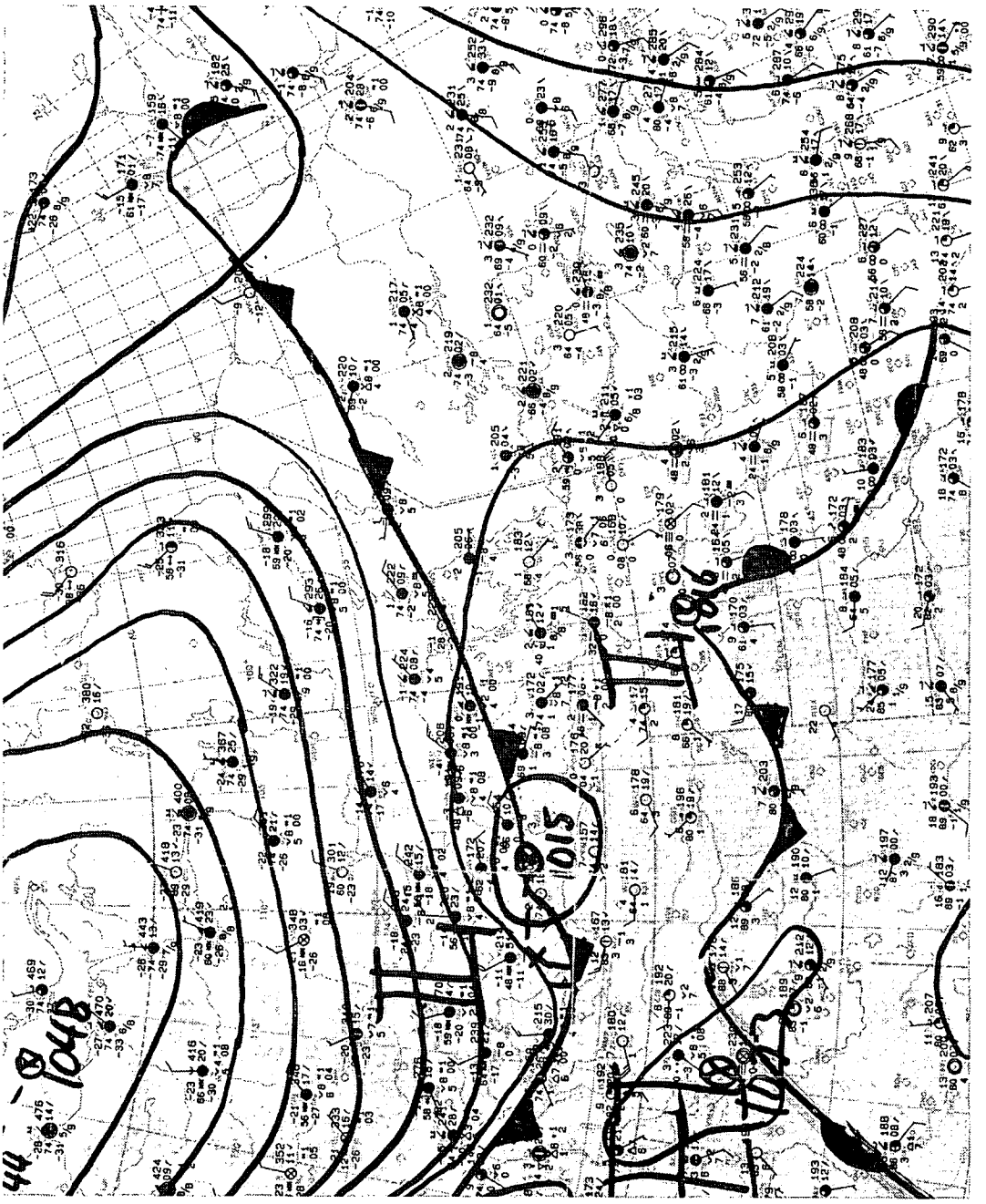
The area forecast for the area designated as FACN3, which includes Dryden along the southern edge and which was issued at 1130Z and was valid from 1200Z to 2400Z on March 10, 1989, gave the following forecast (not verbatim):

Figure 4-1 Environment Canada, Surface Analysis, March 10, 1989, 1200Z, Prairie Weather Centre



Source: Exhibit 508

Figure 4-2 Environment Canada, Surface Analysis, March 10, 1989, 1800Z, Prairie Weather Centre



Source: Exhibit 509

> Two broken variable to scattered cloud layers based at 3000 feet above sea level (asl) and 8000 feet asl are forecast. Isolated altocumulus castellanus embedded in the layer cloud are expected to give visibilities as low as 3 miles in light rain with a risk of freezing rain. There is a risk of embedded cumulo-nimbus cloud giving visibilities as low as 3 miles in thunder and light rain showers near the end of the period. A few ceilings as low as 300 feet and visibilities down to 1/2 mile are forecast due to patchy drizzle and fog. The freezing level is forecast to be near the surface with an above freezing layer from 2000 feet asl to 6000 feet asl. Light to moderate rime icing is forecast in the cloud above 6000 feet and severe clear icing is forecast in freezing rain. Moderate turbulence is expected near the altocumulus castellanus cloud.

Mr David Patrick, a meteorologist employed by Atmospheric Environment Service of Environment Canada in the Prairie Weather Centre in Winnipeg, prepared a report (Exhibit 313) on weather conditions that existed along the flight path of Air Ontario flights 1362 and 1363 on March 10, 1989. Mr Patrick was also the shift supervisor on duty at the Prairie Weather Centre on that day.

When asked during his testimony about the forecasts for March 10, 1989, in relation to typical March weather in that area, Mr Patrick stated the following:

> A. Well, each March is different, but from my experience, in almost every March if not every March in northwestern Ontario, you can expect to have weather of this nature from time to time, so it is certainly not an everyday occurrence, but in March, there is melting snow and that generates moisture and it forms stratus clouds and fog, so low stratus and fog is – it occurs fairly often in northwestern Ontario in March in the springtime, and low visibilities and ceilings and snowshowers do occur from time to time.
>
> The only thing that was really unusual that day was – really not freakish but unusual – was that there were thundershowers over southern Manitoba that were moving towards northwestern Ontario. That's unusually early in the season to be getting thundershowers.
>
> (Transcript, vol. 49, p. 11)

Winnipeg (YWG) Weather

Winnipeg Forecasts (FT)

The Winnipeg forecast issued at 1045Z on March 10, 1989, and valid from 1100Z on March 10 to 1100Z on March 11 read as follows:

> Ceiling 200 feet, sky obscured, visibility 1/2 mile in fog, occasional sky partially obscured, ceiling 5000 feet overcast, visibility 6 miles in light rain and fog. After 1800Z 600 feet scattered cloud, ceiling 5000 feet overcast, occasional ceiling 600 feet overcast, visibility 2 miles in light rain and fog. After 0200Z [March 11] ceiling 4000 feet broken, 8000 feet broken, occasional sky partially obscured, ceiling 2000 feet overcast, visibility 2 miles in light freezing rain, light snow and fog after 0700Z [March 11].

The amended Winnipeg forecast issued at 1412Z on March 10, 1989, and valid from 1400Z on March 10 to 1100Z on March 11 read:

> Ceiling 500 feet, sky obscured, visibility 1 mile in fog, occasional sky partially obscured, ceiling 5000 feet overcast, visibility 6 miles in thunder and light rain showers. After 1800Z 600 feet scattered cloud, ceiling 5000 feet overcast, occasional ceiling 600 feet overcast, visibility 2 miles in light rain and fog. After 0200Z [March 11] ceiling 4000 feet broken, 8000 feet broken, occasional sky partially obscured, ceiling 2000 feet overcast, visibility 2 miles in light freezing rain, light snow and fog after 0700Z [March 11].

The Winnipeg forecast issued at 1630Z on March 10, 1989, and valid from 1700Z on March 10 to 1700Z on March 11 read:

> Sky partially obscured, ceiling 500 feet broken, visibility 1 mile in fog, variable to 500 feet scattered, ceiling 4000 feet broken, visibility 5 miles in fog. After 2000Z 800 feet scattered, ceiling 4000 feet broken, occasional sky partially obscured, ceiling 800 feet broken, visibility 3 miles in fog. After 0200Z [March 11] ceiling 1000 feet broken, 4000 feet broken, wind 040°T at 10 knots, occasional 5 miles visibility in light snow showers, with a risk of light freezing drizzle. After 1200Z [March 11] ceiling 1500 feet broken wind 360°T at 10 knots.

Winnipeg Reports (SA)

The Winnipeg regular special report (RS)[2] issued at 1200Z read:

> Sky partially obscured, measured ceiling 400 feet broken, 10,000 feet overcast, visibility 3 miles in fog, temperature and dew 0°C, wind 160°T at 7 knots.

---

[2] RS is a regular special (an observation taken on the hour, as is normal, but that reports a significant weather change).

The Winnipeg aviation weather report (SA) issued at 1300Z read:

> Sky partially obscured, 500 feet thin scattered, estimated ceiling 10,000 feet overcast, visibility 2 miles in fog, temperature 0°C, dew point -1°C, wind 160°T at 7 knots.

When Air Ontario flight 1362 departed Winnipeg eastbound at 1349Z (7:49 a.m. CST), the weather at Winnipeg was as indicated at 1300Z.

The Winnipeg SA issued at 1400Z read:

> Sky partially obscured, 500 feet scattered, estimated ceiling 10,000 feet overcast, visibility 2 miles in fog, temperature 0°C, dew point -1°C, wind 150°T at 6 knots.

The Winnipeg SA issued at 1500Z read:

> Sky partially obscured, measured ceiling 700 feet broken, 4300 feet overcast, visibility 1 mile in light rain showers and fog, temperature 1°C, dew point -1°C, wind 300°T at 4 knots.

The Winnipeg SA issued at 1600Z read:

> Sky partially obscured, measured ceiling 500 feet broken, 4500 feet overcast, visibility 3/4 mile in fog, temperature 1°C, dew point 0°C, wind 090°T at 9 knots.

The Winnipeg SA issued at 1700Z read:

> Sky partially obscured, 500 feet thin scattered, 12,000 feet thin broken, visibility 3 miles in fog, temperature 2°C, dew point 0°C, wind 120°T at 10 knots.

The Winnipeg SA issued at 1800Z read:

> Sky partially obscured, estimated ceiling 3500 feet broken, visibility 4 miles in fog, temperature 3°C, dew point 0°C, wind 140°T at 8 knots.

The Winnipeg SA issued at 1812Z read:

> Sky partially obscured, estimated ceiling 1500 feet overcast, visibility 4 miles in light rain showers and fog, wind 120°T at 5 knots.

Between 1812Z and 2200Z the weather at Winnipeg did not deteriorate below sky partially obscured, estimated ceiling 1500 feet overcast, and visibility 3 miles in fog.

Dryden (YHD) Weather

Dryden Forecasts (FT)

The Dryden forecast issued at 1330Z on March 10, 1989, and valid from 1400Z to 2300Z on March 10 read:

> 4000 feet scattered, ceiling 8000 feet broken, occasional sky partially obscured, ceiling 700 feet broken, 4000 feet overcast, visibility 2 miles in light rain and fog.

The amended Dryden forecast issued at 1502Z on March 10, 1989, and valid from 1500Z to 2300Z on March 10 read:

> 4000 feet scattered, ceiling 8000 feet broken, occasional sky partially obscured, ceiling 700 feet broken, 4000 feet overcast, visibility 2 miles in light rain, light freezing rain, and fog.

This was the first forecast specifically calling for freezing rain at Dryden. Aircraft C-FONF was, at the time this forecast was issued, en route from Dryden to Thunder Bay. The aircraft arrived at Thunder Bay at 1532Z.

The Dryden forecast issued at 1630Z on March 10, 1989, and valid from 1700Z on March 10 to 0300Z on March 11 read:

> 3000 feet scattered, ceiling 10,000 feet overcast, occasional ceiling 3000 feet broken, 10,000 feet overcast, visibility 5 miles in light rain, light freezing rain, and fog. After 1900Z 800 scattered, ceiling 4000 feet overcast, occasional sky partially obscured, ceiling 800 feet overcast, visibility 2 miles in light rain and fog, with a risk of thunder and rain showers until 2100Z. After 2100Z ceiling 1500 feet broken, 4000 feet overcast.

This second forecast calling for freezing rain at Dryden was issued while the aircraft was at its Thunder Bay station stop. It departed for Dryden as flight 1363 at 1655Z, 25 minutes after this forecast.

Dryden Reports (SA)

The actual weather reports for Dryden indicated that on March 10, 1989, from 1200Z until 1742Z, the ceiling and visibility did not go below 4000 feet and 12 miles, respectively. Light snow started falling at 1742Z. Aircraft C-FONF landed in Dryden at 1739Z (11:39 a.m. CST).

The Dryden special report (SP)[3] issued at 1748Z read:

> Sky partially obscured, estimated ceiling 4000 feet overcast, visibility 2½ miles in light snow, wind 260°T at 3 knots.

The Dryden SA issued at 1800Z read:

> Sky partially obscured, estimated ceiling 4000 feet overcast, visibility 2½ miles in light snow, barometric pressure 1022.5 hPa (hectopascals), temperature 1°C, dew point -3°C, wind 190° at 3 knots, altimeter setting 30.12" Hg. (Actual recorded temperature before rounding off was 0.7°C.)

The Dryden SP issued at 1806Z read:

> Precipitation ceiling 300 feet, sky obscured, visibility 3/8 mile in snow, wind 170° at 4 knots.

This was the last weather report issued before aircraft C-FONF commenced its takeoff roll at Dryden at 1809Z (12:09 p.m. CST).

The Dryden SP issued at 1811Z read:

> Precipitation ceiling 1000 feet, sky obscured, visibility 3/4 mile in light snow, wind 170° at 4 knots.

The Dryden accident observation report issued at 1812Z read:

> Precipitation ceiling 1000 feet, sky obscured, visibility 3/4 mile in light snow, wind 170° at 4 knots, barometric pressure 1021.8, temperature -0.3°C, dew point 2.1°C, wind 170° at 4 knots, altimeter setting 30.10" Hg.

From the above observations, it is apparent that during the 30 minutes that flight 1363 was on the ground in Dryden, the weather deteriorated significantly. By 1806Z (12:06 p.m.), approximately three minutes prior to takeoff, the weather had dropped to a precipitation ceiling of 300 feet, with visibility three-eighths of a mile in snow.

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[3] SP denotes a "special observation." SPs are made when there are specific changes in the observed weather conditions, such as the commencement or cessation of snow, or when requested.

Eyewitness Weather Information for Dryden

A number of witnesses testified about the weather conditions at the Dryden Municipal Airport at the approximate time of the takeoff roll of flight 1363. The evidence shows that, at such time, a heavy snow squall affected the eastern part of the airport, more particularly the area surrounding the button[4] of runway 29.

Observations made by two commercial pilots, Mr Roscoe Hodgins and Mr Craig Brown, and a private pilot, Mr Robert McGogy, all of whom had been flying in the area that day, confirm the above observations. Mr Hodgins is an experienced pilot with about 8000 hours' flight time, and Mr Brown had 1250 hours. Mr McGogy had about 80 hours' flying time.

Mr Hodgins landed at the Dryden airport at 1710Z (11:10 a.m.). During his testimony, he stated that the weather at that time was "good VFR," with no precipitation and very little wind (Transcript, vol. 22, p. 124).

Mr Hodgins taxied to the Ministry of Natural Resources building, located south of the runway, approximately midway between the button of runway 29 and taxiway Alpha. He shut down his aircraft, put the engine heater and cover on, and started to fill up the seed-spraying hopper of his aircraft. These combined tasks took about 10 minutes. While he was filling the hopper, snow began to fall, interrupting his work and prompting him to put wing covers on the aircraft.

Mr Hodgins heard the engines of flight 1363 at 1801Z (12:01 p.m.) and recalled that "[i]t was snowing quite heavy" at that time (Transcript, vol. 22, p. 136). He also saw the Cessna 150, registration C-FHJC, piloted by Mr McGogy, land on runway 29 at 1806Z (12:06 p.m.). He stated that at that time "[i]t was snowing quite heavy" (Transcript, vol. 22, p. 138). Three minutes later, at 1809Z (12:09 p.m.), flight 1363 was at the eastern end of runway 29. Mr Hodgins described the weather and visibility as he observed them when the aircraft began its takeoff roll:

> A. It was snowing quite heavily. I would say the visibility was half to three-quarters of a mile with large, fluffy flakes fluttering down like leaves; you know, they weren't falling straight, they were in a fluttering motion.
>
> (Transcript, vol. 22, p. 140)

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[4] The term "button" is often used by pilots when referring to the threshold area of a runway. "Threshold" in general terms defines the beginning of the runway surface which is of sufficient load-bearing strength to allow continual flight operation by aircraft that the runway is intended to serve. In this Report, the terms "button" and "threshold" are both used from time to time when referring to the east end of Runway 29 at the Dryden Municipal Airport.

At approximately 1743Z (11:43 a.m.), Mr Brown reported to Kenora Flight Service Station that he was "down and clear in Dryden." He was questioned on his observations of the weather upon landing:

> Q. ... What was the weather like, more particularly, what was the precipitation like, if any, during your taxi down Alpha and over to the refuelling area?
> A. It – the snow had increased from the snow grains reported earlier to a – more of a heavy snowfall and I am estimating the visibility to be approximately five or six miles.
>
> (Transcript, vol. 5, p. 218)

Mr Brown stated that after landing he proceeded to the fuel pumps located on the Dryden ramp, west of the terminal building, and proceeded to refuel. He estimated he was at the fuel pumps at 11:44 a.m.:

> Q. ... I take it then that you, in fact, commenced to refuel your aircraft, is that correct?
> A. That is correct.
> Q. And how long would that have taken?
> A. Approximately 15 minutes, about 5 minutes before we got the fuelling started and another 10 minutes to finish the fuelling.
> Q. ... If I could take you back to that 15-minute period, I take it you were near your aircraft at all times?
> A. Yes, sir.
> Q. Could you describe the weather, particularly, any precipitation phenomena such as snow and visibility during that 10- to 15-minute period?
> A. As I was saying before, it started to increase, the snowfall, and by that time – by that 15 minutes, it snowed very heavily. With visibility going down to about half a mile at its worst time.
>
> (Transcript, vol. 5, p. 220)

After refuelling, Mr Brown taxied his aircraft to the eastern side of the terminal building to park. He taxied by the F-28:

> Q. ... could you describe the snowfall at that point.
> A. It was still heavy, heavy wet snow. Visibility, again, I think was around a mile to a half a mile.
>
> (Transcript, vol. 5, p. 223)

Mr Robert McGogy, a private pilot, took off about 1720Z (11:20 a.m. CST) on a recreational flight in his light aircraft, a Cessna 150, and flew to the north and west of Dryden, returning to Dryden about 1800Z (12:00 noon). The visibility throughout the flight was poor. On his return leg and close to the Dryden airport, "it was almost a whiteout." As he

approached the airport, the snow increased in intensity and the flakes "were approximately the size of 50-cent pieces, and they were very wet" (Transcript, vol. 22, pp. 25, 40).

Mr McGogy testified that in order to maintain visual reference with the ground, his height above ground level varied from a high of 1000 feet while en route to 150 to 200 feet while approaching runway 29.

At 18:04:03Z Mr McGogy radioed Kenora Flight Service Station and asked: "There any chance that plane [C-FONF] can hold, I'm having real bad weather problems here." At 18:04:07Z, First Officer Mills on flight 1363 transmitted:

> Okay three sixty three's, holding short of the active, be advised you are down to a half a mile or less in snow here.
>
> (Exhibit 7A, p. 31)

Mr Brown heard the Cessna 150's transmissions to Kenora Flight Service Station both on its approach to and after landing at the Dryden airport. He also observed the Cessna 150 taxiing down Alpha taxiway towards the Dryden ramp area. The Cessna 150 reported down at 1806Z (12:06 p.m.) and off the runway onto the taxiway at 1808Z (12:08 p.m.). Mr Brown provided the following observations concerning the weather:

> Q. Could you describe the weather again at the point in time that you saw this 150 taxi in down Alpha?
> A. Again, it was still snowing heavily. I'm estimating it to be about half a mile visibility.
>
> (Transcript, vol. 5, p. 225)

Mr Keith Fox, an experienced pilot and F-28 first officer with Air Ontario, was a passenger on flight 1363 from Thunder Bay to Dryden. He testified that at approximately 1804Z (12:04 p.m.) he was driving south from the Dryden airport on Airport Road and saw a Cessna 150 flying north to the airport at an "extremely low altitude" of "no more than 200 feet" (Transcript, vol. 51, p. 189). To be driving south on Airport Road and to see the Cessna 150 flying northward, Mr Fox must have been at least a mile southwest of the button of runway 29. He gave the following evidence regarding the visibility when he observed the Cessna 150 overhead:

> A. I would estimate quarter mile, but it's hard to estimate because it was freezing on my windshield. It was very bad conditions at the time.
>
> (Transcript, vol. 51, pp. 189–90)

Approximately three minutes before the F-28 took off, the airport CFR chief, Ernest Parry, who was located in his vehicle on taxiway Charlie, described a "heavy curtain of snow" and poor visibility when looking towards the east end of runway 29:

> A. ... I realized that I was not even seeing the end of the runway. I was not getting – I could not see the M.N.R. [Ministry of Natural Resources] buildings or towers that were down at that end. I was not seeing that end of the runway.
>
> ...
>
> ...it appeared to be, you know, like a very heavy curtain of snow at that end.
>
> (Transcript, vol. 6, p. 219)

The distance from taxiway Charlie to the MNR buildings is approximately 2000 feet.

Some witnesses in the vicinity of the airport terminal saw smoke from the crash which occurred to the west of the airport. If the smoke they saw was from the fire that started when the aircraft struck the trees on top of the knoll, the distance was about 4500 feet or about seven-eighths of a mile. If the smoke they saw emanated from the crash site, the distance was about one mile. It must be recalled, however, that the heavy snow squall occurred on the east half of the airport, the direction from which flight 1363 commenced its attempted takeoff.

Thunder Bay (YQT) Weather

Thunder Bay Forecasts (FT)

The Thunder Bay forecast issued at 1030Z on March 10, 1989, and valid from 1100Z to 2300Z on March 10 read as follows:

> 600 feet scattered, ceiling 8000 feet broken, occasional sky partially obscured, ceiling 600 feet overcast, visibility 1/2 mile in fog. After 1700Z ceiling 4000 overcast, occasional sky partially obscured, ceiling 1000 feet overcast, visibility 2 miles in light rain and fog, with a risk of light freezing rain.

The Thunder Bay amended forecast issued at 1040Z on March 10, 1989, and valid from 1100Z to 2300Z on March 10 read:

> 600 feet scattered, ceiling 8000 feet broken, visibility 4 miles in fog, occasional sky partially obscured, ceiling 300 feet overcast, visibility 1/4 mile in fog. After 1700Z ceiling 4000 feet overcast, occasional sky partially obscured, ceiling 1000 feet overcast, visibility 2 miles in light rain and fog, with a risk of light freezing rain.

The Thunder Bay amended forecast issued at 1041Z on March 10, 1989, and valid from 1100Z to 2300Z on March 10 read:

> 600 feet scattered, ceiling 8000 feet broken, visibility 4 miles in fog, occasional sky partially obscured, ceiling 600 feet overcast, visibility 1/2 mile in fog. After 1700Z ceiling 4000 feet overcast, occasional sky partially obscured, ceiling 1000 feet overcast, visibility 2 miles in light rain and fog, with a risk of light freezing rain.

The Thunder Bay amended forecast issued at 1043Z on March 10, 1989, and valid from 1100Z to 2300Z on March 10 read:

> 600 feet scattered, ceiling 8000 feet broken, visibility 4 miles in fog, occasional sky partially obscured, ceiling 300 feet overcast, visibility 1/4 mile in fog. After 1700Z ceiling 4000 feet overcast, occasional sky partially obscured, ceiling 1000 feet overcast, visibility 2 miles in light rain and fog, with a risk of light freezing rain.

The Thunder Bay amended forecast issued at 1444Z on March 10, 1989, and valid from 1400Z to 2300Z on March 10 read:

> 100 feet scattered, ceiling 800 feet overcast, visibility 5 miles in fog, occasional ceiling 100 feet sky obscured, visibility 1/4 mile in fog. After 1700Z ceiling 4000 feet overcast, occasional sky partially obscured, ceiling 1000 feet overcast, visibility 2 miles in light rain and fog, with a risk of light freezing rain.

The Thunder Bay amended forecast issued at 1616Z on March 10, 1989, and valid from 1600Z to 2300Z on March 10 read:

> 500 feet scattered, ceiling 10,000 feet broken, occasional sky partially obscured, ceiling 500 feet broken, visibility 1 mile in fog. After 2100Z 2000 feet scattered, ceiling 8000 feet broken, occasional ceiling 2000 feet overcast, visibility 5 miles in light rain, light freezing rain, and fog.

The Thunder Bay forecast issued at 1630Z on March 10, 1989, and valid from 1700Z March 10 to 0500Z on March 11 read:

> 500 feet scattered, ceiling 10,000 feet broken, occasional sky partially obscured, ceiling 500 feet broken, 10,000 feet overcast, visibility 1 mile in fog. After 2100Z 800 feet scattered, ceiling 4000 feet broken, occasional ceiling 800 feet broken, visibility 5 miles in light rain showers and fog, with a risk of freezing rain until 0000Z.

Thunder Bay Reports (SA)

The Thunder Bay SA issued at 1200Z read:

> Indefinite ceiling 400 feet, sky obscured, visibility 1/8 mile in fog, temperature -6°C, dew point -7°C, wind 230°T at 2 knots.

The Thunder Bay SA issued at 1300Z read:

> Sky partially obscured, measured ceiling 400 feet broken, 4500 feet overcast, visibility 1/8 mile in fog, temperature -6°C, dew point -7°C, wind calm.

The Thunder Bay SA issued at 1400Z read:

> Measured ceiling 100 feet overcast, visibility 3/8 mile in fog, temperature -5°C, dew point -6°C, wind 260°T at 2 knots.

The Thunder Bay SA issued at 1500Z read:

> Sky partially obscured, measured ceiling 100 feet broken, 5000 feet overcast, visibility 1/2 mile in fog, temperature -4°C, dew point -5°C, wind 270°T at 2 knots.

The Thunder Bay SP issued at 1521Z read:

> Sky partially obscured, estimated ceiling 300 feet broken, 11,000 feet overcast, visibility 1 mile in fog, wind calm.

The Thunder Bay SP issued at 1547Z read:

> Sky partially obscured, 500 feet thin broken, estimated ceiling 11,000 feet broken, 25,000 feet overcast, visibility 1½ miles in fog, wind 240°T at 2 knots.

The Thunder Bay SA issued at 1600Z read:

> Sky partially obscured, 500 feet thin broken, estimated ceiling 11,000 feet broken, 25,000 feet overcast, visibility 1½ miles in fog, temperature -3°C, dew point -4°C, wind calm.

The Thunder Bay SA issued at 1700Z read:

> Sky partially obscured, 4500 feet scattered, measured ceiling 7000 feet broken, 9000 feet overcast, visibility 1½ miles in fog, temperature -2°C, dew point -3°C, wind calm.

The Thunder Bay regular special (RS) issued at 1800Z read:

> Measured ceiling 8000 feet overcast, visibility 3 miles in fog, temperature 0°C, dew point -3°C, wind 090°T at 3 knots.

Sault Ste Marie (YAM) Weather

Sault Ste Marie Forecasts (FT)

The Sault Ste Marie forecast issued at 0445Z on March 10, 1989, and valid from 0500Z to 1700Z on March 10 read:

> 10,000 feet scattered, high broken. After 0800Z 10,000 feet scattered, high broken, variable ceiling 10,000 feet overcast until 1500Z.

The Sault Ste Marie forecast issued at 1045Z on March 10, 1989, and valid from 1100Z to 2300Z on March 10 read:

> 10,000 feet scattered, high scattered, occasional visibility 3/4 mile in fog. After 1400Z 10,000 feet scattered, high broken. After 1800Z ceiling 10,000 feet broken.

Sault Ste Marie Reports (SA)

Between 1200Z and 2300Z on March 10, 1989, the lowest weather observed at Sault Ste Marie was at 1200Z, when scattered cloud was reported at 600 feet and 10,000 feet, with 10 miles visibility.

Runway Visual Range

General Description

Runway visual range (RVR)[5] in respect of a runway means the maximum horizontal distance, as measured by an automated visual landing distance system and reported by air traffic services (ATS), for the direction of takeoff or landing at which the runway, or the lights or markers delineating it, can be seen from a point above its centre line at a height corresponding to the average eye level of pilots at touchdown.

To compute RVR, three factors must be known: first, the transmissivity of the atmosphere as provided by a visibility sensor; second, the brightness of the runway lights, which is controlled on request by the air traffic control (ATC) controller; and third, whether it is day or night, since the eye can detect lights more easily at night than during the day. During twilight there is a problem, similar to that with prevailing visibility, when neither day nor night conditions prevail.

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[5] Exhibit 607: A.I.P. Canada: Aeronautical Information Publication, section RAC 9.21.1

RVR is measured by a visibility sensor, such as a transmissometer, located near the runway threshold. A light emitted from a source is attenuated in the atmosphere because of snow, fog, rain, and other conditions. The amount of this attenuation, or the transmissivity of the atmosphere, can be obtained by measuring the amount of light reaching a detector after being transmitted by a projector. The visibility sensor samples the atmosphere at a height that best represents the slant transmittance from the pilot's eye at cockpit level to the runway.

Operational Use of RVR

RVR information is available from ATC controllers, control towers, and flight service station (FSS) operators:

> When applicable, RVR information will be passed to the pilot as a matter of routine and may only be used in the determination or application of visibility minima if the active runway is the one served by the transmissometer.
>
> ...
>
> NOTE: RVR reports are intended to provide an indication of how far the pilot will be able to see along the runway in the touchdown zone; however, the actual visibility at other points along the runway may differ due to the siting of the transmissometer. This should be taken into account when decisions based on reported RVR must be made.[6]

In periods of low visibility, large fluctuations can occur during extremely short periods of time. In accordance with International Civil Aviation Organization (ICAO) recommendations, the RVR computer automatically averages the readings over the last minute.

RVR Equipment at the Dryden Airport

The Dryden airport has one set of RVR equipment, consisting of a transmissometer and a sensor, positioned near the threshold of runway 11. The equipment is remotely connected to the Kenora Flight Service Station and is normally controlled from there. The readout is made only in Kenora, not in Dryden. The transmissometer samples a 250-foot path-length parallel to the runway at its west end.

The readout from the RVR equipment is recorded on paper, and only a trained person is able to interpret and calibrate the readout. Mr Brian Sheppard, a senior instrument meteorologist with Environment Canada's Atmospheric Environment Service at Downsview, Ontario, assisted the Commission in interpreting and calibrating the Dryden RVR record. In

[6] Ibid., section 9.21.3

support of his work, he prepared a report (Exhibit 498) and an amendment (Exhibit 499) to it, and testified at the Commission hearings.

During his testimony, Mr Sheppard provided detailed explanation and support for his calculations of visibility. He also stated that the agreement between the visibility from the meteorological observations at Dryden and the visibility calculated from the RVR information is "well within my experience of such comparisons" (Transcript, vol. 65, p. 114). It must be remembered that the RVR equipment measures the visibility only in the space between the transmissometer and the sensor, while the meteorological observer looks at the entire horizon circle and finds a value that represents the average visibility for that horizon circle.

Visibility Comparisons: RVR and Meteorological Observations

Mr Sheppard provided a chart (Exhibit 499, p. 2) to show the comparison of the visibilities from the RVR and the meteorological observer:

		Observer	
Time	**RVR (Feet)**	**Miles**	**Feet**
1800Z	5000	2 1/2	
1805Z	1400	—	
1806Z	1600	3/8	1980
1811Z	2600	3/4	3960

At the request of the Commission, Mr Sheppard estimated the RVR-derived visibility for 1809Z (12:09 p.m.), the time the attempted takeoff commenced. He estimated that at 1809Z the visibility at the west end of the runway was 2200 feet; however, in making his estimate, he assumed that "some change did not take place in the atmosphere," and that there was continuity in the RVR trace (Transcript, vol. 65, pp. 111–12).

Visibility at Dryden, 1809Z (12:09 p.m.)

Summary of the Evidence

Based on the radio transmission made by First Officer Mills at 1804Z, the visibility in the area of taxiway Alpha at that time was one-half of a mile or less. Based on the testimony of Mr Fox, the visibility south of the airport at about 1804Z was about one-quarter of a mile.

The weather reports indicate that the visibility at the Dryden airport at 1800Z was two-and-a-half miles, at 1806Z was three-eighths of a mile, at 1811Z was three-quarters of a mile, and at 1812Z was three-quarters of a mile. From his vantage point at the airport terminal, Mr Brown estimated that at 1808Z the visibility was about one-half of a mile. The testimony of Mr Hodgins indicates that the visibility at the button of

runway 29 at 1809Z was one-half to three-quarters of a mile, and that as he looked down the runway to the west as the F-28 was taking off, the visibility was about three-quarters of a mile.

Based on the RVR data, Mr Patrick said in evidence that at 1809Z the visibility at the west end of runway 11/29, near the threshold of runway 11, was approximately 2200 feet (between three-eighths and one-half of a mile). At 1812Z the visibility from the terminal to the west, as evidenced by those who saw the smoke, was about one mile.

These close estimates of visibility made by witnesses in the vicinity of the Dryden airport, and the close agreement between witness estimates and the visibilities reported by the meteorology observer and the RVR equipment, are conclusive evidence of the visibility at the time the F-28 started its takeoff roll. The fact that some witnesses saw smoke from the crash fire, about one mile west of the terminal, is not conflicting evidence; their observations were made about two minutes after the F-28 started its takeoff roll, and there is a great deal of evidence that the heaviest snowfall, and hence the lowest visibility, was at the east end of the runway. The position from which the F-28 commenced its takeoff run – the east end of the runway – was approximately 6000 feet from the RVR equipment.

Findings

- The visibility at the button of runway 29 at the Dryden airport at the time the F-28 aircraft, C-FONF, began its takeoff roll, at approximately 1809Z (12:09 p.m. CST), was between three-eighths and three-quarters of a mile.

- The forecast for the area FACN3, which included the Dryden airport, issued at 1130Z on March 10, 1989, and valid from 1200Z to 2400Z, included a risk of freezing rain, with severe clear icing in the freezing rain.

- The Winnipeg terminal forecast issued at 1045Z on March 10, 1989, and valid from 1100Z on March 10 to 1100Z on March 11, as well as the Winnipeg terminal amended forecast issued at 1412Z on March 10, 1989, and valid from 1400Z on March 10 to 1100Z on March 11, forecast occasional light freezing rain.

- The Dryden terminal amended forecast issued at 1502Z on March 10, 1989, and valid from 1500Z to 2300Z, as well as the Dryden terminal forecast issued at 1630Z on March 10, 1989, and valid from 1700Z on March 10 to 0300Z on March 11, forecast occasional light freezing rain.

- All of the Thunder Bay terminal forecasts covering the period on March 10, 1989, from 1100Z on March 10 to 0500Z on March 11, forecast a risk of light freezing rain, occasional light freezing rain, or a risk of freezing rain.

- Based on this weather information and its availability to the flight crew of Air Ontario flight 1362/1363 and the Air Ontario system operations control (SOC) personnel, I find that the flight crew and SOC personnel should have been aware of the fact that the aircraft could be exposed to airframe icing during the station stops at Winnipeg, Dryden, and Thunder Bay on March 10, 1989.

5 EVENTS AND CIRCUMSTANCES AT THE DRYDEN MUNICIPAL AIRPORT PRECEDING TAKEOFF

Air Ontario flight 1363 landed at Dryden on runway 29 at 11:39 a.m. CST. It taxied down taxiway Alpha to the terminal and was marshalled to the front of the terminal by Mr Vaughan Cochrane, the refuelling agent and general manager of Dryden Flight Centre. The aircraft came to a stop, facing west, at the Dryden airport terminal at 11:40 a.m. The centre line of the parked aircraft was approximately 90 feet from the terminal, and the left wing tip was approximately 60 feet from the terminal (figure 5-1).

Between 11:40 a.m. and 12:01 p.m., Air Ontario 1363 was refuelled with the right engine operating and with the passengers remaining on board the aircraft. Eight passengers deplaned in Dryden and seven passengers, two of whom were children, boarded the aircraft.

Condition of Runway on Landing

It was acknowledged by all witnesses that, when the aircraft landed, the runway was bare and wet. Flight attendant Sonia Hartwick described the snow on landing as "big, wet, fluffy snowflakes falling very lightly ... they were drifting down at a little bit of an angle" (Transcript, vol. 10, p. 203).

Mr Richard Waller, a passenger seated in aisle seat 3D (figure 5-2), testified that, on landing in Dryden, it was snowing "big ... very wet snowflakes which melted upon contact with the ground" (Transcript, vol. 18, p. 114). As the aircraft taxied towards the terminal, the snow was light and the weather gloomy and overcast.

Figure 5-1 Dryden Municipal Airport

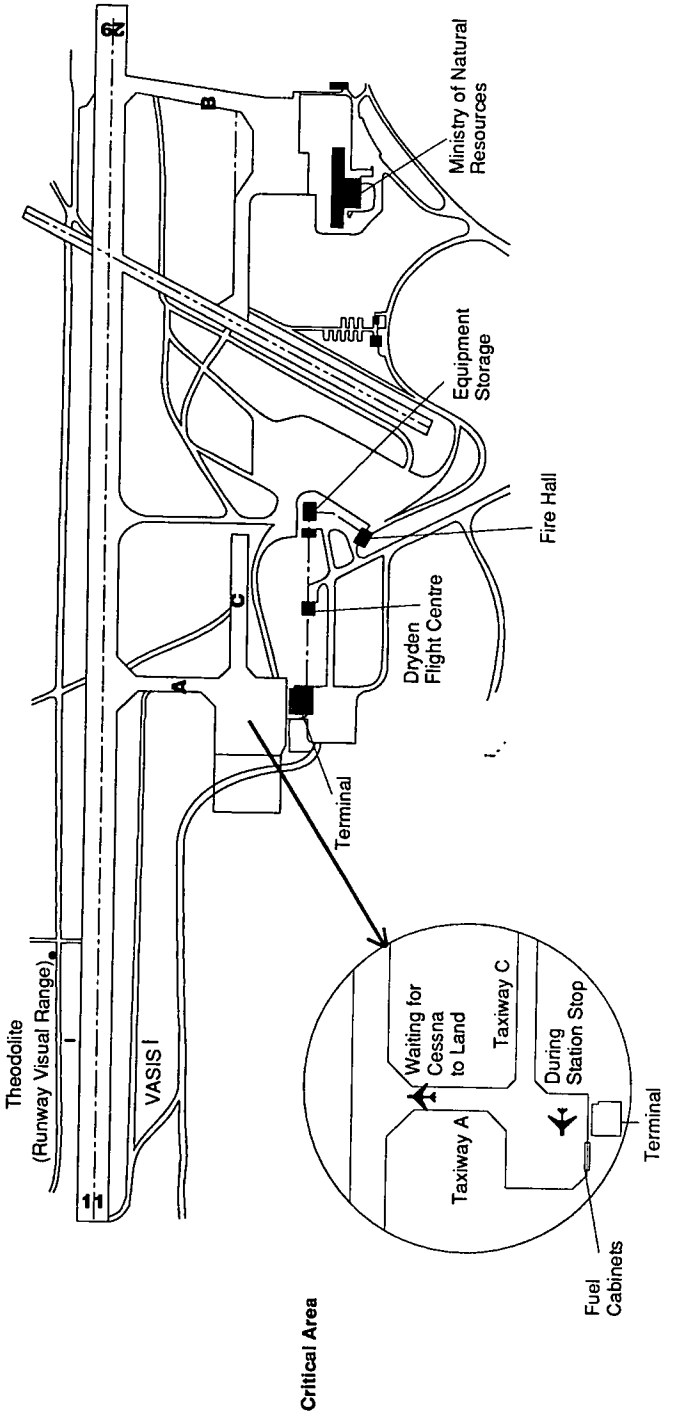
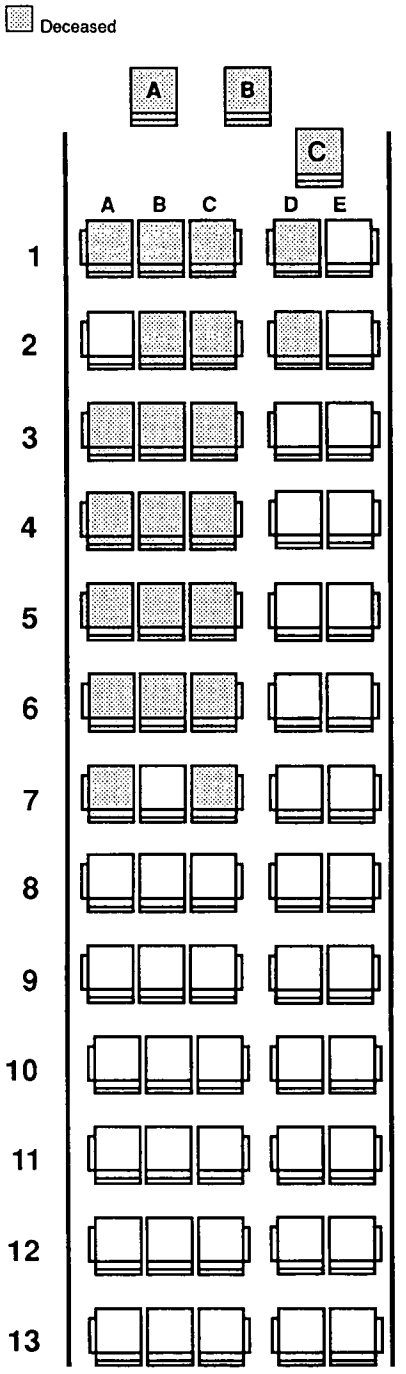


Figure 5-2 Seating Plan of Flight 1363



A Capt. George Morwood
B F/O Keith Mills
C Purser Katherine Say

	A B C	D E
1	Donald Allcorn Pamela Kliewer Brian Kliewer	Steve Syme Karen Syme
2	Uwe Teubert Lisa Kliewer Michael Kliewer	Hilda Rabb Jack Phibbs
3	Ryan Kozak George Kozak Kenneth John McLeod	Richard Waller Clyde Ditmars
4	Wilfred P. McColeman Geraldine McColeman Fred Gallinger	Brian Adams Brian Perozak
5	Mark Monroe William Schweitzer Alvin Rossaasen	Shannon Haines John Archer
6	Donald Finlayson Wendy Fortier Greg Fortier	Gordon Tucker Tina Maronese
7	Rudy Barton Allan MacDougall Nancy Ayer	Ricardo Campbell Shelley Podiluk/ Megan Podiluk
8	Tom Harris Byron Knott Ron Mandich	Flight Attendant Sonia Hartwick Paul Taggert
9	Lori Godin Dan Godin Alfred Bertram	Susan Godin Danielle Godin
10	Donna Menzies Kelly Mackenzie James Mackenzie	Susan Ferguson Michael Ferguson
11	Michael Gatto Ryan Gatto Lois Haines	Violet Woods John Biro
12	David Berezuk Michael Berezuk Sandra Berezuk	Douglas McFarlane Gary Scott McFarlane
13	Gary Jackson Donald Crawshaw Dennis Swift	Murray Haines Jessi Haines

Hot Refuelling

Because the auxiliary power unit (APU) on the F-28 was unserviceable and there was no F-28 ground-start equipment at Dryden, there was no way to restart the main aircraft engines if both were shut down. Therefore, refuelling had to be done while one of the main aircraft engines remained running. This practice, which is commonly referred to as a "hot refuelling," was performed while the passengers remained in the aircraft. Hot refuelling with passengers on board is a highly questionable and unsafe practice. My recommendation that this procedure be prohibited, as contained in my *Interim Report* of November 30, 1989, was accepted and implemented by Transport Canada.

Immediately after the aircraft stopped, Mr Jerry Fillier, an employee of Dryden Flight Centre, brought a baggage cart close to the right side of the aircraft to unload and load baggage. Mr Cochrane assisted him, and then boarded the aircraft at approximately 11:43 a.m. to advise the crew of the baggage count. At this time Mr Fillier was told by a crew member that fuel was required, but he was not advised that it would be a hot refuelling or that any precautions or special steps were necessary to perform the procedure safely. (For a discussion of hot refuelling, see my first *Interim Report*, pp. 23–24, and in this Report chapter 17, F-28 Program: Ground-Start Facilities, and chapter 21, F-28 Program: Hot Refuelling and Ground De-icing.

Mr Cochrane left the aircraft, asked Mr Fillier to bring the fuel truck to the plane, and then went inside the terminal to the Air Ontario desk to call the crash fire rescue (CFR) service unit. According to the Air Ontario Flight Attendant Manual and the ESSO Aviation Operations Standards Manual, the CFR unit was to stand by while any hot refuelling was in progress. The Air Ontario Flight Operations Manual, which was used by pilots and other operational personnel, was silent on the issue of hot refuelling.

At 11:48 Mr Fillier returned with the fuel truck and positioned it near the right side of the aircraft. He then proceeded to the cockpit of the F-28 to find out how much fuel was required. He was told by the captain to bring the fuel up to a total of 13,000 pounds, being 6500 pounds per wing.

Mr Fillier then returned to the fuel truck and hooked up the anti-static bonding cable to the aircraft. He was about to make the connection between the hose and the underside of the right wing when Mr Cochrane instructed him to fuel another aircraft. Mr Fillier advised Mr Cochrane of the amount of fuel uplift required, and Mr Cochrane took over the fuelling of the F-28. He made the single-point connection of the two-inch fuel hose to the underside of the right wing and set the gauges

at the aircraft control panel at the wing root to the amount of fuel requested by the captain.

Mr Cochrane then turned on the fuel flow at the control panel located at the wing root, walked to the fuel truck to open the controls to permit the flow of fuel, and then walked back to the control panel to observe the fuelling operation. From that position he could observe the fuel truck, the single-point fuel entry underneath the right wing, and the aircraft fuel control panel.

It was Mr Cochrane's evidence that he recalled seeing the fire trucks coming along taxiway Bravo to stand by for the hot refuelling; by that time, all the necessary hookups had been completed. From the evidence presented, it is my conclusion that the fuelling process began before the fire trucks actually had arrived and were positioned near the aircraft.

The fuelling was completed at approximately 11:59 a.m. Once the aircraft had received the required amount of fuel, the fuelling process automatically shut itself off at the aircraft. When Mr Cochrane returned to the aircraft to disconnect the hose, a valve in the wing did not close as required, and approximately 5 litres of fuel spilled onto the ramp from the wing-refuelling receptacle.

Mr Cochrane moved the fuel truck away from the aircraft, went into the cockpit to advise the crew that fuelling was completed, and walked towards the terminal, stopping to speak with Mr Stanley Kruger, crew chief of the airport's CFR unit. Mr Cochrane advised Mr Kruger of the fuel spill and was asked if he wanted it washed down by a booster line from one of the rescue vehicles. Mr Cochrane indicated that in his opinion this was not required, and that it would be better to move the aircraft and then clean up the spilled fuel. The fuel spill was washed down by Mr Gary Rivard of the CFR unit after the F-28 left the ramp.

Concurrent Events

At Dryden, Captain Morwood initially stayed in the cockpit while First Officer Mills went to the lavatory in the rear of the aircraft. When the first officer returned to the cockpit, the captain went into the terminal and telephoned Air Ontario System Operations Control (SOC) in London. Mr Wayne Copeland of SOC informed him of the 11 a.m. Winnipeg weather (sky partially obscured, three miles visibility in fog). The captain informed SOC that a short delay would be needed for refuelling and that, if required to proceed to his alternate of Sault Ste Marie, he would proceed directly to it, rather than via Thunder Bay. While the captain was inside the terminal, First Officer Mills, seated in

the aircraft, obtained, via radio, updated en-route and Winnipeg weather from the Kenora Flight Service Station (FSS).

The first officer received the 11 a.m. hourly weather observation as well as updated terminal forecasts at approximately 11:58 CST. During his conversation, at approximately 180030Z (12:00:30 CST), he advised the FSS operator on duty at Kenora that the visibility at Dryden was about one and one-half miles and described the precipitation as "quite puffy, snow ... looks like it's going to be a heavy one" (Kenora FSS taped log, Exhibit 7A, p. 29). Meanwhile, snow was accumulating on the wings. At approximately 12 noon, the captain returned to the aircraft. He walked quickly from the terminal to C-FONF. One witness described his walk as being "in somewhat expedient fashion" (Transcript, vol. 28, p. 21). On boarding the aircraft, the captain, as described by a passenger, "rather looked disgusted ... just not a happy expression" (Transcript, vol. 17, p. 45). No one among the 45 survivors of the crash or the witnesses on the ground observed either pilot do an inspection of the exterior of the aircraft (a walkaround inspection).

Prior to the start of the left engine, Mr Cochrane boarded the aircraft briefly to give the crew the fuel slip. According to Mr Cochrane, Captain Morwood asked if de-icing was available and was told that it was; however, the captain did not request de-icing.

At 12:03 p.m., as Air Ontario flight 1363 taxied for runway 29, the first officer radioed a request to Kenora FSS for instrument flight rules (IFR) clearance to Winnipeg. Immediately after this request, the pilot of a Cessna 150 reported to Kenora FSS that he was four miles south of the airport and inbound for landing. The Dryden weather at 12:04 was below visual flight rules (VFR) limits, and Kenora FSS advised the Cessna pilot that special visual flight rules (SVFR) would be required to land at Dryden. The Cessna pilot requested that Air Ontario 1363 hold while he landed and reported that he was having "real bad weather problems" (Exhibit 7A, p. 31).

Captain Morwood's Call to System Operations Control

As noted in chapter 3, Dryden Municipal Airport and Air Ontario Facilities, on March 10, 1989, Dryden Flight Centre, operating under a contractual arrangement with Air Ontario, provided aircraft and passenger-handling services for Air Ontario at the Dryden Municipal Airport.

The Air Ontario counter was located in the southwest corner of the terminal. The public counter space was equipped with a Reservac computer linked with the Air Canada system, a boarding pass printer, one telephone for normal use, and one direct line telephone to the

security counter in the airport boarding lounge. There was also a VHF two-way communications radio with three dials, to control volume, tuning, and squelch.

On March 10, the first flight to be serviced by Dryden Flight Centre was Air Ontario 1362 during its morning stop between Winnipeg and Thunder Bay. The next Air Ontario flight to be serviced was flight 1363, arriving from Thunder Bay on its return trip to Winnipeg.

The actions of Captain Morwood during the final moments before he boarded C-FONF for the last time were significant to the Commission's investigation into the human performance aspects of this aviation accident. In the course of the investigation, my staff became aware of information that suggested Captain Morwood had a heated conversation over the telephone while he was at the Dryden Airport terminal prior to the departure of flight 1363. A thorough inquiry was conducted into this potentially critical information, and sworn evidence on the subject was elicited from all relevant witnesses. Although there was some inconsistency in the evidence on this subject, I am able to draw some conclusions regarding the demeanour of Captain Morwood during the period immediately preceding the crash. It is, however, necessary to review carefully all the evidence on the subject. I will begin with the evidence of the two individuals who spoke with Captain Morwood on the telephone at the material time.

Evidence of Ms Mary Ward and Mr Wayne Copeland

Ms Mary Ward, the crew scheduler on duty at Air Ontario SOC in London, confirmed that on March 10, 1989, some time between mid-morning and afternoon, she took a telephone call from Captain Morwood, who was at the Dryden terminal. Ms Ward testified that she spoke with Captain Morwood for only a moment and noticed nothing unusual or abnormal about his tone of voice or his telephone demeanour. She stated:

> A. Captain Morwood mentioned the weather had gone down, and as soon as he mentioned that, I put him over to the dispatcher, Wayne Copeland.
>
> (Transcript, vol. 56, p. 118)

Mr Copeland, a dispatcher at Air Ontario SOC, testified that, at about midday on March 10, 1989, he spoke to Captain Morwood for approximately one minute. Mr Copeland stated that they discussed the payload, passenger load, and IFR alternate, and that the captain did not seem upset, in a hurry, or in any way abnormal. Mr Copeland emphatically

stated that there was no heated exchange between him and Captain Morwood. Following the accident, at approximately 2 to 3 p.m. on March 10, Mr Copeland made the following note detailing the content of his conversation with Captain Morwood:

> At approx 1200L (Dryden time) received call from Capt Morwood from Dryden. Morwood and I discussed the fuel load, pax [passenger] load and IFR alternate. At this time I relayed the YWG [Winnipeg] 1700Z wx [weather] which was "-X 5 -SCT 120 -BKN 3F" Morwood then seemed content with the wx and advised that because of the load he would be holding YAM [Sault Ste Marie] direct as the alternate due to load, not YAM via YQT [Thunder Bay] as originally planned. Also mentioned there would be a short delay due fuel being uplifted.
>
> (Exhibit 350)

Mr Copeland, in referring to this note, explained that he had advised Captain Morwood that the Winnipeg weather was as follows: sky partially obscured, a thin scattered cloud layer based at 500 feet, a thin broken cloud layer based at 12,000 feet, with three miles of visibility in fog. This was the extent of Mr Copeland's evidence on the subject of his telephone conversation with Captain Morwood.

Telephone toll records indicate that a telephone call, 1.9 minutes in duration, was placed from the Air Ontario counter at the Dryden airport to Air Ontario SOC at 11:58 a.m. CST. In my view this corresponds with the telephone call described by Ms Ward and Mr Copeland.

Evidence of and Related to Ms Jill Brannan

Ms Jill Brannan, a ticket agent employed by Air Ontario's passenger handler, Dryden Flight Centre, was on duty at the Air Ontario counter at the Dryden airport terminal on March 10, 1989. Ms Brannan testified that she observed Captain Morwood come over to the Air Ontario counter during both station stops on March 10. She testified that she observed and overheard him in telephone conversation with London operations during the morning station stop (i.e., the stop of flight 1362 from Winnipeg to Thunder Bay), but that she had no recollection of his making a telephone call during the second station stop (flight 1363).

Ms Brannan testified that Captain Morwood came into the terminal immediately following the arrival of flight 1363 and that he was on the inside of the counter at the same time she was processing the lost-baggage claims of some passengers who had just deplaned from flight 1363. Ms Brannan testified that she and Captain Morwood discussed the fact that during the captain's telephone conversation with London SOC

on the morning station stop, Captain Morwood had turned off the Dryden Flight Centre VHF radio.

Although Ms Brannan testified that she did not remember Captain Morwood's making any telephone call during the flight 1363 station stop, a number of witnesses gave evidence that Ms Brannan told them that Captain Morwood did make such a call.

Mr Christopher Pike, who worked for the maintenance department at the Dryden airport, testified that Ms Brannan told him that Captain Morwood "had been on the phone and ... was late" (Transcript, vol. 28, p. 52).

Mr Trevor Northcott and Mr Allan Hymers, both of Dryden, testified that they had a conversation with Ms Brannan at the Dryden airport terminal approximately one hour after the crash of C-FONF and that Ms Brannan told them about Captain Morwood's telephone conversation during the station stop. Mr Northcott stated in evidence that Ms Brannan advised both him and Mr Hymers that:

> A. ... when he [Captain Morwood] slammed up the phone, he was certainly upset or disturbed about something.
> Q. And she referred to the phone being slammed?
> A. Yes, she did.
> Q. And did she say anything else about that phone call, sir?
> A. No. She – not that I can recall, that – just assumed that he was – would be talking to Dispatch or Flight Ops or whoever, in the main office, I suppose, in London or –
> Q. Okay. Subsequent to her relating this telephone call to you, did she refer to receiving some radio communication from the pilot of that aircraft?
> A. Yes.
> Q. And would you tell the Commissioner about that, please.
> A. She said it was very unusual but he was talking on the radio. I don't know if she said the captain was talking on the radio, but the – there was two or three calls, and that he still appeared upset or disturbed about something.
>
> (Transcript, vol. 21, p. 113)

Mr Hymers's evidence on his conversation with Mr Northcott and Ms Brannan is as follows:

> A. ... she had told us that he had come in from the flight and he had made a phone call. And her words on the phone call were – she said – she said, I don't know what was said but he was really upset about something.
>
> And then she said he had left and that was about the only thing that he had said to her.

> And I actually don't know what was said to make her get that opinion and he went back to the aircraft.
>
> (Transcript, vol. 21, p. 79)

A final account of the Morwood telephone call came in the testimony of Ms Tara Barton. Ms Barton, a customer-service agent for Canadian Partner Airlines at the Dryden Municipal Airport, testified that at approximately 2:30 p.m., following the crash on March 10, 1989, she spoke with Ms Brannan in the Dryden airport terminal.

> A. ... I had first asked her if she wanted anything and she had said the cup of tea and ... I went over and talked to her for a while at that point.
> Q. And what else did you talk about?
> A. I had asked her how she was doing, how she was holding up. And she had said that she was worried.
>
> And the word "worried" struck me funny and I asked her, I said, why are you worried. I said, you wouldn't have done anything else for that flight that you wouldn't have done for any other flight, would you. And she said, no.
>
> She explained how the – the day had been unusual or the morning had been unusual from the beginning. She saw the captain come in both off 1362 and again off 1363 and made a phone call.
> Q. He made a phone call on just 1362?
> A. No, off of both flights.
> ...
> Q. Did she say anything else?
> A. She said that the second phone call had upset him and I told her not to worry about it. I said they can't fault – they are not going to fault you for anything that you have done as long as you have done your job.
>
> (Transcript, vol. 25, pp. 207–208)

Evidence of Captain Keith Fox and Ms Carol Petrocovich

In addition to hearing this "second-hand" evidence regarding Captain Morwood's demeanour in the Dryden terminal, I did hear from two individuals who spoke with Captain Morwood at the material time. Captain Keith Fox, an Air Ontario pilot, and Ms Carol Petrocovich, a court clerk in Kenora, Ontario, were both passengers who had departed from Air Ontario flight 1363 at Dryden. While standing adjacent to the Air Ontario counter at the Dryden terminal, they both spoke with Captain Morwood.

Captain Fox, after returning to the terminal from the airport parking lot, observed Captain Morwood on the telephone. Captain Fox testified:

A. ... I noticed George Morwood was standing at the Air Ontario counter. He was talking on the telephone.
Q. Now, when you say at, was he in front of the counter or behind the counter?
A. He was in front of the counter.
Q. Yes? And what was he doing again?
A. He was on the telephone. And I waved to him, sort of to say goodbye, and he motioned me over, he wanted to talk to me.

And he put his hand over the receiver, and he apologized to me for the delay. He said, sorry about the delay ... but they had us going out of Thunder Bay at – and he named a weight.

And I just did a quick calculation in my head, and I realized that, you know, going out at that weight that he gave me, that would put them over their landing weight in Dryden.
Q. You don't recall what weight he told you?
A. It was – thinking about it, I recall he used something and change. He did say that. But it was well over, you know, the limit. It was obvious from what – the figure he gave me.
...
Q. Do you recall it putting [him] over the maximum takeoff weight?
A. I don't recall that. I just recall – I had other things on my mind, but I recall it was definitely much over the landing weight.
Q. Do you recall the mood of Captain Morwood?
A. At that time, he just seemed more apologetic to me about the delay. And he also – on his P.A. announcement, he apologized for the delay as well on the way up to Dryden.

(Transcript, vol. 51, pp. 184–85)

Ms Petrocovich was at the Air Ontario counter, processing her lost-baggage claim. She testified that an off-duty pilot [Keith Fox] was ahead of her in the line, processing his own claim. She observed the pilot behind the counter [Captain Morwood] initiate a conversation with Captain Fox. Ms Petrocovich testified:

A. The gentleman ahead of me, it became apparent ... because of the conversation that took place that he was an off-duty pilot travelling as a passenger. He was quite concerned about some missing flight bags.

The pilot on the opposite side of the Air Ontario counter initiated some conversation with the gentleman ahead of me. He made a comment to him to the effect, You wouldn't have believed my [weight] in Thunder Bay before we took the fuel off; it was sixty-six and change.

Q. And was there any reply from the other individual in front of you?
A. Just acknowledgement of the comment.
Q. Now, what happened next?
A. The gentleman ahead of me, as I said, was extremely concerned about his missing flight bags. He was pressing the ticket agent to let him go out onto the tarmac and check the baggage compartment of the plane.

She replied with, as long as he had his identification card and put it on, he could go out and look in the baggage compartment. And he left.

Q. Can you describe the pilot standing behind the Air Ontario ticket counter.
A. He was about five-foot-ten, medium build, approximately 180 pounds, dark hair, slightly greying at the temples, dark-skinned, glasses. He wore a white shirt with dark pants ... dark tie, epaulets, approximately early fifties.
Q. Did you notice the demeanour of the pilot behind the counter when he was having his conversation with the individual in front of you?
A. As he was having this conversation with the gentleman ahead of me, he had his ear to the receiver of a telephone the entire time. He was dialling, and it appeared as if he was not getting a response from the other end. He continued dialling –
Q. Before that, what was his demeanour when he was talking to the other individual in front of you?
A. With regard to the comment about sixty-six and change, it was sort of disbelief.
Q. Now, was he on the telephone while he was talking to this individual in front of you?
A. Yes, he – well, he had the receiver up to his ear.
Q. Now, once the person in front of you left the counter, describe what happened then.
A. I started to make my claim with the ticket agent for the missing baggage. As we did so, the pilot spoke to me. He initiated a conversation. He said something to the effect, Oh, don't tell me we have lost your luggage too.

And I said it wasn't really important. He said they had thrown off approximately 10 to 12 bags in Thunder Bay, so, hopefully, it would come that same day.

(Transcript, vol. 26, pp. 10–12)

Ms Petrocovich went on to identify the Air Canada missing baggage report that she and Ms Brannan completed at the Air Ontario counter. Ms Petrocovich, who confirmed that the form was completed at approximately noon, testified that while she and Ms Brannan were completing the form, the pilot behind the counter tried unsuccessfully four or five times to complete a telephone call. She observed the pilot

asking Ms Brannan to confirm the number he was dialling. Ms Petrocovich testified that she recognized the telephone as a local "Oxdrift exchange" number, beginning with the three digits "937." The Dryden airport is included within the Oxdrift exchange, but the Town of Dryden is not. Ms Petrocovich, who did not recall the final four digits of the number, was certain that the pilot dialled a local Oxdrift number and not a Dryden number or a long-distance 1-800 number.

Ms Petrocovich confirmed that the pilot was still behind the Air Ontario counter when she completed her baggage claim and left the terminal. She provided the following evidence on the pilot's demeanour while she was at the counter:

> A. ... there was an element of frustration because he could not complete his telephone call. Other than that ... he initiated a conversation with me and apologized for losing my luggage, and I don't think that falls into the category of a pilot's specifics, handling baggage, and ... I thought that was extremely kind of him, and he was extremely pleasant to me. But, as I said, he was frustrated because he could not complete his telephone call.
>
> (Transcript, vol. 26, p. 18)

When the evidence of Ms Petrocovich is considered, it is apparent that Captain Morwood was attempting to place two telephone calls, one local and one to Air Ontario SOC at London. Although he was unsuccessful in placing the local call, he obviously was successful in placing the call to Mr Copeland of Air Ontario in London. (The confirmed telephone call between Captain Morwood and Mr Copeland of Air Ontario SOC was a 1-800 long-distance telephone number.) It is evident that Captain Morwood attempted to place the local call prior to the call to London. In all likelihood, the 11:58 a.m. call to Air Ontario SOC occurred after Mr Fox and Ms Petrocovich left the Dryden terminal.

It was not possible to determine the party within the Oxdrift exchange whom Captain Morwood unsuccessfully tried to reach. It may have been he was attempting to call the CFR fire hall regarding the hot refuelling and was unsuccessful because the CFR personnel were already en route. (The Dryden CFR fire hall is in the 937 Oxdrift exchange.) Such a theory would, however, be speculation.

Having considered all the evidence regarding Captain Morwood's actions in the Dryden terminal during the flight 1363 station stop, I accept as fact that Ms Brannan did speak with the four witnesses – Pike, Northcott, Hymers, and Barton – about the noon-hour Morwood/SOC telephone call. The next step in assessing the evidence is to determine what weight, if any, can be attached to the substance of the comments Ms Brannan made to these individuals.

I note that much of what Ms Brannan told these four individuals was consistent with other evidence: Captain Morwood did make a telephone call, he was late, two subsequent radio communications were made to the Air Ontario counter by flight 1363, and the first radio communication was a hurried complaint about the additional wait for the Cessna 150. Because of the accuracy of the verifiable portion of what Ms Brannan told witnesses Pike, Northcott, Hymers, and Barton, and the fact that her comments to these individuals were consistent with the overall scenario at the Dryden terminal during the noon-hour station stop of flight 1363, I am prepared to attach some weight to the substance of the four indirect accounts of Captain Morwood's demeanour; and I am satisfied that Captain Morwood was exhibiting signs of frustration while he was in the Dryden airport terminal.

Later Events at the Terminal

Ms Brannan specifically recalled speaking with airport employee Christopher Pike before flight 1363 departed, a conversation corroborated by Mr Pike. Mr Pike testified that before going to the Air Ontario counter to speak with Ms Brannan, he had seen the captain "on his way out the arrival doors in somewhat expedient fashion" (Transcript, vol. 28, p. 21). Since Captain Morwood was on the telephone at the counter until about 12 noon, Mr Pike would have had to arrive at the Air Ontario counter shortly after 12 noon.

While Mr Pike was at the Air Ontario counter with Ms Brannan, two radio transmissions were received from flight 1363. The first transmission was to the effect that flight 1363 would have to wait for an incoming aircraft. Ms Brannan was questioned regarding this first radio transmission:

Q. And what conversation with the pilot were you referring to?
A. When he had called me on the radio just before he had taxied out.
Q. And that was the conversation about having to hold because of the small aircraft; is that right?
A. Yes.
Q. That's the conversation where you felt he sounded – describe how you thought he sounded.
A. I thought he sounded upset.
Q. And, again, would you tell me why you concluded that this man sounded upset.
A. Because he was talking really fast, and like, I couldn't really understand exactly what he was saying, just that he was saying

something about an incoming plane and God knows how long we're going to have to wait now.

And I didn't answer back because I didn't know what to say to him. And then, like not even two minutes later, he called back and said that he was going to taxi out now. And I said okay.

Q. He said something like, God knows how long we're going to have to wait now, right?
A. Yes.
Q. And he said that quickly, did he?
A. Yes.
Q. So quickly that you had trouble understanding him?
A. Yes.

(Transcript, vol. 20, pp. 170–71)

The following testimony by Mr Pike regarding the radio transmissions supports the evidence of Ms Brannan:

A. The first radio transmission was to the effect, Looks like we are going to have to wait. I can't believe there is a small aircraft coming in.

The second transmission –

Q. No, let's talk about the first for a moment. Did you gather anything about the way the pilot felt from what you heard on that radio transmission?
A. Yes, I did.
Q. Could you tell us about it.
A. He was very impatient, anxious ... Pissed off.
...
Q. You also heard a second transmission, sir?
A. Yes, I did. He had called in and said that, I see the small plane is down and we are taxiing out.

(Transcript, vol. 28, pp. 22–23)

On the evening of March 10, Mr Pike reduced to writing his recollection of the content of the radio transmission from flight 1363. His written recollection is repeated verbatim as follows:

> Looks like we're going to have to sit a while. I can't believe there's a small plane coming in God knows how long we're going to sit here. I see the small plane is down now and we're going to taxi now. I can't believe there's a small plane coming in God knows how long we're going to have to stay here now. (Talking real fast. Impatient, Pissed off.) I see the small plane's down and we're going to taxi now.
>
> (Exhibit 189)

Mr Pike elaborated upon the content of this note:

> Q. Now, Mr. Pike, the original which I have before me reads, and I quote,
>
> "I can't believe there is a small plane coming in. God knows how long we are going to have to stay here."
>
> And then you write,
>
> "Now talking real fast."
>
> What did you mean by that?
>
> A. It was the manner in which he was speaking. It was very quick. It was fast enough that Jill Brannan could not understand what he was saying and I had to repeat it to her.
>
> Q. And the next two words are "impatient, pissed off."
>
> A. Right.
>
> Q. That was the way you sensed –
>
> A. His feeling.
>
> (Transcript, vol. 28, pp. 24–25)

Very soon after the first transmission, a crew member of flight 1363 called back on the radio and said "okay, we're going to taxi out now." Ms Brannan stated that "the second time, he seemed a little calmer" (Transcript, vol. 20, p. 107).

It must be noted that Ms Brannan could not positively identify which crew member was speaking during these two radio communications. Mr Pike, however, expressed a view that it was the captain of the aircraft.[1] Given that it was apparently the task of First Officer Mills to perform the required operational radio communications while the aircraft was on the ground, and that he was in continuous contact with Kenora FSS and the pilot of the Cessna 150 when the Cessna made its final approach and landing, it seems likely that Mr Pike was correct in his assessment that it was Captain Morwood who twice radioed the Air Ontario counter at the Dryden terminal immediately before takeoff.

Role of the Cessna 150 Aircraft

As previously noted, while Air Ontario flight 1363 was preparing to depart from Dryden, a Cessna 150, registration C-FHJS, piloted by Mr Robert McGogy, was inbound to the airport. Mr McGogy, a low-time pilot with a private pilot's licence, had on March 10, 1989, a total of approximately 80 VFR flight hours.

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[1] Because it was not Air Ontario's practice to record aircraft/station radio communications, there was no record of the two communications in question.

On March 10 Mr McGogy had decided to do some recreational flying. He drove from his home in Vermilion Bay to Dryden airport, where his aircraft was parked. Mr McGogy testified that the weather looked "a little bit iffy" (Transcript, vol. 22, p. 14), so he spoke to Mr Cochrane, who advised that "the weather would stay approximately the way it was and within about an hour would probably get worse" (Transcript, vol. 22, p. 17). Following this discussion and after having Dryden Flight Centre refuel his aircraft, Mr McGogy went flying. Figure 5-3 represents the course of his flight, as recalled by him in testimony. The visibility throughout the flight was poor. On his return leg and close to the Dryden airport, "it was almost a whiteout" (Transcript, vol. 22, p. 25). As he approached the airport, the snow increased in intensity, and the flakes "were approximately the size of 50-cent pieces, and they were very wet" (Transcript, vol. 22, p. 40).

In the first of two conversations with Kenora FSS, at 12:03:08, Mr McGogy reported that he was four miles south of the airport, inbound for landing. The FSS operator advised the pilot that the Dryden airport weather was below VFR minima and that he would require a special VFR clearance to enter the zone.[2] Mr McGogy responded that he would be using runway 29, but he did not request special VFR.

Mr McGogy testified that in order to maintain visual reference with the ground, his height above ground level varied, from a high of 1000 feet while en route to 150–200 feet while approaching runway 29.

Based on the evidence of Mr McGogy and his taped radio conversations with Kenora FSS, it is clear that he was a low-time pilot who was in serious trouble. Mr McGogy was already within the five-mile radius of the control zone surrounding the Dryden airport when he contacted Kenora FSS at 12:03. From the evidence it would appear that, when he made this initial communication, the weather was below VFR minima and any SVFR minima.

At 12:04:03 Mr McGogy asked: "There any chance that plane can hold, I'm having real bad weather problems here" (Kenora FSS taped log, Exhibit 7A, p. 31). Flight 1363 then indicated that it would hold.

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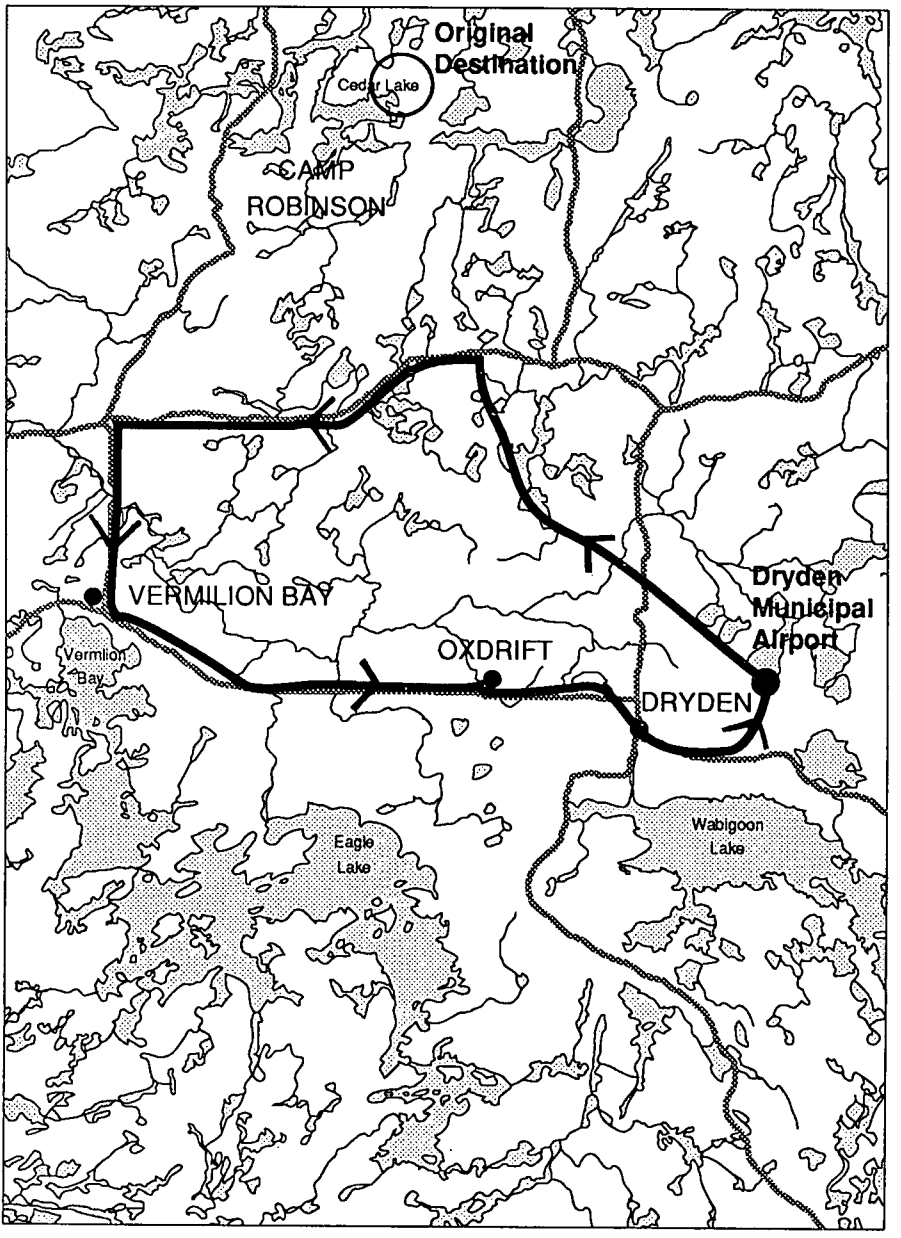
[2] For an explanation of VFR minima, see chapter 3, Dryden Municipal Airport and Air Ontario Facilities. When weather minima are below VFR minima, special VFR flight (SVFR flight) may be authorized by the appropriate air traffic control unit subject to current and anticipated IFR traffic. This authorization is normally obtained through the local tower or FSS and must be obtained before SVFR flight is attempted within a control zone. On March 10, 1989, the applicable SVFR weather minima were as follows: (a) ceiling of not less than 500 feet and ground visibility of not less than 3 miles; (b) ceiling of not less than 600 feet and ground visibility of not less than 2 miles; or (c) ceiling of not less than 700 feet and ground visibility of not less than 1 mile.

Figure 5-3 Flight Path of the Cessna 150



The crew of flight 1363 informed the passengers of the additional delay caused by the Cessna, and at approximately 12:04 a crew member, probably Captain Morwood, called Ms Brannan on the radio to advise that the F-28 would have to hold for a light aircraft.

At 12:04:07, First Officer Mills made the following radio transmission:

> Okay three sixty three's, holding short of the active, be advised you are down to a half a mile or less in snow here.
>
> (Exhibit 7A, p. 31)

Since the crew of the F-28 were aware of what was transpiring in relation to the Cessna, there are several possible explanations of the purpose of First Officer Mills's transmission. In addition to advising both Kenora FSS and the pilot of the Cessna 150 that Air Ontario 1363 would hold and would not proceed onto the active runway, its purpose may have been the following:

- to warn the pilot of the Cessna 150 of the weather at the airport;
- to advise either Kenora FSS or the Cessna 150 pilot, or both, that the weather was below special VFR limits; and/or
- to inform Captain Morwood, indirectly, of the deteriorating weather and the fact that Captain Morwood was below his takeoff limitation.

Mr Keith Fox, a passenger who departed flight 1363 at Dryden and himself an Air Ontario F-28 pilot, testified that when he was driving south from the airport on Airport Road he saw Mr McGogy's Cessna 150 flying north to the airport at an "extremely low altitude ... [of] no more than 200 feet" (Transcript, vol. 51, p. 189). Mr Fox gave the following evidence regarding the estimated visibility at the time he observed the Cessna 150 overhead:

> A. I would estimate quarter mile, but it's hard to estimate because it was freezing on my windshield. It was very bad conditions at the time.
>
> (Transcript, vol. 51, pp. 189–90)

Mr McGogy estimated that he landed approximately 200 feet beyond the button of runway 29. He testified that the runway had approximately one-quarter inch of slush at its centre, with a greater accumulation of slush on the north side of the runway.

After landing at 12:06:42, Mr McGogy contacted Air Ontario 1363 on the radio, asking, "Are you using Runway one one or two nine?" Air Ontario 1363 replied, "We'll go for 29" (Exhibit 7A, p. 33). Having confirmed that the F-28 would be using runway 29, Mr McGogy taxied west, beyond taxiway Alpha, allowing the F-28 to proceed from taxiway

Alpha onto the active runway and to turn right (east) towards the button of runway 29. Mr McGogy then taxied off the runway onto taxiway Alpha and subsequently onto taxiway Charlie, in order to bring his aircraft to its parking location near Dryden Flight Centre.

Five minutes and 53 seconds passed between the time Air Ontario 1363 commenced to hold at the intersection of taxiway Alpha and the ramp and the time it advised Kenora FSS that it was "about to roll" (Exhibit 7A, p. 35). The total time that elapsed up to the actual commencement of the takeoff roll was estimated to be 6 minutes and 4 seconds. A delay of approximately 2 minutes and 45 seconds is attributable to flight 1363 waiting for the Cessna 150 to land.

At 12:07, as flight 1363 taxied for the button of runway 29, the flight crew received their instrument flight rules (IFR) clearance for their flight to Winnipeg. Meanwhile, the snow was continuing to fall heavily, becoming increasingly thick on the wings. When flight 1363 was backtracking towards the button of runway 29, the flight crew lowered the flaps to 18° for takeoff. After turning the aircraft around at the east end of runway 29 they powered up the engine for about 15 seconds before beginning the takeoff roll. The last transmission received from the flight crew, at 12:09:29, was the call, "about to roll twenty-nine at Dryden" (Exhibit 7A, p. 35). The aircraft then started the takeoff roll, approximately one hour and 10 minutes behind schedule.

Eyewitness Observations of Precipitation

Ramp Area

It was acknowledged by every witness who testified on the subject that, during the station stop at Dryden, the ramp area in front of the terminal and where the F-28 waited for Robert McGogy's Cessna 150 to land was, at the very least, wet at all times from falling precipitation.

The ramp area in front of the terminal was black and wet, and, as 12 noon approached, the snowfall's intensity increased and a film of slush began to cover the ramp.

Mr Alfred Bertram, a survivor of the crash and himself a flight service specialist with Transport Canada, was seated in aisle seat 9C and had a reasonable line of vision to the ramp area. Referring to the period when the aircraft initially parked at the terminal, he stated that he "was marvelling at the fact that snowflakes this size (indicating) were actually melting" (Transcript, vol. 18, p. 12).

Mr Ronald Mandich was one of the surviving passengers who boarded flight 1363 in Dryden. He testified as to his observations while boarding the aircraft:[3]

> Q. Now describe boarding the aircraft.
> A. Well, as we left the security area after going through security, I would say that the airplane was approximately 50 to 80 feet from the doorway.
>
> And as I proceeded with my briefcase in one hand and I flipped my hood on my jacket up over my head because the snow was intense enough so that I figured by the time I got to the airplane, I was going to have a head full of snow and then I would have to deal with that after I got on the airplane ...
> Q. Did you observe any snow or precipitation on the tarmac areas as you walked up?
> A. My recollection is that the tarmac had been scraped from previous snow such that there were bare spots and there were hard packed covered areas. And the snow was sticking to the hard pack snow areas and it was melting on the pavement areas.
>
> (Transcript, vol. 17, pp. 351–52)

Mr Daniel Godin, seated in 9B, made some critical observations of the ramp on the left side of the aircraft, the area between the aircraft and the terminal. Mr Godin testified that he observed an emergency vehicle standing by during the refuelling and noted that, because of the intensity of the snowfall, the only reason the vehicle could be seen was that it had its headlights and flashing roof lights illuminated. As well, he testified that he saw the refuellers pulling down their toques and pulling up their collars because they were getting covered in wet snow.

In his testimony, Mr Godin stated:

> A. We – as we were sitting there, a dead-style snowstorm hit us, no wind. It started snowing quite heavily.
>
> I watched the snow hit the side windows of the airplane, immediately turn to water and run down to give us the effect of raining.
>
> Outside, I had watched the tarmac, and, at all times, you could see asphalt on the tarmac, but it was covered by a layer of thin slush.
>
> (Transcript, vol. 17, pp. 174–75)

[3] It must be noted that refuelling began at approximately 11:50 a.m., and the passengers who boarded at Dryden embarked before the refuelling commenced.

Two passenger/pilots on board the F-28, Air Ontario Captain David Berezuk and Air Canada Captain Murray Haines, testified about the ramp area in front of the terminal. Captain Berezuk described the area as black and wet. Captain Haines testified that the flakes "melted when they hit the tarmac" (Transcript, vol. 19, p. 15). Captain Haines did not believe it to be snowing at the time he boarded the aircraft at Dryden.

As the aircraft moved away from the front of the terminal to the intersection of the ramp and taxiway Alpha, where it waited for the Cessna 150 to land, the snowfall increased in intensity. According to Mr McGogy's testimony, there was up to one-quarter inch of slush at the intersection by the time the Cessna 150 had passed through taxiway Alpha, this being seconds after the F-28 progressed through taxiway Alpha onto the active runway.

Wings

With the exception of Mr Vaughan Cochrane, every witness who had observed the aircraft wings while the aircraft was parked in front of the terminal testified that the wings were, to some extent, covered with snow, wet snow, or ice.[4] Those who observed the wings while the aircraft was waiting at the intersection of the ramp and taxiway Alpha also testified that the wings were, to some extent, covered with snow.

While the F-28 was standing in front of the terminal, a number of revealing observations were made. Mr Michael Ferguson was seated in 10E, a window seat with a direct unobstructed view of the right wing. He stated that the amount of snow covering the wing was such that he "couldn't see ... the line of rivets on the wing" (Transcript, vol. 13, p. 15).

Mr Gary Jackson was seated in 13A, a window seat with a direct line of vision to the left wing. He recalled that during the time the aircraft was at the terminal, the snow was "slowly but steadily increasing." He stated that snow was collecting on the wing and that "[a]t the terminal, between 5 and 10 per cent of the wing would have been covered" (Transcript, vol. 16, pp. 125, 126). He was able to see the metal on the wing through the snow.

Mr Ricardo Campbell was seated in 7D, an aisle seat directly over the wing. He stated that, while waiting at the terminal prior to the aircraft taxiing for the first time, he observed "straight ice" on the right wing. "There was a glaze," he said (Transcript, vol. 17, pp. 46, 47). Air Ontario Captain David Berezuk was seated in 12A, a window seat with a direct line of vision over the left wing. He stated that, just before the aircraft taxied out, he looked at the wing and saw a trace of snow covering all of the wing. He estimated that this trace of snow, at the highest point,

[4] See my first *Interim Report*, pp. 24-25.

was approximately one-quarter inch thick. Referring to the distribution of snow over the wing, Captain Berezuk said that at its highest point the snow "was sort of a texture of a sculptured carpet" (Transcript, vol. 14, p. 55).

Mr John Biro was seated in 11E, a window seat directly overlooking the wing. He stated that the snow on the wing was melting, but not as rapidly as it was falling, and that there was an accumulation of snow on the wing. At the time the fuel truck was by the aircraft the accumulation was, he believed:

> A. ... about between an eighth and a quarter of an inch accumulation. And it seemed to stay about that way throughout the refuelling process because it was melting next to the wing and the new snow was landing on top of the wet, melting snow.
>
> (Transcript, vol. 21, p. 9)

Air Canada Captain Murray Haines, who was seated in 13D, testified that he had a good view of the right wing:

> A. ... the first large snowflakes fell and they fairly adhered themselves to the wing. As they touched the wing, they melted a bit and adhered to the wing.
>
> (Transcript, vol. 19, p. 15)

Flight attendant Sonia Hartwick stated that she looked at the wing while the aircraft was parked in front of the terminal, and that there was "a fluffy layer of snow on the wing" (Transcript, vol. 10, p. 218).

Similar observations of snow accumulation on the wings, while the aircraft was standing in front of the terminal, were also made by firefighter Gary Rivard, who was attending to the hot refuelling, and by Ms Cherry Wolframe, an employee of Dryden Air Services, who was inside the terminal.

Observations of Mr Vaughan Cochrane

The only eyewitness to testify that he did not see any snow on the wings while the aircraft was in front of the terminal was Mr Vaughan Cochrane. Mr Cochrane had initially boarded the F-28 to give the baggage count to the crew. It will be recalled that he refuelled the aircraft, and then spoke with Mr Stanley Kruger about the fuel spill.

At approximately 12:01, Mr Cochrane boarded the aircraft for a second time, to advise that the fuelling was complete. His observations of the events surrounding the crash were recorded by him in a prepared statement, drawn up at approximately 3 p.m. on the afternoon of the crash. This statement contains in my view three noteworthy items:

- On start up commenced snowing heavy wet snow ...
- A/C was taxiing before any build-up on wings ...
- My impression are undecided however I do not feel icing was heavy or sustained to be a major factor ...

(Exhibit 415)

As noted earlier, while Captain Morwood was in the terminal, First Officer Mills was checking the weather with Kenora FSS. First Officer Mills made the following transmission from the aircraft to Kenora FSS at 12:00:30:

> Okay we check that, we're down to about a mile and a half in Dryden in snow right now, quite puffy, snow, looks like it's going to be a heavy one. Uh, okay and go ahead the rest.
>
> (Exhibit 7A, p. 29)

This radio transmission was apparently made by First Officer Mills before Mr Cochrane boarded the F-28 for the second time to give the crew the fuel slip.

In view of this radio transmission, Mr Cochrane was asked to recall the snowfall at that time:

> Q. ... would you like to reconsider your own recollection of what the snowfall was like when you boarded the aircraft which would have been, in all probability, after that point in time?
> A. No, I think that's consistent with a light to moderate snowfall. He [Keith Mills] of course, from his perspective, was looking out to the west and could see the approaching weather.
> Q. So you would not disagree that it was puffy snow that was falling at that time?
> A. No, I wouldn't disagree with that.
>
> (Transcript, vol. 53, pp. 159–60)

Following the crash, Mr Cochrane gave two interviews to Mr Guy Dutil of the Canadian Aviation Safety Board (CASB). In his first interview, on the morning of March 11, 1989, Mr Cochrane recalled what he observed when he was in the aircraft to advise that fuelling was complete:

- ... I gave the pilot his final uplift ... at that point it had started to snow fairly heavy wet snow.

- ... we gave him the O.K. to depart because it was snowing heavy they closed the door right off quick.

- Marshalled them off the gate and he departed the gate. There was no significant accumulation of snow on it.

- When it was sitting on the ramp during the turn around that – that airplane was clean. It started to snow on it about the time we started closing it up.

(Exhibit 414[a], pp. 3, 8)

In his second interview with Mr Dutil, on March 14, 1989, Mr Cochrane described coming out of the cockpit after the fuel uplift was given:

- I marshalled the aircraft off the gate, toward the taxiway. The question is about snowing, or was about snowing. It had started very, very light snowfall as I was coming down from out of the cockpit. As the aircraft turned to taxi, it was snowing very, very lightly.

- In my mind there was no question at that point about de-icing the aircraft, there was just no significant accumulation of snow on the airplane.

- ... when that airplane left the ramp, it was ready to go flying. It hadn't snowed enough to create an accumulation.

- The snow had not started when he had marshalled off the ramp or was so light as to be insignificant ...

(Exhibit 414[b], pp. 3, 7, 9)

Mr Cochrane, when questioned on the obvious discrepancy in the two statements that he gave CASB regarding the intensity of the snowfall, explained:

> A. I would have to say that the first interview with Mr Dutil was probably the most current and would probably represent the best information.
>
> (Transcript, vol. 54, p. 173)

When he was questioned before the Commission, Mr Cochrane was presented with the observations of witnesses describing the snowfall and condition of the wings while the aircraft was parked in front of the terminal. In view of the consistent nature of the observations made by other eyewitnesses, Mr Cochrane's contrary evidence was challenged. He stated that his observations of the aircraft wings were restricted to those made from the stairs of the aircraft, and he conceded that the other witnesses, who were sitting in the aircraft, looking out at the wings, would have had a better view. I have no hesitation in concluding that

the evidence of the other witnesses correctly reflects the condition of the wings of the aircraft while it was on the ramp.

Waiting for the Cessna 150

When the aircraft departed from in front of the terminal, it moved to the intersection of the ramp area and taxiway Alpha, where it waited for the Cessna 150 to land and clear the active runway. A number of observations made by witnesses aboard the aircraft reveal the effect of the deteriorating weather conditions on the wings.

Air Ontario Captain David Berezuk, who from his vantage point in seat 12A was able to see the left wing, acknowledged that the snow was accumulating and staying on the wing.

Q. And what did you see?
A. I saw snow accumulation on the left-hand wing wet in texture and, again, like a sculptured carpet.
Q. And how much snow was accumulating?
A. At what time?
Q. When the aircraft was parked on the taxiway just prior to Alpha.
A. Approximately quarter of an inch.
Q. It was a quarter of an inch. Now, you said it was a quarter of an inch by the terminal approximately?
A. That is correct.
Q. Now when it taxied out and stopped just prior to entering taxiway Alpha, how much – how thick was the snow?
A. It was more than one quarter of an inch at that time due to the increasing snow.
Q. And was it adhering; was it staying on the wing?
A. Yes.

(Transcript, vol. 14, pp. 59–60)

In response to further questioning, Captain Berezuk provided evidence of his additional observations to the effect that up to one-half inch of snow had accumulated on the wings while flight 1363 waited at the intersection for the Cessna 150 to land:

Q. And at the end of the five minutes as the aircraft was sitting there, did you observe the left wing?
A. Yes.
Q. And did you observe the right wing?
A. Yes.
Q. And can you tell me what the weather conditions were like at the end of the approximate five minutes?

> A. At the end of the five minutes, the portion of the left wing, of which I stated I could see, was varying in amounts up to one half an inch at that time.
>
> (Transcript, vol. 14, pp. 61–62)

Mr Michael Ferguson, from his vantage point in seat 10E, made the following observation:

> A. ... The wing was covered with snow. I remember saying to my wife to look at the wing ...
>
> (Transcript, vol. 13, p. 17)

Mrs Susan Ferguson corroborated the evidence of her husband, Mr Michael Ferguson.

Ms Kelly Mackenzie, seated in 10B, a vantage point close to the centre of the wing, described what she saw on the wing of the aircraft:

> A. ... I was noticing that white was starting to cover the wings at this point ... it was just building up to a white colour. That's what I saw.
>
> (Transcript, vol. 19, pp. 185–86)

Mr Brian Perozak was seated in window seat 4E. Looking over his right shoulder while the aircraft waited for the Cessna to land, he observed "up to a half an inch of fluffy snow on the wings" (Transcript, vol. 16, p. 229).

Flight attendant Sonia Hartwick also testified that, while waiting for the Cessna 150 to land, "there was a layer of fluffy snow on the wing" (Transcript, vol. 10, p. 228).

Findings

Landing at Dryden

- Air Ontario flight 1363 landed in Dryden on March 10, 1989, in visual meteorological conditions. When the aircraft landed, the runway was bare and wet. Light snowflakes that melted upon contact with the tarmac were falling when the aircraft taxied to the Dryden terminal.

At the Dryden Terminal

- While passengers were leaving and boarding the aircraft, the snowfall was steadily increasing in intensity. Initially, snowflakes were melting on contact with the tarmac, but, by the time the aircraft was about to

leave the terminal, at approximately 12:01 p.m., a thin film of slush was covering the ramp.

- While at the Dryden terminal, the aircraft was refuelled. Because the auxiliary power unit on the F-28 was unserviceable, it was necessary to keep one engine running during the refuelling. This practice, which is commonly referred to as a "hot refuelling," was performed while the passengers remained in the aircraft and in all probability commenced before the required fire trucks were in place.

- Hot refuelling with passengers on board is a highly questionable and unsafe practice that was contrary to the provisions of the ESSO Aviation Operations Standards Manual and the Air Ontario Flight Attendant Manual.

- During the refuelling procedure, Captain Morwood went into the airport terminal while First Officer Mills remained in the aircraft.

- Captain Morwood unsuccessfully attempted to place a local telephone call from the Air Ontario counter at the Dryden airport terminal. While he attempted to place this telephone call, Captain Morwood spoke with Captain Keith Fox and Ms Carol Petrocovich. Captain Morwood apologized to Captain Fox for the delay of flight 1363 and explained that, in Thunder Bay, "they" (presumably Air Ontario System Operations Control (SOC)) had put the flight well over its maximum landing weight at Dryden. Captain Morwood apologized to Ms Petrocovich regarding her lost baggage.

- Captain Morwood showed signs of frustration when he was unable to complete his local telephone call.

- After failing in his attempt to place the local call, at 11:58 a.m., Captain Morwood telephoned Air Ontario SOC, speaking with Ms Mary Ward and then Mr Wayne Copeland. Captain Morwood advised Ms Ward that the weather at Dryden had deteriorated, and he discussed fuel and passenger loads and the Winnipeg weather with Mr Copeland.

- Ms Brannan of Dryden Flight Centre was in a position to observe and/or overhear Captain Morwood making this telephone call. Although Ms Brannan stated that she had no recollection of speaking with anyone about the telephone call, I am satisfied by the evidence of witnesses Pike, Northcott, Hymers, and Barton that she did advise them of such a telephone call.

- Although Mr Copeland and Ms Ward stated that Captain Morwood was not upset when they spoke with him, they were not in a position to observe his demeanour following his telephone conversation. I am satisfied that, in the Dryden terminal before and after the SOC telephone call, Captain Morwood was exhibiting signs of frustration and of being in a hurry.

- Captain Morwood left the terminal in a hurried fashion after he completed his telephone call to Air Ontario SOC.

- On boarding C-FONF at approximately 12 noon, Captain Morwood seemed troubled and did not have a "happy expression."

Accumulation of Snow on the Wings while Aircraft at Gate

- Snow continuously accumulated on the wings of the aircraft throughout the station stop. When the aircraft was about to leave the terminal area, at approximately 12 noon, its wings were covered in snow to depths varying from one-eighth to one-quarter of an inch.

- Ground handler Vaughan Cochrane was in a position to observe the wings prior to the aircraft's leaving the terminal area, and he knew, or ought to have known, that the wings were covered in snow. Captain Morwood asked Mr Cochrane whether de-icing was available, and Mr Cochrane indicated that it was. There was no follow-up to this inquiry by either Captain Morwood or Mr Cochrane.

Waiting for the Cessna 150

- As the F-28 was about to proceed onto the runway, it was unexpectedly subject to a delay, of approximately 2 minutes and 45 seconds, while, in heavy snow and poor visibility, a Cessna 150 aircraft landed.

- The pilot of the Cessna 150, Mr Robert McGogy, was not instrument rated. He was already within the five-mile radius of the control zone surrounding the Dryden airport when he first contacted Kenora FSS at 12:03:08 p.m. It would appear that, when he made this initial communication, the weather was below VFR minima and any SVFR minima.

- During this delay, a pilot from flight 1363, in all likelihood Captain Morwood, radioed back to the Air Ontario counter at the Dryden airport and, in a hurried, impatient manner, said to the Air Ontario

ticket agent something like: "I can't believe there is a small plane coming in. God knows how long we are going to have to stay here."

- At approximately the same time, Captain Morwood made a public address announcement to the passengers, explaining the reason for the delay.

- A short time later, Captain Morwood radioed back to the Air Ontario counter and, in a calmer tone, advised the Air Ontario ticket agent that the small plane had landed and that flight 1363 was about to taxi out.

- During the delay created by the Cessna 150, the snowfall increased in intensity such that visibility was reported by First Officer Mills at 12:04:07 p.m. to be one-half mile or less.

- During the delay, the accumulation of snow on the aircraft wings increased to an uneven depth of one-quarter to one-half inch.

- At the time the F-28 entered the runway and began back-tracking to the button of runway 29 (approximately 12:07:00 p.m.), there was an accumulation of approximately one-quarter to one-half inch of slush on that portion of the runway.