18 THE F-28 PROGRAM: SPARE PARTS

From the evidence it became clear that one of the requisites for the safe and efficient operation of an aircraft in scheduled commercial service is an adequate supply of supporting spare parts (spares). This is particularly true with regard to the introduction of a new aircraft type into a carrier's fleet.

Transport Canada, through its legislation and airworthiness inspectorate, is charged with the responsibility of ensuring adequacy of spares before approving an aircraft type for operation by any carrier. Prior to the licensing by Transport Canada of an air carrier's proposed aircraft operation, the carrier must establish that it has either an adequate in-house supply of spares or ready access to another supply of spares sufficient to support the intended operation.

Evidence was called both from Transport Canada as to the necessary compliance with the governing legislation and from Air Ontario as to the adequacy of its planning for spares to support the F-28 program.

Governing Legislation

Air Navigation Order (ANO) Series VII, No. 2, Part II, entitled "Aircraft Maintenance," sets forth the requirements of support equipment for the proper maintenance of aircraft. Section 12(1) reads:

> An air carrier shall provide adequate shelter, workshops and facilities, and such equipment as may be necessary for the proper maintenance of aeroplanes and auxiliary equipment in use.

Mr Ole Nielsen, superintendent, Air Carrier Maintenance Division, Airworthiness Branch, of Transport Canada's Ontario Region, was principal inspector for Air Ontario from mid-1987 until June 1988, when he became superintendent. (The introduction of the F-28 into the Air Ontario fleet occurred in June 1988.) Mr Nielsen was asked to describe his understanding of section 12(1):

> Q. Now, is my understanding correct that your authority, the authority imposed on you, is to look at the governing ANO for large air carriers in commercial operation and make this determination?

A. Yes. We make a determination of the air carrier's ability to maintain the airplane based on these requirements.
Q. Right. And I take it that equipment, et cetera, means that they will have enough spares to run?
A. Equipment runs the gamut from ground support equipment through the spares inventory that the air carrier maintains.
Q. Right. And can I take it from your answer that ... before this thing gets put on the operating certificate ... you have to be satisfied that there are adequate spares to provision it?
A. That is correct.
Q. Right. And indeed, it's in evidence that it was put on the operating certification on the 3rd of June of 1988.
A. Yes. Although they did have problems with the spares as you are aware.

(Transcript, vol. 129, pp. 110–11)

Serviceability Difficulties

A number of the pilots employed by Air Ontario were asked questions about the reliability of the F-28 and the availability of spare parts.

Captain Christian Maybury, a commercial pilot since 1968 with 15,000 hours' experience, stated his understanding of the availability of spares for the F-28, as follows:

Q. ... What was your view as an operating F-28 pilot of the degree and level of expertise of maintenance that was helping you?
A. Not very good. There were some ongoing problems, and I think they – for one thing, there was a great shortage of spare parts. It seemed to be an ongoing problem.

(Transcript, vol. 92, p. 43)

Captain Erik Hansen, an Air Ontario pilot with more than 19,000 hours' experience, was questioned on the adequacy of spare parts for the F-28. He testified that Air Ontario "didn't have very many [spares for the F-28]," and cited the ongoing unserviceability of the F-28 radar altimeter and autopilot pitch control as examples of the inadequacy of the F-28 spare parts supply (Transcript, vol. 94, p. 139).

Captain Monty Allan, an Air Ontario pilot with more than 6000 hours' flying experience, gave testimony on the subject of the maintenance and reliability of the F-28:

A. ... As a result, we had some snag deferrals that seemed to lag on for quite awhile. The deferrals were perhaps based on in part that they were troubleshooting it which is not unusual or in part more often the case is a lack of parts.

Since at the outset, we were only operating one aircraft and even at the end just two, it's very expensive, I guess, for the company to keep a large inventory of spare parts for the aircraft. And quite often, legal deferrals were made related to nil parts available which meant that they did not have the part in stock and they would have to look to other carriers or manufacturers to secure the part, which took any length of time, a day or several days or weeks, I guess, in some cases.

Q. From time to time, sir, during the time that you were flying the F-28, was it your view that there were excessive deferred defects?

A. I don't think excessive defects would appropriately reflect the way I felt. I think it was defects that were deferred for an excessive amount of time, so specific defects which probably exceeded that reasonable time period for being rectified.

(Transcript, vol. 91, pp. 47–48)

Plan to Provide Spares

Captain Joseph Deluce formally became the F-28 project manager in January 1988 and, in this capacity, oversaw the implementation of both the original and the revised F-28 project plans. Both project plans called for the provision of spares to have been the responsibility of the vice-president of maintenance and engineering, Mr Kenneth Bittle. Nevertheless, president and CEO William Deluce, because of his experience in aircraft and spare parts procurement, initially took charge of this aspect of the F-28 implementation project.

The critical path of the original F-28 Project Plan indicated that the provisioning of spares would be completed by the twenty-sixth week of the program or by the fourth week of April 1988. In the Revised Project Plan of December 1987, parts and equipment provisioning was described as simply "ongoing."

The original plan was to purchase a package of spares from the Turkish airline Turk Hava Yollari (THY), which was the previous owner and operator of the Air Ontario F-28s. This spares package was understood by Mr William Deluce to be sufficient to maintain up to a six-aircraft fleet, which was the number of F-28s that Air Ontario eventually planned to acquire.

A second option was to purchase a spares package from Transport Aérien Transrégional (TAT), the lessor of the Air Ontario F-28s and itself an F-28 operator having spares for sale. Mr William Deluce confirmed that the TAT spares option would have been more expensive than the THY spares package.

THY Spares Package

On October 30, 1987, Mr Kenneth Bittle wrote to Mr Alex Bryson of Transport Canada, informing the regulator of Air Ontario's intention to acquire the THY spares and requesting that a Transport Canada inspector go to Turkey, audit the THY parts overhaul facility, and approve the THY certification of its spare parts.[1] In the letter it was anticipated that, although the purchase was still under negotiation, this inspection should be done prior to the end of 1987.[2]

Upon receipt of this letter, Transport Canada replied to Air Ontario that it was not in a position to have an inspector travel to Turkey; however, advice was given as to the steps that would have to be taken if Air Ontario intended to import these THY spare parts.

Mr Bittle, when questioned on his October 30, 1987, correspondence to Mr Bryson, testified that he understood the carrier had to show that spare parts were available as part of the operating certificate application; however, he did not consider this letter to have been official notification of spares availability.

Mr Bittle accompanied Mr William Deluce to Turkey in January 1988 to survey the spares. By the end of their trip, Mr Bittle understood from William Deluce that the deal for the THY spares was so imminent that both Mr Bittle and Mr Deluce contemplated chartering a DC-8 cargo aircraft in England to facilitate the transfer of the parts to Canada.

On March 4, 1988, Mr Teoman Ozdener, who had been hired as an F-28 maintenance specialist, outlined for Mr Bittle what options were open to Air Ontario management with regard to the spare parts situation. Mr Ozdener explained to Mr Bittle that, if the THY deal were completed, the spares problem would be solved. If the THY deal did not

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[1] In order for spare parts to be used in Canadian-registered aircraft, it is necessary for Transport Canada to satisfy itself of the soundness and integrity of the parts. Regulatory authorities of most countries will inspect and certify domestic maintenance and overhaul facilities as capable of maintaining and reconditioning parts to a sufficiently high standard for use in domestic aircraft. Canada and other countries have bilateral arrangements whereby one country has confidence in and will rely upon another country's inspection and certification of its domestic maintenance and overhaul facilities – and the spare parts emanating from such facilities. In such circumstances, the parts will be "tagged" as having been maintained or overhauled by a facility certified by a foreign regulatory authority; and other countries, like Canada, will respect the "tags" and allow for the importation and use of such parts in domestic aircraft. There was no such bilateral arrangement between Turkey and Canada. Therefore, in order for Air Ontario to use the THY parts, it was necessary for it to request that a Transport Canada airworthiness inspector attend at the Turkish overhaul facility and provide a Canadian approval for the use of the Turkish parts.

[2] It was also intimated in this letter that the first aircraft "could be ready" by January 1988 and the second by March 1988.

go through, alternative sources of spares would have to be found, either by pooling parts with other F-28 operators or by buying parts independently from another source. Mr Bittle testified that, by March 4, 1988, he was still expecting the THY deal to go through.

On March 28, 1988, Mr Ozdener once again outlined for Mr Bittle his thoughts on the spares issue. Mr Ozdener wrote in his report to Mr Bittle: "THY DEAL IS 'VERY' CRUCIAL FOR OUR OPERATION" (Exhibit 813, p. 8). Mr Ozdener continued to plan for the contingency of the THY deal failing, which in simple terms meant that if the THY deal failed, Air Ontario had to look for spares from alternative sources, either from TAT or from some other source. Mr Bittle testified that during this period of time he was in frequent contact with Mr William Deluce – the "main man," to use his words, when it came to the THY spares deal. They were expecting delivery of the first aircraft around May 1, 1988, and Transport Canada certification of the parts could have taken up to six months.

On April 4, 1988, Mr Bittle wrote to Mr John Aguiar, his materials supervisor, and to Mr Ozdener, his F-28 specialist: "It would appear that the purchase of spares and equipment from THY is at least two to three weeks away and as such we must make a firm or alternate arrangements via TAT for renting of the bare minimum of rotables and test equipment" (Exhibit 828). Mr Bittle went on to say that the consumables should be purchased in small quantities and expressed the belief that the THY inventory would eventually be Air Ontario's.[3]

Mr Bittle explained in general terms the actions taken as a result of the delay in the THY deal:

> A. ... When it became evident that the THY deal was not happening, it certainly wasn't happening under the speed that we originally anticipated, and then, eventually, maybe it wasn't going to happen, so we re-activated some of those original plans and started to source out parts and equipment from other places and in – in anticipation of either having to keep them on a long-term basis or, on a short-term basis, to cover us until these THY parts came in-house, were certified and usable.
>
> (Transcript, vol. 103, pp. 82–83)

Mr Bittle contacted TimeAir, an F-28 operator, for the purpose of accessing its spare parts inventory. After agreeing to provide Air Ontario

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[3] Aircraft spare parts can be categorized under the broad headings of "consumables" and "rotables." Consumables are items such as gaskets, oil filters, hoses, or brake pads, which are used and then discarded when no longer serviceable. Rotables are items like fuel or hydraulic pumps, or generators, which can be overhauled or serviced and then used again.

with such access, TimeAir's maintenance manager, Mr Ritchie Rasmussen, at the request of Mr Bittle, wrote a short letter to Transport Canada addressed "To Whom This May Concern," dated April 19, 1988, and stating as follows:

> Time Air Inc. have an agreement to supply spare parts, including tools and equipment in reference to Fokker F28 MK1000 aircraft to Air Ontario.
>
> We have a working agreement operationally to support Air Ontario to do with the maintenance and support of the Fokker F28 aircraft in conjunction with our operation.
>
> We have also agreed to assist Air Ontario with the installation of 18 parameter FDR to meet M.O.T. requirements.
>
> (Exhibit 829)

According to the evidence of Mr Ole Nielsen, the principal Transport Canada airworthiness inspector for Air Ontario, the letter of Mr Rasmussen satisfied the spare parts prerequisites for putting the F-28 on Air Ontario's operating certificate. However, it must be pointed out that this three-sentence letter is the only documentary evidence of any such arrangement between Air Ontario and TimeAir. Mr Nielsen testified as follows on this subject:

> Q. ... was this directed to you by the author of the document, Mr Rasmussen?
>
> A. It was not specifically addressed to us, and I can't give you the specific dates when we were informed that ... there were not going to be any Turkish parts available.
>
> And we subsequently informed Air Ontario, Mr Commissioner, that we would not add the airplane to their operating certificate without them having adequate spares to maintain the aircraft.
>
> The determination of adequate spares is not made by us, it's made by the organization's quality control people, who certainly know the aircraft much better than we do.
>
> But at the same time, without any spares whatsoever in the organization, we were not in a position to add the airplane to the operating certificate.
>
> So Air Ontario subsequently went to TimeAir and requested the use of their spares while they were negotiating – I believe they were negotiating on some other spares from Europe.
>
> But in the interim, we told them that they had to have spares, and this letter was then produced to us by Air Ontario.
>
> Q. And this was satisfactory to you as the inspector that spares were –
>
> A. Yes.
>
> Q. – not an issue?

A. We ... can't advise the carrier that they must have spares at their ... base of operation. I mean, they could have it at some other base.

So for all intents and purposes, this satisfied the requirement for spares.

...

Q. ... is this a normal procedure for Transport Canada?

A. No, and it's not encouraged. This was a rather unusual circumstance where they had spares lined up in Turkey, and I believe the deal fell through. And now to operate the airplane, they needed some coverage for spares.

So this type of letter is not usually provided to us. We normally have formal contracts with other carriers. If one carrier is contracting all its maintenance to a third person, then there would be a specific contract in place for that provisioning of spares.

(Transcript, vol. 129, pp. 115–17)

After writing to Mr Aguiar and Mr Ozdener on April 4, 1988, with regard to contingency planning for spare parts, Mr Bittle wrote to chief operating officer Thomas Syme on the same subject. Mr Bittle's April 5, 1988, memorandum to Mr Syme indicated that certain decision dates had to be put in place regarding the spares situation. The memorandum emphasized that if the THY deal did not go through by May 15, 1988, "a firm order of between $1.5–$2 million" had to be placed elsewhere to ensure required provisioning for continued operation (Exhibit 814).

In his testimony, Mr Bittle described the memorandum as a timetable, given the impending delivery date of the aircraft:

A. ... [W]e requested from TAT on a rental basis a minimum stock of rotables, parts and equipment to support one airplane – and these ... should be coming over with the airplane – and that we ... also purchased, a ... minimum stock of consumables, consumables being filters, nuts, bolts, O-rings, things you use up and throw away, rotables being things you can overhaul or repair.

... April 11th ... we should be in a position to start looking at another alternate arrangement for a parts package, towards a possible firm order on May 15th.

May 15th was my final date for decision on the THY spares. If we don't have any, then we should go and start ordering – the parts that we would have started negotiating to buy on April 11th we should start ordering on May 15th.

(Transcript, vol. 103, pp. 92–93)

Parts Situation as F-28 Entered Revenue Service

As of May 31, 1988, following an inspection of the Air Ontario maintenance facilities by Transport Canada, the F-28 aircraft was included on the Air Ontario operating certificate. The inspection apparently satisfied the regulator that there were adequate equipment, parts, and facilities "necessary for the proper maintenance" of the newly acquired F-28s. As noted by Mr Nielsen in testimony, the decision on what constituted adequate spares was left to the quality control personnel of the airline.

The parts situation may have been adequate to meet the broad Transport Canada guidelines but was not sufficient to satisfy the marketing department of Air Ontario.

By June 17, 1988, Mr Bittle was very concerned about the lack of spare parts and expressed these concerns in a memorandum to Mr Syme. He stated in the memorandum:

> John Aguiar, myself and others are taking a lot of heat lately from various departments in the company with respect to the F-28 part situation. As we discussed before, it is well known that this part situation came upon us in a somewhat unusual way. The employees' belief that we "just forgot to order parts" or "didn't want to order parts" is a mistaken belief. It is causing a lot of hardship for all of us and ruining the credibility of this department. It is essential that the memo which you indicated would be issued from Bill is sent out immediately so that people understand the situation.
>
> (Exhibit 815)

According to Mr Bittle's testimony, the explanatory memorandum requested from Mr William Deluce and promised by Mr Syme was never issued.

When asked the source of the criticism of his department, Mr Bittle explained:

> A. [They were] people in marketing and – primarily in marketing ... they had sold this airplane to the public and it was on service and not reliable, and we were reporting back in a very, very concise form, you know, the airplane was late or it didn't go, parts on order or no parts or whatever, and this is where they were saying, what's the matter, Bittle you asleep at the switch, here? You forgot to order parts?
>
> And no, they don't go down to the stores and look at the shelf and see what's there. They don't have access to that.
>
> (Transcript, vol. 103, p. 109)

On the same date, June 17, 1988, Mr Bittle wrote a memorandum to Mr Aguiar and Mr Ozdener, with a copy to Mr Syme, stating that the "F-28 part situation is critical," and asking them to reply to him no later than June 22, indicating what plans they had in place to purchase an inventory of spare parts (Exhibit 816). At the date of Mr Bittle's two memoranda, the F-28 had been in revenue service for more than two weeks.

When asked why he used the word "critical" in his memorandum to Mr Aguiar and Mr Ozdener on the F-28 parts situation, Mr Bittle explained:

> A. Well, I just felt that reliability was to the point where it was not a very viable operation financially to operate the airplane as it was.
>
> We needed more parts, and so I guess the word "critical," from my point of view, was that we had reached a point where we have to make a decision here.
>
> Q. ... Or what was to happen?
>
> A. Well, I just didn't think we could operate waiting for these THY parts. It wasn't practical to keep beg[ging], borrowing and stealing from other companies. It wasn't a good way. There was too many delays, too many cancellations.
>
> (Transcript, vol. 103, p. 118)

F-28 project manager Joseph Deluce also identified the spare parts shortage as a significant cause of the poor reliability of the aircraft in its first month of commercial service. In his F-28 status report written in late June 1988, Captain Deluce wrote:

> The single most significant problem with the F28 is its reliability in our system. The various problems in this area include the following:
>
> a) Relatively inexperienced flight crews on this type of aircraft. (It will take some time for crews to learn the peculiar[ities] of operating an F28.
>
> b) Insufficient spares availability.
>
> c) Low level of expertise on the technical side in maintenance and troubleshooting the F28.
>
> d) Poor follow-up system of grounded F28 aircraft.
>
> (Exhibit 807, p. 044)

During this period of time, Mr Aguiar and Mr Ozdener attempted to secure a spare parts inventory from a variety of sources around the world. By mid-June 1988, Mr Aguiar and Mr Ozdener confirmed access to a supply of spare parts from sources in Norway, Sweden, and The Netherlands. On June 17, 1988 – the same day that Mr Bittle wrote to Messrs Syme, Ozdener, and Aguiar regarding the issue of spares – Air

Ontario's chief maintenance inspector, Mr Douglas Christian, wrote to Mr Ole Nielsen of Transport Canada requesting that Air Ontario be granted approval to certify and use the parts to be obtained from Norway, Sweden, and The Netherlands.

On June 27, 1988, Mr Nielsen responded to the request of Air Ontario by granting a limited approval (100 hours) for Air Ontario to use some of the parts from the named European sources.

Mr Nielsen was questioned on his impressions of the Air Ontario spares situation and his reaction to Air Ontario's correspondence to him of June 17, 1988:

> Q. When you received this letter on June 17th, Mr Nielsen, what, in a general sense, did this tell you about the parts situation at Air Ontario?
>
> A. Specifically, we knew they had the contract with TimeAir for parts, but we also knew that their – I believe about the same time that their parts situation with Turkey had come to an end.
>
> So this was ... their initial attempt at obtaining – perhaps not their initial attempt, but it was one of their attempts to obtain provisioning for the aircraft.
>
> The spares that they had obtained ... from these three facilities were not acceptable for import at the time, based on existing regulation.
>
> Q. ... And this is what I take it you told them in Exhibit 999 ... your letter dated June 27th, 1988.
>
> A. Yes, I spelled out the reasons why ... initially those spares were not acceptable. Braathens, the ones from Braathens in Norway weren't acceptable because we did not have a bilateral agreement with Norway.
>
> ...
>
> A. ... [A]nd the inventory from FFV Sweden was a similar problem. With no bilateral agreement, we could not accept the parts.
>
> The items ... from Allen Air Motive, although they came from Holland ... were not acceptable because they were released to the operator by means of Allen Air Motive's Federal Aviation Agency foreign repair station certificate. And we did not recognize ... FAA foreign repair station certificates.
>
> If they had been received with Dutch certification, we would have accepted that because we did have a bilateral agreement with Holland at the time.
>
> (Transcript, vol. 129, pp. 120–22)

When questioned further about allowing Air Ontario to operate with these now-acquired spares from Norway, Sweden, and The Netherlands, Mr Nielsen testified:

> A. – I had contacted our headquarters, Henry Dyck specifically, and we requested that – either we requested that an exemption be made to allow the use of these parts because we had actually – we had gone to Toronto and – at Pearson and witnessed the parts and we were satisfied that the parts would have been quite acceptable, but due to the regulatory requirements, they were not.
>
> So we requested that headquarters consider an exemption, which came, they allowed the use of the parts for 100 hours – we allowed the use of the parts for 100 hours ... pending the resolution of that request. And that is not outside the realm of normal day-to-day business. We do allow the use of foreign parts for up to 100 hours on any aircraft in Canada.
>
> (Transcript, vol. 129, pp. 122–23)

Mr Nielsen testified that the spares obtained by Air Ontario for the maintenance of the F-28 aircraft by June 1988 were "very limited" and that it was a "certainly limited inventory to maintain a jet type airplane" (Transcript, vol. 129, p. 124).

Ongoing Spares Provisioning

The efforts of Air Ontario maintenance to improve its spare parts supply continued throughout the period of time when the airline operated the F-28 aircraft. As stated, in the early stages of F-28 operations, while there was still a possibility that Air Ontario would acquire the THY spares inventory, Air Ontario's parts acquisition was limited to "bare minimum" renting from Fokker, ad hoc borrowing from TimeAir, leasing from parts supply companies, and small-scale purchasing from other sources.[4] When it became apparent that the THY deal would not be completed, spare parts were acquired from many international sources; and, in September 1988, Air Ontario took a significant step by exercising its option to purchase parts that it had been leasing pursuant to a June 1988 lease agreement with a company called Satair.

The evidence reveals, without any doubt, that there were insufficient spare parts to support the Air Ontario F-28 aircraft during the first weeks of commercial service. However, Mr Ozdener and Mr Bittle were of the opinion that there were adequate supporting spare parts as they expanded their inventory in the months that followed.

Mr Ozdener, in defence of the spares sourcing and acquisition that he ultimately coordinated, gave the following evidence:

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[4] Exhibit 828, memorandum dated April 4, 1988, from Kenneth Bittle to John Aguiar and Teoman Ozdener, Re: THY Parts

A. We never grounded an aircraft. Whenever we need a part, within 24 hours, we could bring anything from any place in the world.

There's a system called AOG.[5] You just call AOG and within 24 hours, the fastest way you will have the component or piece in your hands, sir.

(Transcript, vol. 101, p. 162)

Mr Bittle elaborated upon the complaints that Air Ontario maintenance was receiving from other departments in the company regarding the spares situation:

A. In my experience, in the parts department, you never have enough parts unless you have another airplane parked right beside the one you have and everything is there because ... Murphy's law says the part you need you don't have. Doesn't matter how much you spare up for it.

And so when you are lower than you would like to be, that situation is ... amplified even more, so sure, guys say, gee, we had to cancel a flight today or delay a flight because we didn't have the part. That ... reflects back on them and they expressed that to me.

Q. And is this the "ruining the credibility of the department" you are talking about?

A. Yeah. Yeah.

(Transcript, vol. 103, pp. 110–11)

Mr Bittle was questioned further on his opinion regarding the adequacy of Air Ontario's spare parts support. Given that he accepted responsibility for the spare parts situation at Air Ontario, I feel that it is necessary to quote from Mr Bittle's evidence at length:

Q. And I take it you would agree with me that the ... two F-28 aircraft that you brought into your fleet were not new aircraft?

A. That's right.

Q. They were used aircraft?

A. That's right.

Q. They had been, for example, we have heard evidence, parked in Turkey for a considerable period of time without being used?

A. Yes.

Q. And in those circumstances, being used aircraft and aircraft that had not flown for an extensive period of time, you would agree with me that it's all the more important to have a very good

[5] AOG Aviation Supply Inc. is an international aviation parts supplier based in Scottsdale, Arizona.

spares package when you are buying such an aircraft or two such aircraft?

A. ... [A]ny airplane needs a good spares package.

Q. But particularly an older airplane where, in your own words, you have to work out the bugs?

A. It becomes useful, yes. It's – you know, I wouldn't differentiate, because on a new airplane, number 1, the cost of operating or cost of acquiring it is higher.

So if you are trying to say that a new airplane, you wouldn't need as many spares, I disagree. Because when you are down with a new airplane, it becomes even more exciting.

Q. But with an old airplane – let's leave the new airplane aside. With an old airplane that's been parked, particularly one that's been parked for two years and not used, you need a good spares package because you are going to have problems?

A. Yes.

Q. And because it's been parked for two years, you are going to have more problems than if it had been in regular use and regularly maintained?

A. Yes.

Q. And for that reason, you need – all the more reason to need a good spares package?

A. Sure.

Q. Okay. And you didn't get that, did you?

A. I had adequate spares. I felt we had adequate spares.

Q. Were not spares a problem throughout the F-28 program?

A. As I said yesterday, spares are always a problem, and someone will always say to you, we didn't have enough spares.

I felt we had the correct level of spares.

Q. Would you not agree with me that a number of other people in management positions in Air Ontario identified the lack of adequate spares as being a specific problem to the F-28 program?

A. Unqualified people, but yes.

Q. Okay. You call Joe Deluce unqualified?

A. Yes. When it comes to that, yes.

Q. He was wrong in identifying the problem of obtaining spares?

A. He was not aware fully of what the problems are associated with it.

He was not a – he is not an individual that's in that kind of business, so he doesn't – you know, if any pilot, if any person wanted to dispatch a flight and there wasn't a part, they are going to say we don't have enough parts. They don't know why, they just say that.

Q. And it's your position, then, that with respect to the F-28 program, you consider as vice-president of maintenance that that would have been one of your areas of responsibility, wouldn't it, as vice-president?

A. Yes.
Q. The buck would stop at your desk with respect to spares?
A. Yes.
Q. That you had adequate spares throughout the operation of the program at Air Ontario?
A. Yes, I do.

(Transcript, vol. 104, pp. 159–62)

These comments by Mr Bittle and Mr Ozdener regarding the adequacy of spare parts are revealing. Both men were of the view that the spare parts support for the F-28 was adequate. Yet pilots who were flying the aircraft on the line – including the F-28 project manager and chief pilot – were of the view that insufficient spare parts caused delays and cancellations of F-28 flights. The evidence certainly indicated a difference in perception between the maintenance managers and others at Air Ontario regarding this issue. I accept the evidence of Mr Bittle when he commented:

> A. ... if any pilot, if any person wanted to dispatch a flight and there wasn't a part, they are going to say we don't have enough parts. They don't know why, they just say that.
>
> (Transcript, vol. 104, p. 162)

The statement would also appear to be applicable to the perceptions of both dispatch and marketing personnel; and, in the present case, perceptions are important. In particular, I am focusing on the perceptions of line pilots who were eager to make the jet program a success and who were subject to pressure, from many sources, to maintain on-time performance. In such circumstances, the reactions of pilots to perceived inadequacies in maintenance support may certainly vary.

It would appear that in the eyes of some – for example, Mr Bittle – the maintenance department lost some credibility over the spares situation. The comments of some F-28 pilots – for example, Captain Maybury, who described the ongoing assistance provided by Air Ontario maintenance as " ... [n]ot very good" (Transcript, vol. 92, p. 43) – would indicate that Mr Bittle's concern was well founded.

In chapter 10 of my Report, Technical Investigation, I identified 28 instances when maintenance deferrals were noted in the aircraft journey logbook of C-FONF during the period of time that Air Ontario had no approved MEL for the F-28. Of the noted deferrals, on at least five occasions the absence of parts or equipment was given as the reason for the deferral. The most recent of these "parts on order" deferrals occurred on November 23, 1988.

The following defects were recorded in the journey log of C-FONF as of the morning of March 10, 1989, prior to departure from Winnipeg:

1 September 22, 1988 – Captain's panel does not have a lighted time piece. Deferred IAW ANO Series 2-20. Licence ACA 87077. (Note – This deferral had been carried for almost six months).
2 February 8, 1989 – Roll and yaw not working properly in autopilot. Licence ACA 87118. Deferred.
3 February 8, 1989 – First Officer windshield wiper creeps up in flight. Licence ACA 87118.
4 February 23, 1989 – Pilot reports LH fuel gauge still intermittent (reads full). Licence ACA 87015. Carried Forward – Deferred.
5 February 24, 1989 – Number 1 Constant Speed Drive warning light tests but won't come on after shut-down. Licence ACA 87042. Deferred MEL 02-24.
6 March 9, 1989 – APU will not fire test. Licence ACA 87101. Deferred MEL 49-04.

(Exhibit 492, para 1.2, pp. 3–4, and Appendix 17 (Records Report))

There were also other discrepancies that were brought to the attention of the flight crew by the cabin crew prior to the first flight on March 10, 1989, but were not entered in the journey logbook (or any other log as far as can be determined). These included:

1 The exit light over the main entry door was not working.
2 The exit light over the cabin door, on the cabin side, was not working.
3 The cabin emergency floor lighting was dimmer than normal and had a bluish colour rather than a bright white colour.
4 There were three altitude-compensating oxygen masks missing from the back of the aircraft.
5 There had been some difficulty closing the main entry door in Winnipeg. A plastic surclip that normally held the door handle in the stowed position when the door was closed had broken, and, as an expedient, the handle was being held in place by double-sided tape. The difficulty in closing the door could have been attributable to the fact that the door operating handle was being held in the stowed position by the tape while an attempt was made to close the door. Neither the tape itself nor the fact that the surclip was broken apparently posed any danger of the door opening inadvertently.

(Transcript, vol. 55, pp. 78–85; based on testimony of Mr Gregory Morrison)

It is not known if any other problems developed during the flights on March 10, 1989.

Whether any of these maintenance deferrals can be attributable to insufficient spare parts is not altogether clear. In some instances, as described, there is specific mention of "parts on order," while in other instances the maintenance notation is simply "carried forward" or "deferred." I believe it is likely that some of the "carried forward/deferred" notations can be attributed to the lack of a replacement part. For instance, I can think of no other reason for the captain's panel to be without a lighted timepiece for a period of more than six months, except that Air Ontario maintenance did not have a replacement timepiece to effect a rectification.

Flight attendant Hartwick was questioned on Captain Morwood's reaction to these unserviceabilities:

> Q. Now, when these things were brought to Captain Morwood's attention, what was his reaction?
> A. He said, Oh, God, more snags. He was a little – he was frustrated things weren't being fixed.
> Q. So this would have been early Friday morning, right?
> A. That's correct.
> Q. And these things were put before him, and he was frustrated, and the words, to the best of your recollection ... is something like – what did –
> A. Damn it, more snags, this type of expression.
>
> (Transcript, vol. 10, pp. 168–69)

Insufficient supporting spare parts can contribute to the protracted deferral of necessary aircraft maintenance. When aircraft are operating with the maintenance of essential aircraft equipment deferred, pilots must contend with the operational constraints inherent in the unserviceabilities. When aircraft are continually operated with unrectified unserviceabilities, pilots can lose confidence in their maintenance organization and become frustrated in the operation of their aircraft. Based on the evidence before me, it would appear that some Air Ontario F-28 pilots, including Captain Morwood, were losing confidence in their organization and were frustrated with the F-28 operation.

Spare Parts: How Much Is Enough?

The spare parts requirements set out in Air Navigation Order Series VII, No. 2, are vague and unhelpful. No guidance is provided to the good-faith operator in determining what constitutes "such equipment as may be necessary for the proper maintenance of aeroplanes" (ANO Series VII,

No. 2, Part II, section 12(1)). Similarly, the regulator is given little assistance in the exercise of its discretion on this issue.

It is to be noted that there is no specific reference to "parts" or "spare parts" in the ANO. The requirement for spare parts, as identified by Transport Canada personnel, is based on the broad interpretation of section 12(1) of the order, which uses the language " ... adequate shelter, workshops and facilities, and such equipment as may be necessary."

Presumably, an airworthiness inspector will attend at an air carrier's maintenance facility to determine whether, in his or her judgement, there is an adequate supply of spare parts to support a given operation. However, the words of the ANO, "adequate" and "necessary," certainly invite diverse interpretation and defy enforcement.

Mr Nielsen, the airworthiness inspector who reviewed the Air Ontario spares situation, stated that the decision regarding sufficiency of spares was left to the quality control personnel of the individual airline because, as he put it, they know best the requirements of their operation. This may be true, but surely there should be some clearly articulated minimum standard that both Transport Canada and an air carrier could refer to in assessing whether a prospective operation has an adequate supply of supporting spare parts. Such an assessment must occur before a prospective operation is licensed; and the minimum standard would necessarily involve more than a "to whom it may concern" letter from another airline.

Mr Nielsen was questioned further on the TimeAir letter that Air Ontario produced in the purported fulfilment of its spare parts supply obligations:

> Q. Now, you are saying that this is the type of practice that is not encouraged by Transport Canada.
>
> A. No, it's not, no.
>
> We want the carriers to have their own parts. Whether through a ... contract agreement or actually purchased, that's entirely up to them, but we certainly want them to have readily available spares to conduct line maintenance at the least, and preferably those spares required to support their MEL requirements.
>
> (Transcript, vol. 129, pp. 117–18)

I note that when Transport Canada accepted the "to whom it may concern letter" as evidence of Air Ontario's ability to access " ... those spares required to support [its] MEL requirements," Mr Nielsen knew that Air Ontario had no approved F-28 MEL; and, as it happened, Air Ontario continued revenue service until December 1988 without an approved F-28 MEL.

Mr Bittle may have been absolutely right when he said that "... you never have enough parts"; however, the experienced judgement of senior maintenance management must certainly be brought to bear to determine how much is enough.

It may be argued that it is appropriate for an air carrier to make its own determination as to what constitutes an adequate supply of supporting spare parts for the purposes of operating its aircraft. Further, it may be argued that this determination is a strictly economic matter; and, if an airline wishes to risk the grounding of aircraft at inappropriate times and suffer the economic and marketing consequences of such groundings, then an airline should be able to make such an assessment and accept such a risk. I am of the view that such reasoning ignores the reality of day-to-day airline operations.

There is always a danger that the purely commercial risk of aircraft groundings and flight cancellations will be translated into operational risks taken by those immediately responsible for the safe operation of the aircraft. The evidence before this Commission indicates that inadequate spare parts support can put pressure on mechanics and pilots to defer aircraft maintenance for long periods of time in order to maintain on-time performance. I am of the view that this tendency was to a certain extent exacerbated at Air Ontario because operational personnel were themselves enthusiastic about the F-28 program and eager for it to succeed and because usual standards of scrutiny and conservatism were allowed to wane.

Findings

- Transport Canada has a legal obligation to determine whether adequate spare parts are available to an air carrier for the "proper maintenance" of aircraft used by the air carrier (ANO Series VII, No. 2, Part II, section 12(2)).

- Unless Transport Canada is satisfied that adequate spare parts are available for a given aircraft, approval of the air carrier to use that type of aircraft should not be granted.

- Transport Canada temporarily allowed Air Ontario to use spare parts from other countries although regulations did not allow those parts to be imported into Canada and approved for use on a long-term basis.

- Transport Canada personnel satisfied themselves that sufficient spares for "proper maintenance" existed by simply relying upon the judgement of Air Ontario quality control personnel and by accepting

at face value a brief letter from TimeAir. This letter merely indicated that TimeAir agreed to supply spare parts to Air Ontario and gave no further details whatsoever.

- Air Ontario did not have an adequate supply of spare parts in house at the time the F-28 was added to the operating certificate and started in commercial service.

- Lack of spares, combined with enthusiasm for the F-28 project, brought pressure to bear upon Air Ontario maintenance personnel and pilots to carry maintenance snags for long periods of time.

- ANO Series VII, No. 2, Part II, section 12(2) is vague in that it does not assist Transport Canada airworthiness personnel to determine what equipment and spares are necessary for the "proper maintenance" of aircraft.

RECOMMENDATIONS

It is recommended:

MCR 58 That Transport Canada direct its airworthiness personnel to determine themselves whether an air carrier has adequate spare parts for the proper maintenance of aircraft. Under no circumstances should this decision, in effect, be delegated to any person employed by the applicant air carrier.

MCR 59 That Transport Canada proffer for enactment an amendment to Air Navigation Order Series VII, No. 2, Part II, section 12(2), that assists Transport Canada airworthiness personnel to determine whether sufficient spare parts exist. Alternatively, an approved written departmental policy should be promulgated to assist airworthiness personnel to make this determination.

MCR 60 That Transport Canada under no circumstances issue an operating certificate or an amendment to an operating certificate until it is satisfied that all spare parts requirements established by Transport Canada are fulfilled.

19 THE F-28 PROGRAM: FLIGHT OPERATIONS MANUALS

Well-developed and up-to-date flight operations manuals are necessary for the safe and efficient operation of commercial aircraft. Such manuals are required both to establish standard procedures in aircraft operations and to provide day-to-day guidance to all operational personnel in an airline in the fulfilment of their duties. For manuals to communicate standard procedures, it is necessary that they be amended regularly, incorporating changes in operational practice, and that amendments be regularly distributed to appropriate personnel.

Generally, flight operations manuals used by Canadian air carriers operating large aircraft are of two types: manuals that deal with the air carrier's flight operations, and manuals that deal with the operation of a specific aircraft type in an air carrier's fleet.

This chapter examines operations manuals that were used by Air Ontario personnel in the operation of the F-28 aircraft.

Terminology

Throughout the Commission hearings, reference was made to a number of air carrier manuals. Witnesses demonstrated inconsistency when referring to the titles of a carrier's various flight operating manuals. To assist the reader, the following are general definitions of the relevant manuals:

1 Flight operations manual (FOM). A manual prepared by a carrier and approved by Transport Canada that sets out the organizational structure of the carrier, the duties and responsibilities of flight crews, and policies and procedures for the flight crew's guidance. The FOM is referred to as an operations manual in ANO Series VII, No. 2, Standards and Procedures for Air Carriers Using Large Aeroplanes.

2 Aircraft flight manual (AFM). A manual prepared by the manufacturer of an aircraft and approved by the airworthiness authority of Transport Canada as part of the type approval of that aircraft. It contains operating procedures, both normal and abnormal, aircraft limitations, and performance data. Certain portions of the AFM are

approved by Transport Canada. During Commission hearings the AFM most often referred to was the three-volume Fokker Aircraft F-28 Flight Handbook.

3 Aircraft operating manual (AOM). A manual prepared by a carrier that sets out detailed operating procedures for a particular aircraft type. Although approval of the manual by Transport Canada is not required, the AOM must be no less restrictive than the AFM prepared by the aircraft manufacturer. During Commission hearings, the AOMs most often referred to were the Air Ontario draft F-28 Operations Manual, the Piedmont Airlines F-28 Operations Manual, and the USAir F-28 Operations Manual (Pilot's Handbook).

4 Standard operating procedures (SOPs). This term is often used interchangeably by Transport Canada inspectors and air carrier operational personnel to describe aircraft operating manuals or condensations of procedures contained in AOMs in the form of checklists for use on the aircraft's flight deck.

5 Flight attendant manual (FAM). A reference manual prepared by a carrier that sets out procedures and practices for the guidance of flight (cabin) attendants in the conduct of their duties and responsibilities in an aircraft. The FAM is referred to by Transport Canada as a cabin attendant manual.

Manuals in Use on C-FONF on March 10, 1989

On March 10, 1989, the onboard library[1] of C-FONF contained, for use by the pilots: the three-volume aircraft flight manual (AFM) entitled, Fokker F-28 Flight Handbook; an F-28 weight and balance and performance manual; a Piedmont Airlines quick reference emergency and abnormal operations handbook; and a Piedmont Airlines normal checklist.

The pilots operating flight 1363 on March 10, 1989, carried the Air Ontario Flight Operations Manual (FOM), an Air Ontario route manual, instrument flight rules (IFR) approach charts, en route charts and related IFR information, and the F-28 Operations Manual. Captain Morwood

[1] An onboard library, located on the flight deck of an aircraft, consists of certain manuals that Transport Canada or the air carrier requires to be carried for the purpose of operation of the aircraft.

had with him a copy of Piedmont's F-28 Operations Manual, and First Officer Mills carried the USAir F-28 Operations Manual. Each flight attendant on the flight carried her own Flight Attendant Manual (FAM) issued by Air Ontario.

Included as part of each of the Piedmont Airlines and USAir F-28 operations manuals was a minimum equipment list (MEL) produced by Piedmont Airlines and USAir for their respective operations of the F-28 aircraft. Although Fokker Aircraft provided to Air Ontario two up-to-date F-28 flight handbooks in August 1988, it is not certain if one of these updated copies was on board C-FONF on March 10, 1989.[2] Since pilot evidence (Captain Monty Allan) suggests that the flight handbooks on board Air Ontario's F-28 aircraft were "a little bit dusty, a little bit dirty" (Transcript, vol. 91, p. 247), it is unclear whether a set of up-to-date flight handbooks was placed on board C-FONF. It is also not certain if a copy of the Fokker master minimum equipment list (MMEL) produced by Fokker Aircraft was on board C-FONF on the day of the crash.[3]

At the time of the crash, Air Ontario did not have its own F-28 operations manual. The Piedmont and USAir F-28 manuals were being used by Air Ontario and its F-28 pilots in the air carrier's flight operations, without the consent of Piedmont and USAir. No amendment service was requested by Air Ontario and no revisions were provided by Piedmont and USAir for their F-28 operations manuals.

Air Ontario leased from Transport Aérien Transrégional (TAT) of France the Fokker F-28 Mk1000 aircraft that crashed, which was registered to Air Ontario in June 1988 as C-FONF. It was contemplated and indeed stipulated in the lease agreement that C-FONF would be operated in accordance with the Fokker F-28 Flight Handbook and with an approved Air Ontario F-28 operations manual. At the time of the crash, Air Ontario had not completed drafting its own F-28 operations manual for approval by Transport Canada.

Flight Operations Manual

As stated elsewhere in this Report, the *Aeronautics Act* makes the minister of transport responsible for aeronautics applying to all aircraft operations within Canada. Air Regulations and Air Navigation Orders

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[2] Aircraft C-FONF bearing serial number 11060 was imported into Canada carrying a Fokker F-28 Flight Handbook without a complete set of revisions. In May 1988 Air Ontario maintenance requested a revision package for the out-of-date flight handbook set on board C-FONF, and at the same time it ordered one complete flight handbook for each of C-FONF and C-FONG.

[3] Because the entire cockpit was completely consumed by fire, none of the referenced manuals and documents was recovered, either in whole or in part.

(ANOs) are developed by Transport Canada for the regulation of aeronautics and aircraft operations. ANO Series VII, No. 2, is the Canadian legislation that must be complied with by an air carrier operating large aircraft in commercial air service.

As part of the flight operations requirements, section 31 of ANO Series VII, No. 2, states that "An air carrier shall provide an [Flight] *Operations Manual* for the use and guidance of operations personnel in the execution of their duties." As both the regulator and air carriers normally refer to an operations manual as a flight operations manual, I will also do so for the purposes of this Report. Section 33 of the ANO states that the contents of a flight operations manual shall include at least the items set forth in Schedule B of ANO Series VII, No. 2, and be "presented in sufficient detail to enable the operations personnel to perform their duties in a proper manner." Section 35 of ANO Series VII, No. 7, requires the air carrier to provide a complete copy of its flight operations manual or appropriate parts to each crew member. The FOM provided by Air Ontario to Captain Morwood and First Officer Mills that would have been carried on board C-FONF by them on March 10, 1989, was submitted by Air Ontario to Transport Canada for approval in September 1987 and was approved by Transport Canada on February 29, 1988.

Section 32 requires an air carrier to "provide" a copy of its flight operations manual to Transport Canada. The FOM is the primary operational document of all air carriers. I therefore consider it important to set out in its entirety what Canadian legislation requires as a minimum for an air carrier to include in its FOM. Schedule B of ANO Series VII, No. 2, states as follows:

OPERATIONS MANUAL [FOM]

1. The following items shall be contained in an Operations Manual.
(a) a true copy of the air carrier's operating certificates;
(b) a chart of the air carrier's management organization and general operating policies;
(c) the duties, responsibilities and succession of command of operations personnel;
(d) reference to appropriate Air Regulations, Air Navigation Orders, Information Circulars and operating certificates;
(e) the procedures for determining the usability of landing and take-off areas and for disseminating pertinent information thereon to operations personnel;
(f) the procedures for accident notification;
(g) the procedures for operating in conditions of ice, hail, thunderstorms, turbulence or any potentially hazardous meteorological conditions;

(h) emergency flight procedures and emergency duties assigned to each crew member;
(i) the procedures for familiarizing passengers with the use of emergency equipment during flight;
(j) other information or instructions relating to safety;
(k) details of the approved crew member training programs including ground, flight and emergency phases thereof;
(l) information pertaining to flight release and operational control, including procedures for the monitoring and control of each flight, as applicable;
(m) information pertaining to enroute operation, navigation and communication procedures, including procedures for the release or continuation of flight if any equipment required for a particular type of operation becomes inoperative or unserviceable enroute;
(n) information concerning the air carrier's approved routes including the types of aeroplanes authorized for each route, their crew member composition, the kind of operation, such as VFR, IFR or Night VFR, and any other pertinent information;
(o) information concerning airports into which the air carrier is authorized to operate, including
  (i) locations,
  (ii) the types of aeroplanes authorized to use the airport,
  (iii) instrument approach procedures,
  (iv) take-off and landing weather minima, and
  (v) any other pertinent information;
(p) take-off, enroute and landing weight limitations;
(q) the methods and procedures for maintaining the aeroplane weight and centre of gravity within approved limits; and
(r) information pertaining to the air carrier's flight watch system.

I note that sections 31 through 37 and Schedule B of ANO Series VII, No. 2, are generally similar to subparts 121.133 and 121.135 of Part 121 of United States Federal Aviation Regulations (FARs), which list the required contents of FOMs used by United States air carriers. I shall compare specific items in these subparts of the United States FARs with ANO Series VII, No. 2, later in this chapter of my Report.

ANO Series VII, No. 2, requires the air carrier to issue a copy of an approved FOM to each flight operations employee and further requires this manual to be kept up to date through the issuance of amendments reflecting changes in Canadian air regulations or in the air carriers' operating procedures.

The purpose of an air carrier FOM is unique. Not only does it provide important operational information for the flight crew, but it is also the "bible" which all operations personnel rely upon to ensure that safe flight operations are conducted by an air carrier. The FOM is also a

fundamental standard by which both the air carrier and the regulator measure the effectiveness and safety of the air carrier's flight operation.

Recognizing the importance of the FOM in directing air carrier operations, and given the fact that Transport Canada uses the FOM as a standard to assess and audit an air carrier's operation, I would describe at least the portions of the FOM that detail the mandatory requirements set out in Schedule B of ANO Series VII, No. 2, to be akin to subordinate legislation to the Air Regulations and to the ANO. The degree of detail and comprehensiveness with which an air carrier sets forth the requirements mandated by Schedule B in my view reveals the thoroughness and rigour with which an air carrier not only meets the regulatory requirement but also articulates its own expectation of a safe operation. In my view it also reveals the corporate philosophy and overall image of an air carrier. It is therefore important to determine if the information, advice, and direction contained in Air Ontario's FOM were sufficient to allow operations personnel to perform their duties in a proper manner.

The evidence shows that Air Ontario Inc., the merged and successor airline to Austin Airways Limited and Air Ontario Limited, operated from June 1987 until February 1988 without an updated and approved FOM reflecting the operations of the merged air carrier. Air Ontario Inc. did not produce a consolidated FOM and submit it to Transport Canada until September 1987, and Transport Canada did not approve it until February 1988. Captain Robert Nyman, the director of flight operations, testified that Air Ontario simply continued to use the old Air Ontario Limited FOM and the Austin Airways Limited FOM for the separate operations carried on within Air Ontario Inc. The FOM approved by Transport Canada in February 1988 was the result of Captain Nyman taking parts of both the old Air Ontario Limited and the Austin Airways Limited FOMs and combining the information in one document. As a result of FOM information combined from out-of-date manuals, items in the Transport Canada–approved Air Ontario Inc. FOM continued to be out of date in such matters as flight operations management, air carrier bases, various forms, and the reporting relationships among organizations internal to Air Ontario Inc. On March 10, 1989, the date of the crash, the latest amendment in the FOM was dated May 1, 1988.

Although most of the information that was out of date would not adversely affect the operational integrity of Air Ontario, matters that I view as significant were the inaccurate descriptions of the duties and responsibilities of Air Ontario's flight-watch system dispatchers, the inconsistency between the FOM and the FAM regarding hot refuelling, and the lack of an operational flight plan for use in the F-28 operation.

The FAM directs both passengers and flight attendants to leave an aircraft during hot refuelling, but, undeniably, no such direction was

provided in the aircraft fuelling subsection of the FOM. Instructions contained in both ESSO Petroleum Canada's and Transport Canada's policy documents prohibited hot refuelling of an aircraft with passengers on board. This discrepancy should have been rectified by responsible Air Ontario Inc. management, and the prohibition, accordingly, included in the FOM.

As discussed in chapter 23 of this Report, Operational Control, Air Ontario provided to its F-28 flight crew a flight release for use for the conduct of flights in Air Ontario's F-28 aircraft. ANO Series VII, No. 2, Part III, section 15(1), states as follows:

> No person shall commence a flight unless the pilot-in-command and, where applicable, the flight operations officer authorized by the air carrier to exercise operational control over the flight, has approved and signed an operational flight plan setting forth the conditions under which the flight is to be conducted.

Operational flight plan is defined in ANO Series VII, No. 2, as the "operator's plan for the safe conduct of a flight."

Mr David Rohrer, chairman of the operations group of the Commission's investigation team, in testimony referred to the operational flight plan prepared by Air Ontario for the Convair 580 aircraft as one that complied with the criteria set out in ANO Series VII, No. 2. Mr Rohrer testified that no such operational flight plan existed in Air Ontario's FOM for the F-28 aircraft. He testified that the flight release used by Air Ontario for the dispatch of the F-28 aircraft "did not fulfil what I considered to be an operational flight plan" (Transcript, vol. 87, p. 31). A copy of the flight release used by the crew of C-FONF on March 10, 1989, is set out in chapter 23. For purposes of comparison, figure 19-1 is a copy of the sample Convair 580 operational flight plan included by Air Ontario in its FOM. By comparison, the sample operational flight plan for the Convair 580 aircraft is far more complete and detailed than the flight release used by Air Ontario for F-28 flight operations. The Convair 580 operational flight plan contains information similar to that found in an aircraft flight log (referred to in testimony by Captain Claude Castonguay and discussed in chapter 20 of this Report, F-28 Program: Flight Operations Training).

The importance of an operational flight plan such as set out here is that it contains data needed by the flight crew to operate a flight. The data include magnetic tracks, distances to be flown, wind direction and velocities, outside air temperatures, true air speeds, estimated ground speeds, and estimated times to be flown on each flight leg. As well, the data contain estimated fuel flows, fuel burns, and fuel reserves for each leg of the flight. Detailed information provided for the alternate

Figure 19-1 Sample Convair 580 Operational Flight Plan

AIR ONTARIO: CONVAIR 580 OPERATIONAL FLIGHT PLAN 11/08/84
GX F918 08 NOV 84 C-GDTC

FRM	TO	AWYS	MAG HDG	DIS	W/D	W/V	TMP	TAS	EST F.F.	ACT G.S	EST TIME	ACT TIME	ETA	ATA	EST BURN	ACT BURN	EFR	REV EFR	AFR	
YZR	YXU	DRCT	090	52	280	42	-29	287	1900	328	___	:14	____	____	____	618	____	9882	_____	_____	ALTITUDE: 23,000 FT.
YXU	YYZ	DRCT	065	76	280	42	-29	287	1900	322	___	:14	____	____	____	447	____	9435	_____	_____	* CLIMB FACTOR INCLUDED
YYZ	MSS	HL594	078	224	280	42	-29	287	1900	323	___	:42	____	____	____	1317	____	8118	_____	_____	
MSS	YJN	HL586	084	63	280	42	-29	287	1900	330	___	:22	____	____	____	612	____	7506	_____	_____	* APPROACH FACTOR INCLUDED
TOTAL												1:31				2994					
TO ALTERNATE																					ALTITUDE: 9,000 FT.
YJN	YUL	DRCT	341	35	280	10	-6	271	1900	264	___	:22	____	____	____	818	____	6688	_____	_____	* CLIMB & APPROACH INCLUDED
TOTAL												1:53				3812					

FUEL AND WEIGHT CALCULATIONS

DESTINATION FUEL:	2,994	AIRCRAFT WEIGHT:	35,110
ALTERNATE FUEL:	818	PAYLOAD	300
RESERVE FUEL:	2,100	Z.F.W.:	35,410
	------	TOTAL FUEL	10,500
MINIMUM FUEL:	5,912	G.T.O.W.:	45,910
CONTINGENCY:	500	BURN:	2,994
EXTRA FUEL:	4,088	LANDING WEIGHT:	42,916

TOTAL FUEL:	10,500		

DISPATCHER: _____

CAPTAIN: _____

end of report

Source: From Air Ontario's FOM (Exhibit 146)
Note: Any errors contained in this sample operational flight plan have not been corrected

airport includes calculations for required fuel to the alternate, reserve fuel, minimum fuel, and contingency fuel. None of the above items, including the provision of aircraft landing weights and flight altitudes, is contained in the flight release used by the flight crew of C-FONF on March 10, 1989.

Mr Randy Pitcher, a Transport Canada air carrier inspector, Mr Adrian Sandziuk, an Air Canada flight dispatcher, Captain Claude Castonguay, an experienced airline pilot, and Mr David Rohrer, this Commission's operations group chairman and an investigator with the Transportation Safety Board, all testified that the information contained in the flight release for the purposes of operational control of the flight of C-FONF was "minimal," "incomplete," or did not exist. In the view of some of these witnesses, this information did not meet the requirements of ANO Series VII, No. 2, which is to provide the flight crew with a plan for the "safe conduct of a flight."

As discussed in chapter 23, Transport Canada does not prescribe either the form that an operational flight plan should take or the minimum contents. However, the sample Air Ontario operational flight plan for the Convair 580 contains significant operational information not contained in the F-28 flight release. This information, in my opinion, is necessary for a flight crew to plan and conduct their flight in a safe and orderly manner.

The flight crew of C-FONF should have received, prior to the dispatch of flights 1362 and 1363 on March 10, 1989, in addition to the flight release, an F-28 operational flight plan similar in form and content to the sample Convair 580 operational flight plan contained in the carrier's FOM.

While I need not determine that the sample Convair 580 operational flight plan complies with ANO Series VII, No. 2, I find that the flight release used by the flight crew of C-FONF on March 10, 1989, did not meet the requirements of an operational flight plan as contemplated in ANO Series VII, No. 2. Further, the evidence is clear that no operational flight plan was used on March 10, 1989, by the flight crew of C-FONF. No sample operational flight plan was contained in Air Ontario's FOM as an example to be used by the F-28 flight crews, and there is no evidence that one had ever been created by Air Ontario.

ANO Series VII, No. 2, Schedule B, sets out the items that must be contained in an air carrier's FOM. Subsection (l) requires "information pertaining to flight release and operational control, including procedures for the monitoring and control of each flight, as applicable," and subsection (j) requires "other information or instructions relating to safety."

Since there was no operational flight plan for use by the flight crews in the F-28 operation, I am of the view that Air Ontario did not comply with the requirements of ANO Series VII, No. 2, sections 2 and 15, and Schedule B. Air Ontario did not set out in its Flight Operations Manual an example of or the information necessary for an operational flight plan for F-28 aircraft operations in order to demonstrate that procedures were in place to monitor and control the flight of C-FONF and to demonstrate that Air Ontario had a plan for the safe conduct of the flights of C-FONF on March 10, 1989.

In chapter 12 of my Report, Aircraft Performance and Flight Dynamics, I observed that there was a lack of information, advice, and direction relating to ground-accumulated wing contamination in both Air Ontario's draft F-28 Operations Manual and the approved FOM. Similarly, there is little direction in the Air Ontario draft F-28 Operations Manual and the approved FOM regarding takeoff on contaminated runways. Air Canada's FOM, by comparison, although it contains only slightly more information on the prohibition against taking off with contaminated wings, does contain far more advice and direction regarding aircraft de-icing and operation from contaminated runways. A number of amendments on environmental factors are contained in the Air Canada manual, among them an article by Captain Gary Wagner on aerodynamic and performance issues in icing conditions, written as a result of his participation with this Commission of Inquiry. The Air Canada FOM is frequently updated to include new or revised matters of operational concern to flight crews and other operational personnel. While I do not suggest that the material contained in Air Canada's FOM is exhaustive, what is obvious is that the matters of icing, wing contamination and de-icing, and operation from contaminated runways are dealt with in far more depth in the Air Canada FOM than they are in Air Ontario's FOM.

Since an air carrier's operation is inherently dynamic, it is essential that there be ongoing amendments to the FOM to ensure that it reflects changes in the air carrier's operations and provides new information which will make flight operations safer and reflect changing regulatory requirements. Given the facts that Air Ontario Inc. operated for approximately eight months with no approved FOM reflecting the merged operations and that on March 10, 1989, the last major amendment in Air Ontario's FOM was dated May 1, 1988, and taking into account just a few of the deficiencies discussed herein, it is apparent that ongoing changes in Air Ontario's operations were not being reflected on a regular basis in that air carrier's FOM.

Although I am not singling out any particular flight safety deficiency as a result of the lack of currency of the manual, it is my view that failure to maintain a comprehensive FOM, reflecting the continued and

current status of an air carrier's operation, has an overall flight safety implication. If it is understood by operations personnel that the FOM is constantly out of date or that it contains little important information on operational matters, then these operations personnel may discount its effectiveness and value.

Although ANO Series VII, No. 2, contemplates in sections 31 and 36 that there will be amendments in the operations manual, which is to be kept up to date, there are no criteria in the ANO, nor is there direction, with respect to how amendments are made, the frequency and dissemination of amendments, and the review of the contents of a carrier's FOM. In particular, there is no mandatory requirement that the required items in an operations manual, as listed in Schedule B of ANO Series VII, No. 2, be reviewed and amended on a regular basis.

Although the Air Ontario FOM was ultimately prepared, submitted, and approved – eight months after it should have been – I find it unacceptable that Air Ontario did not produce an up-to-date FOM, and that Transport Canada did not insist that it be produced within a reasonable period of time following the merger of Austin Airways Limited and Air Ontario Limited operations. Eight months is an unreasonably long time for an air carrier to be without an up-to-date FOM. A planned audit of Air Ontario Inc.'s operation was delayed in part because Air Ontario did not have a current FOM. This happened in spite of the fact that Transport Canada inspectors were concerned about inadequate operational control by Air Ontario over its widely located flight bases. I cannot see how Transport Canada can ensure that an air carrier's operations personnel are performing their duties in a "proper manner" without a current FOM.

Section 34 of ANO Series VII, No. 2, states that "[a]n air carrier shall provide not less than one complete copy of his Operations Manual to the Director." The ANO requires provision of the FOM to Transport Canada, but the legislation is silent as to whether it must be "approved" by Transport Canada. Since Schedule B of ANO Series VII, No. 2, sets out items to be contained in an FOM, one must assume that Transport Canada also reviews and approves at least the items required by Schedule B. Silence in the ANOs on the matter of the review and approval of the FOM by Transport Canada is, in my view, entirely unacceptable.

The fact that Air Ontario did not produce an up-to-date FOM in a timely manner, and the fact that Transport Canada made no effort to require such FOM to be produced and provided to Transport Canada, persuades me that ANO Series VII, No. 2, is inadequate. It fails to require the air carrier to prepare, and Transport Canada to review and approve, the FOM in a timely and effective manner.

Aircraft Flight Manual

Part of the Canadian certification process for new aircraft types is the requirement that the aircraft manufacturer produce an aircraft flight manual (AFM). This manual, given various names by individual manufacturers (in the case of Fokker Aircraft, it is called the F-28 Flight Handbook, described earlier in this chapter), is referred to in ANO Series VII, No. 2, as the "approved Aircraft Flight Manual." The AFM contains manufacturer's operating procedures that must be followed in order to conform to the aircraft limitations established during certification.

Two Fokker F-28 Mk1000 aircraft, one being C-FONF, which were leased by Air Ontario, were delivered with a three-volume set of the Fokker F-28 Flight Handbook manuals. These manuals were recognized by Transport Canada as the "approved Aircraft Flight Manual" for the purpose of the aircraft's certification.

Reference is made to specific portions of the Fokker F-28 Flight Handbook in various chapters of this Report. The AFM produced by Fokker Aircraft and approved by the Rijksluchtvaartdienst (RLD) is detailed and comprehensive in nature, and I do not propose to discuss this manual in detail in this section of my Report.

Aircraft Operating Manual

There is no legal requirement in Canada for an air carrier to produce and operate its aircraft using its own aircraft operating manual (AOM). ANO Series VII, No. 2, contemplates that the air carrier will use, in the operation of any of its aircraft, the aircraft manufacturer's aircraft flight manual (AFM).

An AFM is a highly detailed manufacturer-produced document, and its use on the aircraft flight deck on a day-to-day basis is often impractical, particularly because of its size and complexity. Most air carriers modify the presentation of the performance data and revise operating procedures set forth and contained in the AFM into handbooks and checklists, producing their own AOMs. These AOMs would be compatible with the air carrier's specific operation. An air carrier that operates a number of different aircraft types often endeavours to standardize as many procedures as is feasible to reduce the risk of error and to facilitate pilot transfers between aircraft types. AOMs, which incorporate the air carrier's standard operating procedures, must be at least as restrictive as the manufacturer's AFM.

Aircraft operating manuals, often referred to by witnesses in these hearings as aircraft standard operating procedures manuals (SOPs), were, in the case of Air Ontario, the Piedmont F-28 Operations Manual, the USAir Fokker F-28 Operations Manual (Pilot's Handbook), and the

draft Air Ontario F-28 Operations Manual. Although, as noted, neither the ANOs nor any other relevant Canadian legislation deals with such an aircraft manual, Transport Canada in its internal policy and guidance documents refers to it as an aircraft operating manual.

Either the approved AFM (referred to in ANO Series VII, No. 2) or the AOM (informally "accepted" by Transport Canada) is carried by all pilots flying a specific aircraft and is used by them in the day-to-day operation of that aircraft type. This manual is a standard against which pilots are tested in ground school, during annual recurrent training, and in the required annual pilot proficiency checks (PPCs) conducted either in the aircraft or in an approved flight simulator.

The air carrier can, and normally does, condense portions of the AFM into checklist format and make such checklists available in the aircraft as separate booklets for ease of use by the pilots and to facilitate immediate reference. Such booklets are normally called quick reference handbooks (QRHs) and aircraft checklists.

Air Ontario did not require its F-28 pilots to use the manufacturer's AFM on a day-to-day basis. Although Transport Canada was not requested by Air Ontario to approve an F-28 AOM, the evidence indicates that it was the intention of Air Ontario to create its own AOM. It was also clear from the evidence that Air Ontario intended to use Piedmont Airlines' and USAir's F-28 operations manuals on an interim basis for the initial startup of Air Ontario's F-28 revenue operations. Apparently, Piedmont Airlines and USAir understood that their F-28 operations manuals would be used only as training tools for the purposes of aircraft ground school and simulator training provided by Piedmont Airlines/USAir to Air Ontario pilots.

In January 1988 Air Ontario sought the approval of Transport Canada to add the F-28 aircraft to its operating certificate. At the same time, Air Ontario also sought approval from Transport Canada for the use, on an interim basis, of Piedmont Airlines' F-28 ground school syllabus, simulator training, and instructors to enable Air Ontario pilots to make the transition to the F-28 aircraft. Pursuant to ANO Series VII, No. 2, Air Ontario required Transport Canada's consent for the use of such an F-28 training program, which Piedmont Airlines had agreed to provide to Air Ontario. Transport Canada anticipated that Air Ontario would submit to Transport Canada in the "near future" its own F-28 training syllabus, including an Air Ontario F-28 operations manual, for its review and approval. Neither Air Ontario nor Transport Canada clarified when the "near future" would be.

Approval for Air Ontario to use Piedmont Airlines' F-28 training syllabus, simulator, and instructors was given by Transport Canada in February 1988. No formal request was made by Air Ontario, nor was permission granted by Transport Canada, to allow Air Ontario pilots to

use the Piedmont F-28 operations manuals in Air Ontario's F-28 revenue operations. The approval granted by Transport Canada was for the contract ground school and simulator training conducted by Piedmont Airlines and was considered to be "an interim measure" (Exhibits 716 and 857, Transport Canada memorandum and letters) to enable Air Ontario to make the transition to the F-28 aircraft. Transport Canada specifically advised Air Ontario that "[i]t is anticipated you [Air Ontario] will submit your own F28 syllabus of training in the near future" (Exhibit 857, letter from Transport Canada to Air Ontario, February 15, 1988). Mr Martin Brayman, at the time Transport Canada's inspector responsible for monitoring Air Ontario's operations, confirmed that he contemplated that the Piedmont F-28 Operations Manual would be part of the training package used to train Air Ontario pilots. He stressed in testimony that such use of all of the training material, including the Piedmont F-28 Operations Manual, was "on an interim basis" (Transcript, vol. 131, pp. 119-20).

The letter of authorization from Transport Canada did not mention the use of the Piedmont F-28 Operations Manual. The mere fact that Air Ontario used the Piedmont F-28 Operations Manual for the entire period it operated its F-28 aircraft appears to indicate that, in the absence of any instructions to the contrary from Transport Canada, Air Ontario assumed it could use the Piedmont manual in its F-28 revenue operations. At least one Transport Canada air carrier inspector, Mr Randy Pitcher, who was trained by Piedmont and thereafter became the designated F-28 inspector for Transport Canada, Ontario Region, felt it was acceptable for Air Ontario to use Piedmont's F-28 Operations Manual, at least for training. Mr Pitcher testified that approval by Transport Canada of the Piedmont Airlines' training program was given to Air Ontario prior to his joining Transport Canada. However, he was informed by Mr Brayman, and he understood from his review of Transport Canada correspondence, that the Piedmont F-28 manual was approved for use by Air Ontario for the purposes of training pilots on the F-28 aircraft.

Air Ontario's F-28 Project Plan contemplated that an Air Ontario F-28 operating manual would be developed under the supervision of the director of flight operations in a format similar to the Piedmont F-28 Operations Manual. The Project Plan contemplated that the development of this manual would be completed in February 1988, during the early stages of the F-28 program and at about the time it anticipated the amendment to the operating certificate to include the F-28 aircraft.

In December 1988, six months after C-FONF was imported into Canada and an operating certificate was granted by Transport Canada to operate the F-28 aircraft, a senior Air Ontario F-28 check pilot, Captain Robert Perkins, was concerned enough about the lack of an Air Ontario

F-28 operating manual to ask Captain Joseph Deluce about its status. Captain Perkins testified that when he "did not receive a favourable reply" to the question he then asked as to whether amendment information was available for the Piedmont F-28 Operations Manual (Transcript, vol. 44, pp. 93–94). Captain Perkins was advised that there would be no amendment service for the Piedmont manual. He further testified that it was his view that Air Ontario should have had either an up-to-date Piedmont manual or its own F-28 operating manual. Mr James Morrison, Air Ontario's newly appointed vice-president of operations, was aware by late December 1988 that no Air Ontario F-28 operations manual had been drafted (Transcript, vol. 115, p. 112). Captain Deluce at that time had enlisted the assistance of Captain Perkins and First Officer Steven Burton to assist him in developing the F-28 operations manual. As a result of a number of circumstances such as a pilot strike, the delay in the delivery of the F-28 aircraft, and the failure of the F-28 project manager, Captain Deluce, to attend to the production of the AOM as contemplated by the F-28 implementation plan, a draft Air Ontario F-28 Operations Manual was not submitted to Transport Canada for approval until June 7, 1989, the same month that Air Ontario discontinued its F-28 service and three months after the crash of C-FONF.

Virtually all of the operating procedures and performance data contained in the draft Air Ontario F-28 Operations Manual were extracted verbatim from Piedmont's F-28 Operations Manual. As discussed in chapter 12 of this Report, Fokker F-28, Mk1000, Aircraft Performance and Flight Dynamics, the authors of the Air Ontario AOM elected to leave out the charts contained in the Piedmont manual that provided weight restrictions to be applied to a takeoff on contaminated runways. In place of the chart was a statement referring the reader to the charts of the Fokker F-28 Flight Handbook. One of the drafters of the Air Ontario F-28 Operations Manual, Captain Perkins, testified that the use of the slush-correction charts from the Fokker AFM was an interim measure only, since it was operationally impractical to use these charts in the cockpit to make slush-correction calculations (Transcript, vol. 44, pp. 184–85). No explanation was given as to what correction charts Air Ontario planned to use as an alternative to the Fokker correction charts and the more restrictive Piedmont charts.

On June 20, 1989, Transport Canada acknowledged receipt of Air Ontario's draft F-28 AOM and advised Air Ontario that it was being reviewed. Because Air Ontario discontinued its F-28 service in June 1989, a review and informal approval by Transport Canada was never completed.

I do not propose to comment on the contents and form of the draft Air Ontario F-28 AOM. I do, however, note that it is unacceptable that Air Ontario did not have in place its own F-28 operations manual at an

early stage of revenue operation with the aircraft. Captain Charles Simpson, the vice-president of flight operations for Air Canada, testified that, once approved, the AOM becomes the "bible" by which the aircraft type is flown (Transcript, vol. 118, p. 76). He further testified that in his view it is the only document that should be on board the aircraft for use as a reference to operate an aircraft type. It is the policy of Air Canada that no new aircraft type be introduced into passenger-carrying line service until an AOM for the particular aircraft type is produced. While Air Canada might use a manufacturer's AFM during initial pilot training on a new aircraft type, Captain Simpson testified, by the time the aircraft type is ready for line operation Air Canada has always developed its own AOM.

After reviewing the F-28 Project Plan of Air Ontario, the manuals used, and the testimony of many Air Ontario pilots, I have a clear impression that Air Ontario F-28 pilots were often left to learn and to discover for themselves what were the best operational flight procedures for the F-28. This was occurring at the same time that the pilots were conducting revenue flights. It can be expected that some learning will take place as pilots gain experience on a new aircraft type. To require the pilots to operate without a company-generated aircraft operating manual, however, places an additional and unnecessary burden on the pilots.

It was an obvious and serious neglect for Air Ontario not to produce, in a reasonable time, an AOM for the F-28. As well, Air Ontario did not raise and Transport Canada did not address the issue of Air Ontario F-28 pilots using, at the same time, in revenue operations, other air carriers' aircraft operating manuals, specifically the Piedmont Airlines F-28 Operations Manual and the USAir F-28 Operations Manual.

The operating methods in these manuals reflected Piedmont's/USAir's standard F-28 operating procedures and, of necessity, would have been different from the operating methods previously used by Air Ontario pilots on other aircraft.

The fact that Air Ontario did not provide its pilots with F-28 operating procedures tailored to their methods of operating was considered to be a problem by the Air Ontario F-28 pilots who testified. Additionally, permitting a different F-28 aircraft operating manual to be used by each of the pilots on the flight deck is potentially hazardous.

Difficulties can arise when an air carrier uses an AOM produced by another air carrier that may operate the same aircraft in a different environment using different flight operations procedures. Aircraft standard operating procedures developed by an air carrier from the manufacturer's aircraft flight manuals incorporate operating procedures standard to all of the carrier's aircraft types. For example, although a manufacturer's AFM describes what actions and procedures are required

for a given operational situation, often it may not explain in sufficient detail how such actions and procedures are to be carried out by the flight crew. Similarly, the AFM may not designate which flight crew member should carry out which action or procedure and what, if any, verbal calls should be made in order that actions carried out can be confirmed. As was shown in the results of the pilot survey conducted by Captain Ronald Stewart, there were no pilot-not-flying (PNF) duties set out in the Air Ontario's operating procedures. This problem was in fact noted by Transport Canada during a flight inspection of the Dash-8 in its audit of Air Ontario in the fall of 1988, as discussed in chapter 33 of this Report. The following is the relevant non-conformance finding (0-15.1) from Transport Canada's 1988 audit report of Air Ontario regarding standard operating procedures (SOPs) manuals (that is, AOMs):

> Standard operating procedures between crews vary. Call outs are not standardized. There are crews doing after start check while taxiing, resulting in no lookout. There is evidence that there is no cross-checking between Captain and First Officer as to altimeter, heading, course and airspeed bug settings. Crew co-ordination and management are at times lax.

Transport Canada concluded that "These problems are due to the company not having Standard Operating Procedures Manuals" (Exhibit 1042, Transport Canada Aviation Group National Audit of Air Ontario Inc., February 1988).

The comments of the Transport Canada auditors reveal a desire by the regulator that air carriers operate their aircraft using company-produced aircraft operating manuals incorporating company standard operating procedures. Transport Canada auditors noted that the chief pilot for Air Ontario's Dash-8 aircraft fleet had not created such an aircraft operating manual. Transport Canada auditors directed Air Ontario to produce such manuals for the Convair 580 and the Dash-8 aircraft. Air Ontario's Flight Operations Manual specifies that one of the duties and responsibilities of a chief pilot is to, "[i]n cooperation with Training and Check Pilots, write and update Standard Operating Procedures Manuals for each aircraft type" (Exhibit 146, Air Ontario Flight Operations Manual, p. 3-8, para. 3.4.6.)

Captain Nyman testified that, contrary to Air Ontario's FOM, which states that aircraft operating manuals are required, and despite Transport Canada's auditors' request that Air Ontario create a Dash-8 standard operating procedures manual, Air Ontario's then Dash-8 chief pilot refused to do so. The chief pilot argued that the de Havilland Dash-8 Flight Manual was sufficient to constitute the air carrier's standard operating procedures manual. Although Captain Nyman, as director of

flight operations, disagreed with the chief pilot's position, he testified that because the chief pilot was Air Ontario's expert on the Dash-8, he did not order him to create a Dash-8 aircraft operating manual. In defence of the chief pilot's position, Captain Nyman stated that the chief pilot was able to convince Transport Canada air carrier inspectors that the de Havilland Dash-8 AFM rather than a company-produced standard operating procedures manual was a suitable document to use (Transcript, vol. 109, pp. 30–33).

The position of Air Ontario's Dash-8 aircraft chief pilot may be correct, but his view differs from both what is contemplated in Air Ontario's FOM and what was viewed by Transport Canada auditors as a deficiency by Air Ontario in not having a Dash-8 standard operating procedures manual.

Mr William Slaughter, who was director of flight standards, Transport Canada, when he appeared before me, testified that Transport Canada approves the manufacturer's aircraft flight manuals and specific parts of the air carrier's FOM. He considered a company-produced aircraft operating manual to be an optional document, internal to the air carrier, with no requirement for Transport Canada to review it. Mr Slaughter stated that although some air carrier inspectors commendably insist that company-produced aircraft operating manuals be submitted to Transport Canada for review, Transport Canada had no authority to require the air carrier to submit its aircraft operating manuals. Mr Slaughter further stated that the only method that Transport Canada has of ensuring that company-produced aircraft operating manuals are acceptable in form and content "is by exception" (Transcript, vol. 144, p. 100). In explaining what he meant by this statement, Mr Slaughter stated that if an air carrier presents its own AOM for review, Transport Canada will review it and provide its informal approval. Also, if Transport Canada suspects that an air carrier's internally produced AOM is deficient, then Transport Canada will step in and review such manual.

It was Mr Slaughter's view that, if an air carrier creates its own AOM, it should be a requirement that Transport Canada review such AOM to ensure that it conforms with the manufacturer's AFM. In any event, air carriers normally produce their own aircraft standard operating procedures manuals. More importantly, because part of these manuals includes "normal" and "abnormal" checklists and handbooks used by pilots on a day-to-day basis, Mr Slaughter acknowledged that Transport Canada should have more control over the contents and use by the air carrier of such AOMs or SOPs manuals.

Mr Ian Umbach, superintendent of air carrier operations, Transport Canada headquarters, also acknowledged during testimony that although Transport Canada reviews air carriers' training syllabi and associated data, such reviews do not necessarily include the review of

a carrier's AOMs. In the case of Air Ontario, Mr Umbach testified that while Transport Canada headquarters reviewed Air Ontario's training syllabus, no one at headquarters reviewed the Piedmont F-28 Operations Manual; nor was he aware of whether anyone at Ontario Region office had reviewed the manual. The evidence indicates that no one in Transport Canada in fact reviewed the Piedmont F-28 and USAir operations manuals used by Air Ontario. It also appears that no one at Transport Canada identified this fact and took steps to stop Air Ontario from continuing the practice of allowing F-28 pilots to use two different AOMs in the cockpit. Mr Umbach acknowledged that there should be some procedure in place to ensure that Transport Canada has reviewed an air carrier's operating manual and compared its contents with those of the aircraft manufacturer's AFM.

Both Mr Slaughter and Mr Umbach in testimony confirmed the inadequacies of the review and the approval process within Transport Canada regarding operational manuals. The stated position of Transport Canada is that although it reviews AOMs, it has no formal right to do so and has no authority to approve them. This position is untenable and creates an unworkable situation. It is my view that Transport Canada should review and approve all air carrier AOMs or SOPs manuals for each aircraft type in use by the air carrier. Both the regulator and air carriers believe that it is necessary for air carriers to develop their own aircraft-operating procedures to reflect the carrier's unique operational environment. However, there is no mechanism in place to ensure that the air carrier in fact develops an AOM that both reflects its operation and guarantees standardized procedures. While Transport Canada certainly does not ignore the reality that most air carriers use aircraft operating manuals specific to their operations, it is legally powerless to compel an air carrier to use such manuals. As well, current legislation provides no mechanism for Transport Canada to approve the manuals prior to their use by an air carrier.

ANO Series VII, No. 2, is silent on the entire issue of air carrier–produced aircraft operating manuals or aircraft standard operating procedures manuals. In contrast, the United States FARs, Part 121, clearly require the review and approval of such manuals. While there is no doubt that an air carrier has the right to use the manufacturer's AFM, most air carriers find it necessary to adapt the procedures and performance data in the AFM to their particular flight operational environment. It was the testimony of Captain Gert Andersson, an experienced F-28 captain with a Swedish air carrier, that performance charts and graphs such as the ones produced by Fokker Aircraft for takeoff on contamination-covered runways "should be used only by experienced performance people." The air carrier should make a "simpler chart for use in the cockpit" (Transcript, vol. 83, pp. 186–87). In reality, that is exactly what

most air carriers do when they create their own AOMs: they reproduce performance data and operating procedures in a format more readily usable by flight crews in the aircraft cockpit.

To ensure that the revised operating procedures sections and the modified presentation of performance data are no less restrictive than the AFM, the regulator must have an opportunity to review and approve such revisions and modifications.

FAR 121.141 states as follows:

> (a) Each certificate holder shall keep a current approved Airplane or Rotorcraft Flight Manual for each type of transport category aircraft that it operates.
>
> (b) In each transport-category aircraft, the certificate holder shall carry either the manual required by §121.133 [FOM], if it contains the information required for the applicable flight manual and this information is clearly identified as flight manual requirements, or an approved Airplane or Rotorcraft Flight Manual. If the certificate holder elects to carry the manual required by §121.133, *he may revise the operating procedures sections and modify the presentation of performance data from the applicable flight manual if the revised operating procedures and modified performance date presentation are –*
>
> (1) *Approved by the Administrator*; and
>
> (2) *Clearly identified as airplane or rotorcraft flight manual requirements.*
>
> (Emphasis added)

I recommend that ANO Series VII, No. 2, be amended to reflect similar provisions contained in FAR 121.141, which contemplate and allow air carriers to use internally produced AOMs and require the contents of such AOMs to be approved by the regulator. Further, as air carriers will in any event modify the presentation of performance data from the AFM in the form of "normal" and "abnormal" checklists and quick reference handbooks for use by the pilots, it is my opinion that air carriers operating large transport-category aircraft should be required to produce AOMs or SOPs manuals for each type of aircraft operated by them and to obtain approval of such manuals from Transport Canada prior to commencing commercial operation with the aircraft.

I will now deal with the second practice of Air Ontario that I view to be potentially hazardous, namely that of allowing on the flight deck the use of two different F-28 operations manuals: the Piedmont Airlines F-28 Operations Manual and the USAir F-28 Operations Manual. By way of background, during the course of training Air Ontario pilots, Piedmont

Airlines' operation was merged with the operations of USAir. USAir, which did not previously operate F-28 aircraft, rewrote the Piedmont F-28 Operations Manual to reflect the operations of USAir. The new F-28 operations manual for use by the merged operation became the USAir Operations Manual (referred to as its F-28 Pilot's Handbook). Air Ontario F-28 pilots who received training following the merger of the two airline operations received ground school and flight simulator training using the USAir F-28 Pilot's Handbook.

Captain Nyman, the flight operations director, first became aware of the change when he took his simulator training course in Tampa, Florida, in December 1988. At that time, Captain Nyman discovered that certain procedures used on the flight deck, such as standard checks and callouts, had been modified by USAir to fit its operation. Captain Nyman testified that he telephoned Captain Joseph Deluce and requested that he put a copy of the Piedmont F-28 Operations Manual in the F-28 aircraft. Captain Nyman wished to ensure that only one manual was being used by the pilots on the flight deck of the F-28; that manual, in his view, was the Piedmont F-28 Operations Manual (Transcript, vol. 109, pp. 67–68).

Despite the fact that the request to place a Piedmont F-28 Operations Manual on board Air Ontario's F-28 aircraft came from the director of flight operations, Captain Deluce never took action in relation to this request. Both manuals continued to be used by pilots on the F-28 flight deck for the duration of Air Ontario's F-28 revenue operations.

The Piedmont F-28 Operations Manual and the USAir F-28 Pilot's Handbook are comprehensive and detailed, reflecting the standard operating procedures of each of these airlines. I find no fault with the individual manuals, either in form or in content.

The fault that existed was in the use of two different aircraft operating manuals to describe flight operating procedures. Captain Simpson, in addressing this problem, explained that "you can't have two pilots in the same airplane using different procedures. It will lead to trouble sooner or later" (Transcript, vol. 118, p. 82). I entirely agree with this position.

Although the Piedmont and USAir F-28 operations manuals are comprehensive, both dealing with the same aircraft type, there are sufficient differences in the operating procedures of these two air carriers to create potential problems on the flight deck. Some of the differences were explored in testimony with Captain Perkins, who was, at the time of the crash, a check pilot on the F-28 aircraft. Briefly, some of the differences are as follows:

- The time between activating the first and the second fire extinguisher in an engine where there are indications of a fire are different. Piedmont states 45 seconds, USAir states 30 seconds.

- The USAir F-28 operations manual deals with the use of the autopilot in the procedure regarding stopping a runaway stabilizer trim; the Piedmont manual does not mention the autopilot.

- Procedures used for landing with one engine inoperative reveal several differences between the USAir and the Piedmont manuals. The Piedmont manual requires lateral fuel balance to be within 1500 pounds; USAir within 1000 pounds.

- The Piedmont manual details the actions to be taken for a go-around and requires the pilots to review them prior to landing; the USAir manual does not mention the go-around, nor is there any requirement to review go-around procedures. Piedmont provides for a level-off height of 600 feet above ground level (AGL) on a single-engine go-around; the USAir manual instructs the pilots to level off at 800 feet AGL.

- The one-engine go-around procedure is found in the Piedmont emergency chapter; the same procedure in the USAir manual is found in the training chapter.

- The Piedmont manual requires a pre-flight exterior aircraft inspection, or walkaround, prior to each flight; the USAir manual requires such inspection at originating stations and crew change points.

These and other differences caused concern among first officers who received their ground school training from USAir and were given a USAir F-28 Pilot's Handbook. Two Air Ontario pilots who were F-28 first officers testified that they were concerned that there was no formal advice given pilots as to which manual was to be used as the Air Ontario F-28 Standard Operating Procedures Manual. One of these first officers was under the impression that since no Air Ontario SOPs manual existed, the Piedmont F-28 Operations Manual was to be used. The other first officer, Captain Deborah Stoger, commented that the flight profiles are different in both manuals. "Captains were expecting Piedmont profiles, but I was trained in USAir procedures" (Transcript, vol. 93, p. 28). As a result of the differences in certain flight profiles between the Piedmont and the USAir aircraft operating manuals, this first officer recalls an instance in flight where there was confusion over the procedures to be used during the approach.

It is clear that differing procedures could cause confusion, especially in an abnormal situation where a particular procedure is not often used. One example, which I have mentioned above, is the difference between the Piedmont manual and the USAir manual regarding the altitude to

be maintained following a missed approach with one engine inoperative. This information, which deals with an abnormal F-28 flying procedure, is normally memorized by pilots and reinforced during training. The Piedmont F-28 Operations Manual describes the go-around procedure in chapter 2, "Emergency and Abnormal" Procedures, which states, "Level-off at 600 ft, AGL" (Exhibit 307, p. 2-11). The USAir Pilot's Handbook describes this procedure in chapter 18, "Training," which states "Climb straight ahead to 800 feet AGL or clear of obstructions" (Exhibit 329, p. 18-55-3). It was also revealed during testimony that the aerodrome approach charts for the Dryden Municipal Airport, produced by Jeppesen/Sanderson for use by Air Ontario F-28 pilots, provided a level-off height of 400 feet AGL for the F-28 aircraft. When, during testimony, the fact was put to Captain Nyman that there were three different obstacle-clearance level-off heights, he agreed that, for compatibility with the Piedmont F-28 Operations Manual, the single-engine level-off height should have been standardized and the Jeppesen charts should have been ordered with a level-off height of 600 feet AGL.

However, even if the Jeppesen charts showed a 600-feet AGL level-off height, there remained discrepancy between the Piedmont and the USAir manuals. Although a go-around procedure on one engine is an abnormal and emergency situation, seldom required to be performed except during training and proficiency checks, an actual go-around on one engine, possibly in bad weather conditions, would be an inappropriate time for the flight crew to disagree about, to be unsure of, or to attempt to clarify the differences in level-off heights.

Although Captain Nyman stated that at least the pilots whom he trained on the F-28 were made aware of the differences between the Piedmont and the USAir aircraft operating manuals, he agreed in testimony that it would have been preferable if Air Ontario had in place, prior to the commencement of revenue service of the F-28, its own standard operating procedures manual containing one set of operational data. Captain Nyman testified that on the F-28 flight deck all Air Ontario F-28 pilots used checklists and emergency quick reference handbooks produced by Piedmont. However, it is my view that commonality should have also extended to having one aircraft operating manual on the flight deck.

As was discussed in chapter 12 of this Report, Aircraft Performance and Flight Dynamics, another example of failure to standardize manuals and procedures was revealed in the confusion that existed among the F-28 pilots as to which slush-correction charts applied: those contained in the Piedmont and USAir AOMs, or the graphs contained in the Fokker F-28 AFM. On the one hand, Captain Perkins testified that he was not bound by the more restrictive Piedmont/USAir slush charts and could use the less restrictive slush-correction charts set forth in the

Fokker Aircraft F-28 Flight Handbook. Captain Nyman, on the other hand, was of the view that the slush chart contained in the Piedmont F-28 Operations Manual was the only slush chart to be used by Air Ontario pilots. Captain Joseph Deluce in testimony agreed that, in hindsight, it would have been best if all pilots referred to one chart only, that being the more limiting chart contained in the Piedmont manual (Transcript, vol. 150, pp. 75–76).

Had it been made clear that the more restrictive AOM was binding, and had the flight crew on C-FONF felt bound by the more restrictive manual, then, given the slush conditions on runway 11/29 at 12:09 p.m. on March 10, 1989, the flight crew would have been prohibited by Air Ontario operating policy from taking off on runway 29 with those slush conditions at a takeoff weight of more than approximately 53,400 pounds. I am fortified in this view by the testimony concerning the "Report of the Board of Inquiry into the Accident at Toronto International Airport, Malton, Ontario, to Air Canada DC8-CF-TIW aircraft on July 5, 1970" (Exhibit 1181, held before the Honourable Mr Justice Hugh F. Gibson, Commissioner).

This report dealt with the inquiry into an Air Canada DC-8 aircraft that crashed on July 5, 1970, while on final approach to Toronto International Airport, leaving no survivors. It was determined that the flight crew had agreed upon a procedure for operating the aircraft spoilers that was contrary to the procedure specified in Air Canada's DC-8 Operating Manual. While using the contrary procedure, an inadvertent, premature deployment of the spoilers occurred 60 feet above the ground prior to the aircraft flare. Evidence indicated that certain Air Canada pilots followed a procedure of arming and deploying the spoilers contrary to the Air Canada DC-8 Operating Manual and that this known procedure was allowed to continue unchecked. It was also determined that the manufacturer's DC-8 AFM contained misinformation regarding use of the spoilers that was not corrected in the Air Canada manual. Another Canadian air carrier had noted the misinformation and clarified it in its own DC-8 operating manual. Both Air Canada's and the other air carrier's AOMs were provided to and reviewed by Transport Canada.

In this report, the Honourable Mr Justice Gibson lists, among others, the following two "contributing circumstances":

> (viii) The failure of the Ministry of Transport to detect the deficiencies and misinformation in the manufacturer's aircraft flight manual as to the operation of the ground spoiler systems on this type of aircraft; and the failure to require the manufacturer in such manual to warn of the danger of inappropriate deployment of the ground spoilers on this type

of aircraft when in flight and especially when it is close to the ground.

(ix) The failure of the Ministry of Transport (1) to have noted the differences in the manuals of Air Canada and other Canadian aircraft operators in relation to the hazards of operating this ground spoiler in this aircraft, (2) to have alerted Air Canada of this, and (3) to have taken appropriate remedial action so that Air Canada's manual in respect thereto was not deficient in respect thereto.

(Exhibit 1181, pp. 107–108)

When questioned about these two "contributing circumstances," Mr Slaughter of Transport Canada agreed in testimony that Mr Justice Gibson attached importance to the need for Transport Canada to review air carriers' AOMs. Mr Slaughter also agreed that in 1989, 19 years after the crash of Air Canada's DC8-CF-TIW aircraft, Transport Canada, which was under no legal requirement to do so, was, owing to workloads and other priorities, still conducting only a cursory examination of air carriers' AOMs.

In my view, the reason this situation continues is that there is no regulatory requirement that air carriers produce AOMs specific to each aircraft type operated by the carrier. Partly because there is no requirement for Transport Canada to do so, these AOMs are neither thoroughly reviewed nor approved by Transport Canada prior to an aircraft type being operated by an air carrier in revenue service.

This situation must change. Legislative requirements should exist for, and inspectors should be specifically dedicated to, the process of the review and the approval of the contents of all air carriers' AOMs.

Flight Attendant Manual

Although a cabin attendant manual (designated the Flight Attendant Manual (FAM) by Air Ontario) is referred to extensively in Transport Canada's procedures document, Manual of Regulatory Audits, and elsewhere, there is no requirement in the Air Navigation Orders for the issuance of a cabin attendant manual. However, Transport Canada policy documents expect air carriers to produce manuals for the flight attendants. Most air carriers, including Air Ontario, do so. On the day of the crash, flight attendants Katherine Say and Sonia Hartwick each carried on board C-FONF an Air Ontario FAM with a last revision date of September 10, 1988.

Section 42 of ANO Series VII, No. 2, requires that an air carrier establish and maintain a ground- and flight-training program approved by Transport Canada to ensure that each crew member is adequately

trained to perform his or her assigned duties. In addition, the air carrier must provide adequate ground- and flight-training facilities and qualified instructors to ensure that proper training of all crew members is carried out. By definition in ANO Series VII, No. 2, "a cabin [flight] attendant means a crew member, other than a flight crew member, assigned to duty in a passenger-carrying aeroplane during flight time."

Under the apparent aegis of section 42 of ANO Series VII, No. 2, Transport Canada reviews the cabin attendant training programs of an air carrier and compels the carrier to ensure that all flight attendants are adequately trained to perform their duties; specifically, abnormal and emergency procedures. Transport Canada is therefore mandated to approve an air carrier's cabin attendant training program. Section 34 of ANO Series VII, No. 2, requires an air carrier to provide a copy of its FOM to Transport Canada. Section 35 requires the air carrier to provide as well a copy of its FOM or "appropriate parts thereof" to each crew member.

Since crew members include flight attendants, I conclude that "appropriate parts" of an FOM will include matters that deal specifically with the duties, responsibilities and requirements of flight attendants. Inspection checklists contained in the Manual of Regulatory Audits remind audit personnel to determine if the contents of the FAMs comply with sections 31 through 37 of ANO Series VII, No. 2. I therefore conclude that, by inference, ANO Series VII, No. 2, allows, and Transport Canada, through policy documents, contemplates, that the part of an FOM dedicated to cabin attendants' duties, responsibilities, and training can be a separate document. Such a document may be a cabin attendant manual, as referred to by Transport Canada, or the Flight Attendant Manual produced by Air Ontario.

In terms of legislative requirements for cabin attendant manuals, I perceive the same problem to exist as exists at present with AOMs. Although Transport Canada reviews cabin attendant manuals such as Air Ontario's FAM if they are submitted to Transport Canada by the air carriers, there is no legislative requirement to produce cabin attendant manuals, nor is there a commensurate requirement that Transport Canada review and approve such manuals.

On the one hand, ANO Series VII, No. 2, requires that cabin attendant training programs, including training relating to abnormal and emergency procedures, be approved by Transport Canada. On the other, there is no commensurate requirement for the review and approval of cabin attendant manuals to ensure, for example, that abnormal and emergency procedures for each aircraft type operated by the carrier are delineated. Although certain abnormal and emergency procedures may be general to all aircraft types operated by an air carrier, other procedures may be specific to an aircraft type. For example, the Air Ontario FAM includes,

in addition to an emergency procedures section, dedicated sections regarding four aircraft: the Hawker Siddeley HS-748, the Convair 580, the de Havilland Dash-8, and the Fokker F-28 Mk1000. The FAM, therefore, may contain procedures relevant to both the FOM and a particular AOM, such as for the F-28 Mk1000.

Since Transport Canada must approve an air carrier's cabin attendant training program and ensure that each crew member is adequately trained to perform his or her duties, and since Transport Canada reviews an air carrier's cabin attendant manual to ensure that it includes all abnormal and emergency procedures, I see no reason why Transport Canada should not also approve, either as a separate document or as part of the FOM, an air carrier's cabin attendant manual.

In directing my attention to portions of Air Ontario's cabin attendant manual relevant to its F-28 operation, I have reviewed the entire contents of the document. The following is stated in the introduction to the FAM:

> 1.1 FOREWORD
>
> This manual has been written for use by, Flight Attendants, Pursers, and In-Flight Supervisors in their perspective roles. This manual is a valid piece of emergency equipment and must be regarded as such.
>
> This manual must be in the possession of each person while he/she operates a flight. An individual will not be considered 'Emergency Qualified' in the event that he/she does not have this manual in his/her possession when reporting for flight assignments. (See Section 2, Item 2.4, Page 6)
>
> 1.2 MANDATE OF THE MANUAL
>
> The mandate of this manual is to establish definite policies and procedures for rendering a uniformly superior service to passengers. Whenever possible, the standard procedures outlined herein will be followed without deviation. However, nothing can replace good judgement in providing passengers with the finest in service and hospitality. Unusual conditions will arise that can only be met by the use of your initiative and ingenuity. Having said this, you must always be alert **never to compromise safety.**
>
> Remember the impression you create in the minds of our passengers are the impressions they will carry with them – because to them, YOU ARE THE COMPANY, you are Air Ontario..
>
> The requirements of Air Transport are such that Company Procedures must be established and maintained to ensure safe and efficient operations.

> This publication is the property of the company and is on loan to company employees. This manual must be returned to the Company upon termination of employment within the 'In-Flight' department.
>
> Trainees, Flight Attendants, and In-Flight Supervisors are required to bring this manual to all recurrent training, type training, and refresher programs that the Company conducts, and to have, on their person, this Manual at all times while completing flight assignments.

I am impressed by the position presented in this introduction by Air Ontario regarding the role and responsibilities of flight attendants. Indeed, I find the Air Ontario FAM, like the introduction, to be thorough and comprehensive in its content.

Legislative Requirements

Imprecision in the language of the Air Navigation Orders is a significant problem, which is referred to in other chapters of this Report. Imprecise language necessitates the exercise of discretion by the individual regulator, which, in the extreme case, can render an air carrier vulnerable to the caprice of an air carrier inspector who is the sole arbiter of what is "satisfactory" or "proper." Alternatively, an inspector, without any further guidance, may be vulnerable to arguments from a persuasive air carrier.

All legislative instruments, including the Air Regulations of the ANOs, must serve to give effect to some government objective. In this case, the basic objective of government in its operational regulation of air carriers is, in my view, to ensure an acceptable level of safety in Canadian commercial aviation. To achieve this objective, the ANOs should provide a minimum acceptable standard in a clear and comprehensive manner. If this were the case, then the air carrier would have unambiguous notice of what is expected from it in its operation; and air carrier inspectors would have a tool that would permit them to insist upon a definite standard of operational practice. Instead, ANOs appear to be a collection of ad hoc, unconsolidated, and in some cases discretionary standards that do not provide readily available assistance to either the regulator or the air carrier. Stated simply, ANOs at times fall short of their purpose, which is to give effect to the government's objective of ensuring an acceptable standard of safety in air carriage.

Having reviewed Air Ontario's Flight Operations Manual and Flight Attendant Manual, the Fokker F-28 Flight Handbook, and the F-28 Aircraft operating manuals used by Air Ontario, I feel compelled to review particular portions of United States air carrier legislation dealing with manual requirements. I find that FAR Part 121 provides more

clearly than does ANO Series VII, No. 2, a statement of the requirement to be met by the air carrier and expected by the regulator.

For example, with respect to the issuance of an operating certificate, FAR subpart 121.59, subsection (a) states as follows:

> **121.59 Management personnel required.**
>
> (a) Each applicant for a certificate under this subpart must show that it has enough qualified management personnel to provide the *highest degree of safety* in its operations and that those personnel are employed on a full-time basis in the following or equivalent positions:
>
> (1) General manager.
> (2) Director of operations (who may be the general manager if qualified).
> (3) Director of maintenance.
> (4) Chief pilot.
> (5) Chief inspector.
>
> (b) Upon application by the supplemental air carrier or commercial operator the Administrator may approve different positions or numbers of positions than those listed in paragraph (a) of this section for a particular operation if the air carrier or commercial operator shows that it can perform the operation with the *highest degree of safety* under the direction of fewer or different categories of management personnel ...
>
> (Emphasis added)

The equivalent Canadian legislation, which is Part I ("Certification Requirements"), section 5, of ANO Series VII, No. 2, states as follows:

> 5. (1) An applicant for an operating certificate shall show that he has the qualified managerial personnel necessary to operate the proposed commercial air service and that such personnel are employed on a full time basis in the following or equivalent positions:
>
> (a) Managing Director;
> (b) Director of Flight Operations (or Operations Manager);
> (c) Director of Maintenance and Engineering (or Maintenance Manager);
> (d) Chief Pilot; and
> (e) Chief Inspector.
>
> (2) Where because of the nature of a commercial air service, positions other than those specified in subsection (1) would, *in the opinion of the Director*, be more appropriate, the Director may

(a) approve different positions or a different number of positions; and
(b) authorize the allocation of more than one position to one person.

6. (1) No person shall serve as a Director of Flight Operations (or Operations Manager) or as a Director of Maintenance and Engineering (or Maintenance Manager), unless his qualifications, background and experience are *satisfactory to the Director.*

(Emphasis added)

Although the provisions in sections 5 and 6 of Canadian ANO Series VII, No. 2, and the United States FAR subparts 121.59 (a) and (b) are similar in intent, what is noticeably different between the two is the test specified by the respective provisions for the determination of the qualifications and standards that must be met by each country's air carriers.

In determining the degree of information, guidance, and instruction in the FOM, section 33 of ANO Series VII, No. 2, stipulates that the requirements of the items set forth in Schedule B be presented "in sufficient detail to enable the operations personnel to perform their duties in a *proper manner*" (emphasis added).

The equivalent United States legislation, FAR subpart 121.135, states as follows:

(a) Each manual required by §121.133 [Preparation] must –
(1) Include instructions and information necessary to allow the personnel concerned to perform their duties and responsibilities with a *high degree of safety;*

(Emphasis added)

The use in the United States FARs of the words "highest degree of safety" and "high degree of safety" in my opinion is significant. These statements of the requirements expected of United States air carriers provide a benchmark for the regulator to review and audit an air carrier. These tests are, in my view, both understandable and meaningful to an air carrier industry. The requirements to meet the test "high or highest degree" of safety can be reasonably established by a regulator and met by air carriers, and are determinable in jurisprudence.

Although the equivalent Canadian legislation, section 33 of ANO Series VII, No. 2, employs the wording "in a proper manner" to determine the sufficiency of the contents of the FOM, it is my opinion that these words form an elusive test, leaving insufficient guidance to the regulator on how "proper manner" is to be interpreted. The use of this test, as does the term "satisfactory to the Director," also gives to those

who apply the law a discretion akin to a mandate to interpret government policy.

The existing tests ("satisfactory," and "in a proper manner") contained in the ANO Series VII, No. 2, are, in my opinion, inadequate. These tests leave the door open to allow the air carrier to negotiate or debate with Transport Canada what the carrier views to be satisfactory and what it considers to be in a proper manner. As well, these tests do not provide Transport Canada air carrier inspectors with certainty in standards that they can rely upon in reviewing documents such as the FOMs. Applying the test "high" or "highest degree of safety" is more meaningful and determinable and should provide greater benefit and certainty to both the air carrier and the regulator.

Findings

- On March 10, 1989, on board C-FONF, Captain Morwood carried a Piedmont F-28 Operations Manual and First Officer Mills carried a USAir Fokker F-28 Pilot's Handbook.

- At the time of the crash, Air Ontario did not have its own F-28 operations manual. The Piedmont and USAir F-28 manuals were being used by Air Ontario and its F-28 pilots in the air carrier's flight operations without the consent of Piedmont and USAir.

- There were some material differences between the two manuals.

- It was the understanding of Piedmont Airlines and USAir that their F-28 operations manuals were to be used only as training tools for the purposes of aircraft ground school and simulator training provided by Piedmont Airlines/USAir to Air Ontario pilots.

- No amendment service was requested by Air Ontario, and no revisions were provided by Piedmont and USAir for the respective F-28 operations manuals.

- The flight release used by the flight crew of C-FONF on March 10, 1989, did not meet the requirements of an operational flight plan as contemplated in Air Navigation Order (ANO) Series VII, No. 2.

- Air Ontario did not set out in its Flight Operations Manual (FOM) an example of, or the information necessary for, an operational flight plan for F-28 aircraft operations so as to demonstrate that procedures were in place to monitor and control the flight of C-FONF and that the

carrier had a plan for the safe conduct of the flights of C-FONF on March 10, 1989.

- No operational flight plan was made available to or used by the flight crew of C-FONF on March 10, 1989.

- Since Air Ontario did not provide the information necessary to flight operational personnel, including the flight crew, to monitor and control the flight of C-FONF, and since the FOM did not contain sufficient information to demonstrate that Air Ontario had a plan for the safe conduct of the flights of C-FONF of March 10, 1989, I find that Air Ontario failed to comply with the requirements of ANO Series VII, No. 2, sections 2 and 15, and Schedule B.

- It was contemplated and stipulated in the lease between Transport Aérien Transrégional and Air Ontario Inc. that C-FONF would be operated in accordance with the Fokker F-28 Flight Handbook and with an approved Air Ontario F-28 operations manual. At the time of the crash, Air Ontario had not completed drafting its own F-28 operations manual (AOM) for submission to Transport Canada.

- The Air Ontario F-28 Operations Manual (AOM) was not submitted to Transport Canada for approval until June 7, 1989.

- Air Ontario Inc. operated for approximately eight months, from June 1987 until February 1988, without an approved and updated FOM reflecting the operations of the merged air carrier Air Ontario Inc. During this period of time, Air Ontario did not have in place a comprehensive FOM reflecting the continued and current status of Air Ontario's operation.

- There was lack of sufficient information, advice, and direction in Air Ontario's FOM regarding aircraft ground de-icing and for operations from contaminated runways.

- Existing ANOs do not contain a requirement for the updating and amendment of FOMs or for approval of updates and amendments by Transport Canada.

- Although a copy of the FOM must be submitted to Transport Canada, ANO Series VII, No. 2, does not specify that the FOM must be approved by Transport Canada.

- Both the Piedmont F-28 Operations Manual and the USAir Fokker F-28 Pilot's Handbook are comprehensive and detailed. No fault is found with these individual manuals, either in form or in content. However, because of the differences between them, only one manual should have been designated for use.

- Air Ontario did not designate one specific F-28 operating manual to be used by the F-28 pilots. This situation created uncertainty in the application of aircraft operating limitations and procedures used by Air Ontario F-28 pilots operating the aircraft.

- Transport Canada failed to review properly and adequately either the Piedmont F-28 Operations Manual or the USAir F-28 Pilot's Handbook, failed to identify the fact that the two different manuals were being used by the pilots, and failed to take steps to stop this practice.

- ANO Series VII, No. 2, is silent on the issue of air carrier company–produced AOMs or aircraft standard operating procedures manuals (SOPs). There is no regulatory requirement that air carriers produce AOMs specific to each aircraft type, and, further, there is no legislative provision that allows Transport Canada to review and approve AOMs prior to an aircraft type being operated by an air carrier in revenue service.

- There is no legislative requirement for an air carrier to produce a cabin attendant manual, and, further, there is no commensurate legislative requirement that Transport Canada review and approve such a manual.

- The existing tests contained and used in ANO Series VII, No. 2, sections 5, 6, and 33, to determine the qualifications of operational management personnel and to determine the sufficiency of the contents of an air carrier's FOM are discretionary and open to interpretation. They do not provide to Transport Canada certainty with which to apply a standard and an adequate standard to be achieved by an air carrier.

RECOMMENDATIONS

It is recommended:

MCR 61 That Transport Canada approve a complete copy of the air carrier's operations manual prior to the granting of an operating certificate or an amendment to an operating certificate, and that it approve all amendments and insertions made to that manual.

MCR 62 That Transport Canada proffer for enactment an amendment to Air Navigation Order Series VII, No. 2, requiring Transport Canada to approve one aircraft operating manual for each type of aircraft operated by the air carrier. It is further recommended that such approval be required prior to the granting of an operating certificate or an amendment to an operating certificate by Transport Canada to the air carrier to allow the commercial use of that aircraft type by the air carrier.

MCR 63 That Transport Canada proffer for enactment an amendment to Air Navigation Order Series VII, No. 2, requiring each air carrier to provide to Transport Canada an air carrier cabin attendant manual for review and approval, either as part of the flight operations manual or as a separate manual.

MCR 64 That Transport Canada proffer for enactment an amendment to Air Navigation Order Series VII, No. 2, deleting the existing tests contained in sections 5, 6, and 33 and replacing them with tests containing the wording "high degree of safety" and "highest degree of safety." Such wording is similar to wording contained in equivalent United States Federal Aviation Regulation legislation dealing with standards and procedures for air carriers using large aircraft.

MCR 65 That Transport Canada proffer for enactment legislation requiring an air carrier to submit its operations manual as defined in Air Navigation Order Series VII, No. 2, to Transport Canada and have it approved prior to the issuance by Transport Canada of an operating certificate or any amendment thereto.

MCR 66 That Transport Canada ensure that air carriers follow and comply with those sections of the operations manuals required by Air Navigation Order Series VII, No. 2.

20 THE F-28 PROGRAM: FLIGHT OPERATIONS TRAINING

Proper operations training is as important as flight operations manuals (chapter 19) in the standardization of flight operations procedures. This chapter examines the Air Ontario flight operations training programs as they applied to F-28 operations. Three areas of training are looked at in particular: flight crew training, flight (cabin) attendant training, and ground handler training. Air Ontario dispatch training is discussed in chapter 23, Operational Control.

Terminology and Regulatory Requirements

Part IV of Air Navigation Order (ANO) Series VII, No. 2, is entitled "Crew Member Requirements." Section 2 thereof defines "crew member" as "a person assigned to duty in an aeroplane during flight time." A cabin attendant is defined as "a crew member, other than a flight crew member, assigned to duty in a passenger-carrying aeroplane during flight time." The term flight crew is defined to mean "a pilot, flight engineer or flight navigator assigned to duty in an aeroplane during flight time."

ANO Series VII, No. 2, Parts IV and V, detail crew member requirements and crew member training and qualifications that must be met by an air carrier. ANO Series VII, No. 2, Part V, details the training requirements for flight crew members and cabin attendants for each aircraft type. The general requirements set out in sections 42, 43, and 44 under the heading "Crew Member Training and Qualifications" are as follows:

> *General*
>
> 42. (1) An air carrier shall establish and maintain a ground and flight training program approved by the Director to ensure that each crew member is adequately trained to perform his assigned duties, including those relating to abnormal and emergency procedures, and knows the relationship of those duties with respect to those of other crew members.

(2) An air carrier shall provide adequate ground and flight training facilities and qualified instructors for the training required by this Part.

(3) An air carrier shall provide ground and flight training for a flight crew member with respect to each type of aeroplane on which that member serves including proper crew member co-ordination and training in all types of situations resulting from powerplant, airframe, or system malfunction or from abnormality or fire.

(4) An air carrier shall maintain a record of the initial and recurrent training and checks provided for each crew member and that record shall be certified as to the proficiency of the crew member at the completion of each training phase or check by the instructor responsible for that particular phase of training or check.

(5) An air carrier shall submit to the Director for approval, a detailed training syllabus for each crew member classification, which syllabus shall consist of

(a) programmed ground and flight training to meet the requirements of section 45 to 52 and Schedule C, as applicable, for each type of aeroplane to be operated; and

(b) a sample of the record required to be maintained pursuant to subsection (4).

43. Notwithstanding section 42, an air carrier may be granted approval to have all or a portion of the required training provided by a training organization other than his own but shall, notwithstanding any arrangement, be responsible for the proficiency of his crew members.

44. (1) No air carrier shall use a person as a crew member unless that person has satisfactorily completed

(a) the initial training phase of the air carrier's approved training program; and

(b) the appropriate recurrent training phase and any required checks at least once every 12 months following the initial training phase.

(2) Where any recurrent training phase is completed or any required check is taken either during the calendar month preceding or following the month in which it became due, it shall be deemed to have been completed or taken in the month in which it became due.

ANO Series VII, No. 2, section 42(5), requires an air carrier to submit a detailed training syllabus for each crew member classification to Transport Canada for its approval. Section 44(1) prohibits an air carrier from using a person as a crew member unless that person has satisfactorily completed the initial training phase of the air carrier's approved training program.

Sections 45 through 52 of ANO Series VII, No. 2, detail the various training requirements under the following subheadings: Emergency

Procedures Training, Pilot Ground Training, Pilot Flight Training, Flight Engineer Training, Flight Navigator Training, Cabin Attendant Training, Line Indoctrination, and Recurrent Training. The training requirements for both the flight crew and the cabin crew are set out in considerable detail. While the qualification requirements for pilots, flight navigators, flight engineers, chief pilots, and chief inspectors are also outlined, there is no provision in the ANOs dealing with qualifications for cabin attendants.

Schedule C of ANO Series VII, No. 2, details the requirements to be met by flight crew members in pilot proficiency check rides. ANO Series VII, No. 2, Schedule D, requires air carriers to obtain Transport Canada approval to use a flight simulator for pilot flight training. Schedule D also stipulates simulator features necessary for Transport Canada approval.

ANO Series VII, No. 2, requires air carriers to carry out aircraft type-specific ground school training for flight crew, followed by written examinations and flight training. It also requires flight crew members to demonstrate knowledge and proficiency in all areas of flight handling. Thereafter, pilots must receive pilot proficiency checks from Transport Canada examiners or company check pilots (CCP) who have authority delegated from Transport Canada to carry out such checks. During pilot proficiency checks, the pilots must demonstrate proficiency in preflight preparedness, takeoffs, landings, normal flight, abnormal procedures, emergency procedures, and instrument procedures. Detailed pilot proficiency check requirements are contained in ANO Series VII, No. 2, Schedule C. Air carriers are required to keep accurate records of all ground school and flight training, including pilot proficiency checks and instrument rating renewals of flight crew members.

Once a pilot has successfully completed an initial pilot proficiency check on an aircraft type, a Transport Canada inspector will endorse his or her licence for the aircraft type. This endorsement authorizes the pilot to fly the aircraft type in revenue operations under the supervision of a pilot-in-command designated by Transport Canada to carry out line indoctrination flight training. Flight crew members must perform their duties in accordance with an air carrier's line indoctrination program and in conformance with ANO Series VII, No. 2, section 51, Line Indoctrination. Normally, a flight crew member must carry out line indoctrination training until the air carrier is satisfied that the trainee is competent to operate in the designated capacity; for example, a pilot-in-command or second in command of an aircraft. On completion of line indoctrination training, a flight crew member receives a line check from an air carrier check pilot, and, if successful, training is considered to be complete and the flight crew member is assigned normal flight crew duties.

Similarly, cabin or flight attendants must receive ground and flight training sufficient to satisfy the requirements of ANO Series VII, No. 2, sections 42, 43, and 44, General, and section 50, Cabin Attendant Training. This training, provided by the air carrier, must be sufficient to ensure that cabin attendants are competent to perform the duties and functions assigned to them "in the interest of the safety of passengers." Cabin attendants are required to attend a ground school course, followed by a written examination, and to receive line indoctrination until the air carrier is satisfied they are competent to perform the duties and functions contemplated in ANO Series VII, No. 2, and as required by Transport Canada.

Finally, an air carrier is required by ANO Series VII, No. 2, section 51, Recurrent Training, to have all crew members carry out recurrent training and required checks at least once every twelve months.

Flight Crew Training

On January 12, 1988, Air Ontario made application to Transport Canada to have the Piedmont Airlines F-28 ground, simulator, and flight training program approved for use by Air Ontario until Air Ontario could submit to Transport Canada its own Fokker F-28 training syllabus. At that time, Captain Robert Nyman, director of flight operations, advised Transport Canada that two pilot candidates were attending Piedmont's ground school course and that Air Ontario expected to acquire two F-28 aircraft in the near future and to train a total of 16 pilots for its F-28 program.

On January 28, 1988, Transport Canada's Large Air Carrier Inspection Branch in Ottawa approved Piedmont Airlines' F-28 syllabus, simulator, and instructors as an interim measure to allow Air Ontario pilots to train for the F-28 aircraft. The Ontario Region branch of Transport Canada advised Air Ontario of such approval on February 15, 1988.

F-28 Ground School Training

All of the pilots who testified before this Commission about their Piedmont/USAir training considered the ground school training to have been excellent. Mr Randy Pitcher, Ontario Region's civil aviation inspector who took the Piedmont F-28 ground school course in July 1988, testified that the course was a total of 80 hours and was "very comprehensive." Operational procedures, flight characteristics, performance capabilities, slush, ice, and rain protection, and many other areas of the F-28 aircraft operation were covered "in detail" (Transcript, vol. 127, p. 22).

The testimony of Air Ontario pilots regarding certain aspects of the F-28 ground school course was of significance to this Inquiry. Of particular relevance was the handling of an F-28 aircraft in weather conditions conducive to the formation of ice on the aircraft or where there is contamination on runway surfaces.

Aircraft Contamination

Captain William Wilcox received the Piedmont Airlines ground school course in March 1988 with five other Air Ontario F-28 pilots including Captain Bradley Somers and Captain Robert Perkins, who also testified before me. Captain Wilcox testified that the pilots being instructed were told a number of times that the F-28 aircraft could not be flown with any contamination on its wings. He testified that one of the ground school instructors, who was previously an F-28 pilot with Empire Airlines, a predecessor airline of Piedmont, reinforced the proscription by way of stories of other pilots who had experiences with contamination: "I recall him telling us of two situations where their airplanes had taken off with some snow on the wings and both of them resulted in near crashes but both of them survived, so to speak. In other words, went airborne, but very scary. You know, one wing stalling, the other remaining flying" (Transcript, vol. 93, p. 112). Captain Wilcox stated that Piedmont Airlines clearly emphasized the need for a "clean wing."

According to Captain Keith Fox, the Piedmont instructors described the characteristics and sensitivity of the F-28 aircraft wing to contamination as follows: "Yes, we were advised that it was very important, critical, that you ... [depart] with a clean wing if you are in icy conditions" (Transcript, vol. 51, p. 19). As part of his introductory notes to the course on December 5, 1988, Captain Fox wrote the following statement:

> * Wing and horizontal stab leading edges – "clean" wing critical
> – refer to ice and rain protection
> 1-311 Piedmont Manual.[1]

Captain Fox testified that ice and any contamination on the F-28, with its swept wing, was "more critical than any other straight wing aircraft" he had flown (Transcript, vol. 51, p. 21).

First Officer Monty Allan testified that he was told during his course that the F-28 wing had "zero tolerance" to contamination:

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[1] Exhibit 382, three-ring binder containing Captain Fox's handwritten notes and printed handout material supplied by Piedmont Airlines Contract Training Services Department

A. ... I couldn't remember whether it was specifically mentioned at the classroom ground school in Greensboro or whether it was by my simulator instructor, but I do recall the mention being, as Piedmont had operational experience, they flew up in the northeast, that you did not take off with any ice on the wings, zero.

Like, it wasn't a matter of measuring what was an acceptable amount and what wasn't.

Q. No contamination?

A. It was imparted to me that it was zero, yes.

(Transcript, vol. 91, pp. 42–43)

First Officer Allan also testified that it was generally agreed by Air Ontario F-28 pilots that there was a common understanding of "zero tolerance" in relation to wing contamination.

Captain Erik Hansen, who completed both his ground school and the simulator flight training with Captain George Morwood, commented that the ground school instructors emphasized that the wings of the F-28 aircraft should not be contaminated either for takeoff or during flight. Captain Hansen recalled Captain Morwood's participation in discussions with Piedmont instructors regarding aircraft wing contamination.

I view Captain Hansen's testimony to be significant because it demonstrates the emphasis placed by Piedmont Airlines on the need to operate the F-28 with clean lifting surfaces, and because it provides clear evidence of the advice and instruction provided by Piedmont Airlines to Captain Morwood. Captain Hansen gave the following testimony relating to Captain Morwood's participation in ground school discussions:

A. Well, it was stressed in ground school. See, I also had a recurring ground school down in, I believe it was Syracuse, same four guys. I'm talking about George Morwood, Reichenbacher, Maybury and myself went to Syracuse for recurring ground school, and that would have been November, October, November of '88.

And now we're getting into the winter operations as such, and again they were stressed with de-icing that this had a clean wing, wouldn't tolerate any contaminants of any kind, so preheat and when you are flying, if you are anticipating that you are going to be encountering icing conditions, turn on your heater or ... heat up the aircraft before entering the ice. Don't use it as a de-icing system, more as an anti-ice system.

Q. Let's digress for one moment ...

George Morwood was with you in Tampa and he was also with you on the recurrent in October or November of '88?

A. That's correct.

Q. Now, in Tampa, could you tell the Commissioner initially if he was in the classroom with you throughout the entire period of time?
A. Yeah, every, every day. Every day, he never missed a class.
Q. So whatever you heard, he heard?
A. Absolutely.
Q. ... Now, could you tell the Commissioner what you heard related to you in relation to the sensitivity of the wing and contamination of the F-28?
A. Well, just that it was ... a clean wing and it didn't tolerate any contaminants as such. And it was of the utmost importance that the aircraft was kept clean and you ensure that it was clean prior to departure.
Q. Was that stressed?
A. It was stressed so that because we, meaning the four of us, like there was 20 some odd other people in the classroom with all kinds of jet experience and also people who flew in the southern States who don't really get into the weather that we did.

But the four of us coming out of Convairs and the Convair will take ... some ice and some contaminants prior to departure before ... you're really starting to get upset about it.

We were very interested in finding out ... when he said clean, what do you mean clean. When he just said super clean, it won't take anything.
Q. Would you ask questions during these sessions, sir?
A. Oh, yes, we did.
Q. And you have indicated to us that George certainly had a propensity to ask questions?
A. To a point where it became annoying, yes, really.
Q. Would both of you or maybe all four of you have directed questions specifically in this area which was peculiar to you; namely, the winter flying?
A. Well ... George would be bringing these things up because this was George's way of getting the floor.

He would say, well, we are flying up and down the Lakes and the weather gets really bad up there, and he would relate a couple of stories in his past experience, whatever they were, flying in bad weather, and he was trying to relate that and put that into the F-28 operation and that kind of stories ... he had a couple of those.

And the instructor just said, look, the aircraft has to be clean and that's it and he won't take any nonsense. You are not flying a Convair now. This is a jet, it's got a clean wing and swept back and all these other good things, so don't.

And George also had a couple of stories of his own to relate because he flew the G-2[2] as well for Steve Roman.

Q. And what stories would he have related in that particular –

A. Well, for the G-2, he said it was so nice to fly because could go in and out of it so fast so he never really had any bad experience with icing in the G-2 and – but then he was also reminded that he wasn't flying a G-2, this was an F-28, and then to keep the aircraft clean.

Q. Was it your impression, sir, and I know that it's hard to put yourself in the position of someone else, was it your impression that you and the other three gentlemen with you including George Morwood understood what was being conveyed by the Piedmont instructors?

A. Yes, there's no doubt.

Q. No doubt in your mind on that?

A. None.

(Transcript, vol. 94, pp. 70–74)

Captain Hansen testified that because his fellow Air Ontario classmates had been flying Convair 580 turboprop aircraft prior to converting to the F-28 aircraft, and because this turboprop aircraft was able, in their view, to operate safely with a certain amount of contamination on its wings, Captain Morwood in particular was interested in discussing with the Piedmont ground school instructors the F-28's capabilities to carry contamination on its wings. Captain Hansen described the dialogue with the Piedmont ground school instructors:

A. ... At no time did they minimize the seriousness of ice or of any kind of contamination. They did not.

But when the four of us sitting in the classroom there and kept hammering on these questions about, well, how little is little ice, will it take a thin layer of frost, perhaps, how about a wet wing, and these questions, they kept on and on and on from the four of us, like I say, primarily from George, if memory serves me right.

The rest of the classmates that we had were getting perhaps a little annoyed, because to them, you know, why do you keep

[2] Captain Morwood accumulated approximately 500 flight hours on the Grumman Gulfstream G-2 executive turbojet. This aircraft has a profile similar to that of an F-28, and some models are also equipped with the same engine type. The Grumman Gulfstream G-2 is somewhat lighter and faster than the F-28, but has operational and handling characteristics generally similar to the F-28 aircraft. Like the F-28 aircraft, the G-2 has a "hard wing" with no leading-edge high-lift devices, a "T"-type configured horizontal and vertical stabilizer, and its two engines are similarly mounted at the rear of the aircraft fuselage.

hammering on this, you know. The book says keep it clean, no contaminants, and that's the end of it.

And maybe it was because that flying the Convairs, which we all did prior to this, we have been able to get away with a certain amount of contaminant on these wings and the aircraft performs well. But this was a different airplane, different wing. This was a jet, not a propeller-driven airplane, and on and on it goes.

Q. And at the end of this whole process, are you confident with George Morwood came away with that feeling, that no matter what, this wing had to be absolutely clean?

A. He had to.

(Transcript, vol. 94, pp. 148–49)

The view expressed by Captain Hansen that turboprop aircraft can handle a certain amount of contaminant on their wings is not unique. Mr Pitcher described a similar opinion, as did expert witnesses from both Fokker Aircraft and from the National Research Council Canada. The aerodynamic reasons why a turboprop aircraft might be able, in some circumstances, to carry a certain amount of contaminant are fully discussed and described in chapter 12, Aircraft Performance and Flight Dynamics.

Based on the testimony of these pilots and of others who appeared before me, and from a review of Captain Fox's handwritten notes and Piedmont's handouts provided to him, I conclude that the operation of the F-28 aircraft with contaminated wings was dealt with thoroughly at the ground school training provided by Piedmont Airlines, at least for Air Ontario pilots who took the course. Testimony of many Air Ontario pilots, including Captains Wilcox, Hansen, and Fox, was candid and revealed a cautious professional view regarding the prohibition of operating an aircraft, especially at takeoff, with contaminated lifting surfaces. The evidence leads me to conclude that all Air Ontario pilots who took the Piedmont ground school course received thorough instruction and caution that it was of utmost importance that the F-28 be operated at all times with a clean, uncontaminated wing. The evidence also leads me to conclude that Captain Morwood considered, as did other pilots, that propeller-driven aircraft, such as the Convair 580, would perform adequately with some contaminant on the aircraft wings. However, it is clear from the testimony of Captain Hansen that Captain Morwood, as one of the pilots who took the Piedmont ground school course, must also have been aware of the prohibition of operating the F-28 aircraft with any amount of contamination on the wings.

Cold-Soaking Phenomenon

Cold soaking is a term used to describe a phenomenon that sometimes occurs as a result of an aircraft operating at high altitudes. An aircraft, while flying at altitude, where the temperature is usually much colder than on the ground, will gradually be cooled to near ambient temperature. Fuel in wing tanks next to the outer skin will also be cooled to ambient temperature, although at a different rate, along with the outer aircraft wing skin surfaces. When an aircraft has landed with cold-soaked wings and fuel, frost or ice may form on the upper and/or the lower wing surfaces next to the fuel tanks, depending on the ambient temperature and the relative humidity. As discussed in detail in chapter 12, one of the relevant aspects of cold soaking concerns the way the cold-soaked wing conducts heat away from precipitation, such as wet snow and rain resting on the wing, and causes the precipitation to freeze. This freezing process was described by Dr Myron Oleskiw of the National Research Council Canada as follows:

> A. As the freezing occurs from the bottom working its way upwards because of the conduction into the fuel tank, the bottom portion would become entirely solid, still with air trapped in it, but there – the water part, of course, would be frozen. Further up, there would be this ice structure but with the water still there.
>
> (Transcript, vol. 68, p. 218)

The fact that precipitation on the upper surface of the wing freezes from the wing surface upwards is particularly insidious. It is possible for slush, which is solidly frozen to the wing, to appear to be largely wet and unfrozen. The potential for human misperception in this scenario is obvious.

In the course of this Inquiry, pilots were asked about their knowledge of cold soaking. Captain Fox testified that he was aware of the term "cold soaking," and that wing cooling at high altitude was brought up during the course. He said that the cold-soaking phenomenon occurred quite often with the HS-748 aircraft, and explained it as follows:

> A. Hawker Siddeley 748, would be high, it would be cold up north, warmer summertime in Pickle [Pickle Lake]. I would come down quickly and land and it would be warm on ground but you get out and there is a frost on the bottom and top of the wings, particularly it stays quite a bit longer on the bottom of the wing and it is from the fuel in the wings is still very cold, got cold soaked up high altitude and it hasn't warmed up yet.
> Q. When you say high altitude, what sort of altitudes would you be flying at with the 748?
> A. Twenty-four, 25,000 feet.

Q. So you were familiar with this concept of cooling of the wing by – and the fuel cooling the wing and then coming down to a lower altitude and having frost or some sort of precipitation show on the wings?
A. Yes.

(Transcript, vol. 51, p. 24)

He testified that this matter was also touched on briefly during the Piedmont ground school course and that a warning on cold soaking was in the Piedmont Airlines/USAir F-28 operations manuals.

A number of other pilots who testified indicated that they were aware of the concept of cold soaking. Captain Wilcox, one of the most experienced F-28 pilots with Air Ontario, provided general observations and his understanding of cold soaking:

A. Other ... than being aware of cold soaking affecting any airplane, this airplane in particular, although not much different than a Convair, we are basically operating at below 25,000 feet, descending into, you know, your warmer, warm, moist atmosphere, and you are always cognizant or looking for it to be occurring underneath the wing.
Q. That's the point, sir. You were aware of the concept of cold soaking?
A. Yes.
Q. And when you used your anti-icing system, you paid particular attention to the wing after that?
A. Correct. You always want to walk around, check that, you know, there's not a heavy frost layer, whatever.

(Transcript, vol. 93, pp. 121–22)

The pilots who testified before me demonstrated various levels of knowledge of cold soaking as it applied to wing contamination. One Air Ontario pilot had never heard of it prior to the crash. However, most Air Ontario pilots and other pilots who testified had a general understanding of the phenomenon. A number of them related personal experiences with cold-soaked wings causing contamination to freeze and adhere to the wing surfaces.

It should be noted that the cold-soaking phenomenon depends on the juxtaposition of various factors, including the time at altitude, the temperature at altitude, the temperature and dew point on the surface, and the amount of fuel in the wing tanks.

Captain Joseph Deluce, F-28 chief pilot, had a general understanding of the cold-soaking phenomenon. He also stated he was aware of the references and cautions contained in the manuals. He agreed that "cold soaking is critical with all aircraft" (Transcript, vol. 112, p. 28). Captain Deluce testified that he did not communicate his views on cold soaking

to his F-28 pilots because, in his opinion, the issues were properly addressed in the aircraft flight and operating manuals and during ground school training. Captain Deluce further stated that cold soaking is something that pilots learn about through operational experience.

Captain Deluce's statement that cold soaking is something that pilots learn through operational experience appears to represent the current state of affairs in the aviation industry. Except for Captain Fox, no one testified that the cold-soaking phenomenon as it affects wing contamination was dealt with either in ground school or in flight training. While manufacturers and air carriers may produce circulars and publications dealing with this matter for dissemination within their own pilot groups, neither the Fokker F-28 Flight Handbook nor the Piedmont/USAir operations manuals cover, in a systematic manner, the issue of cold soaking and the potential for moisture to freeze on upper-wing surfaces. Similarly, the Air Ontario and the Air Canada flight operations manuals do not address this phenomenon either specifically or in detail. The A.I.P. Canada: Aeronautical Information Publication, which is circulated to all Canadian licensed pilots and which, at the time of the crash, contained a caution regarding takeoff with contamination on the lifting surfaces, also fails to cover the matter of cold soaking and its potential to cause contamination to adhere to wings.

It is possible that Captain Morwood and First Officer Mills, despite their collective flying experience of more than 30,000 hours, were not sufficiently aware of the insidious nature of cold soaking. Captain Morwood reported an incident to Air Ontario Flight Operations that occurred in January 1983 in Cleveland, Ohio, when he was flying Convair 580s. He stated as follows:

> Flight was 40 min late leaving the gate due to a combination of events. There was moderate snow in Cleveland temp -5° C, however, the aircraft had 7500 lbs of tanker fuel remaining that must have been relatively warm. I went out to check the wings at 10.30 and I was surprised to find the snow was melting and sticking on the wings in the area of the fuel tanks. I immediately requested a spray, then the fun began. Wright had just taken their spare over to be fuelled, then a problem occurred with fuel truck. They finally arrived at the aircraft around 1130.
>
> (Air Ontario Pilot Incident Report, January 19, 1983)

Captain Morwood in his incident report identified a heat transfer phenomenon that caused moisture to adhere to the upper-wing surface adjacent to the fuel tanks. This report shows that Captain Morwood had some exposure to a form of heat transfer, similar to cold soaking, that caused contamination to adhere to the upper surface of an aircraft wing. I can reasonably assume that First Officer Mills, who like Captain Fox

had previously flown HS-748s and other aircraft in northern Canada, must also have had a fundamental understanding of the cold-soaking phenomenon.

Based upon the evidence of the pilots who testified before this Commission, I find it likely that both Captain George Morwood and First Officer Keith Mills would have had some knowledge, based on their operational flying experience, of the cold-soaking phenomenon. As discussed in chapter 12, Aircraft Performance and Flight Dynamics, ample warnings and cautions were present in the Fokker F-28 Flight Handbook and in aircraft operations manuals used by Air Ontario regarding the danger of taking off with an aircraft with contaminants on the lifting surfaces. However, a systematic and comprehensive discussion of the cold-soaking phenomenon does not appear in these manuals. Comprehensive research such as that conducted by Dr Oleskiw should be used to prepare specific information on the subject. Such information should be inserted in the air carriers' flight manuals and in government publications such as the A.I.P., in order to make all pilots and aviation operational personnel fully aware of the various factors that may cause contamination to adhere to lifting surfaces. A clear warning should be made by air carriers and by Transport Canada that the only way pilots can be certain that lifting surfaces will be clear of contamination prior to takeoff is through strict adherence to a "clean wing" policy.

Runway Contamination

As C-FONF made its last takeoff in Dryden on March 10, 1989, the runway was contaminated with slush on at least the east half of its length and was wet on the remainder. It was therefore of interest to this Commission to know what instruction had been given by Piedmont Airlines/USAir, and what direction was provided by Air Ontario to its pilots, regarding aircraft performance limitations with respect to contaminated runways.

Captain Fox testified that the Piedmont instructors took the students through the performance charts in the Piedmont/USAir F-28 operations manuals, as well as those in the Fokker F-28 Flight Handbook pertaining to contaminated runways. However, the testimony indicates that instruction regarding the Fokker F-28 Flight Handbook was brief. Although the instructors may have demonstrated to students how to use the Fokker F-28 Flight Handbook slush-correction charts, Piedmont Airlines/USAir did not use the Fokker charts for their own operational use.

Captain Fox testified that during the time he was flying Air Ontario's F-28 aircraft, he did not encounter a runway contamination situation where he would have been required to use performance and weight-reduction calculations (Transcript, vol. 51, pp. 28–29). Similarly, although

Captain Hansen did not have an occasion to take off from a contamination-covered runway with the F-28, he testified that he was familiar with both the slush-correction chart contained in the Piedmont Airlines F-28 Operations Manual and the correction chart and graph contained in the Fokker F-28 Flight Handbook.

The runway-correction chart contained in both the Piedmont and USAir F-28 operations manuals entitled "Take-off in Standing Water, Slush or Snow," and dealt with in chapter 12, provides guidance to F-28 flight crews who find themselves required to take the aircraft off from a runway covered with specified amounts of contamination.[3] These charts are considerably more restrictive than the correction chart contained in the Fokker F-28 Flight Handbook. However, the Piedmont/USAir charts are simple to use, and the reduced aircraft weight can be determined quickly.

A number of pilots were asked which slush-correction chart should, in their opinion, have been used by Air Ontario pilots in the operation of the F-28 aircraft: the chart contained in the Piedmont/USAir F-28 operations manuals or the chart and graph contained in the Fokker F-28 Flight Handbook. Captain Hansen testified that he felt bound to use the Piedmont F-28 manual because, in his words, "we were told by Transport Canada in our training that that was our Bible until we had one [an Air Ontario F-28 operating manual] approved of our own." He said that if the more restrictive Piedmont aircraft weight-penalty parameters were used, he would be "on safe ground" and would feel comfortable that he had adequate aircraft performance capability during takeoff in runway contamination (Transcript, vol. 94, p. 150). He further stated that a pilot who was looking for "a few extra pounds in order to get the aircraft off the ground" might choose to use the graph contained in the Fokker F-28 Flight Handbook.

As discussed in chapter 12, Captain Hansen's view was indicative of the position taken by most of the pilots who testified before me. This view was not, however, the view of Captain Perkins, a senior Air Ontario F-28 check pilot authorized for line indoctrination training. Captain Perkins, who was also responsible for assisting Captain Joseph Deluce in drafting Air Ontario's F-28 operations manual, was of the view that the Piedmont/USAir slush-correction chart was "fairly restrictive" and, since it was not FAA approved, he considered it to be for guidance only.

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[3] Exhibit 307, Piedmont F-28 Operations Manual, Normal Operation Mark 1000 Takeoff in Standing Water, Slush or Snow, p. 4-1-42; Exhibit 329, USAir F-28 Pilot's Handbook, Planning & Performance, Take-off Information, Take-off in Standing Water, Slush or Snow, p. 4-1-42.

During Captain Perkins's testimony it became evident that he was under the mistaken impression that the complicated Fokker charts for takeoff from slush-covered runways guaranteed a balanced field.[4] In practical terms, Captain Perkins felt that by using these charts he could be assured that, in the event of engine failure during takeoff roll, he would be able to stop on the runway-clearway, or, alternatively, would be able to continue to a successful takeoff with one engine inoperable (Transcript, vol. 44, pp. 14–17). Mr Pitcher, among others, testified that on this important point Captain Perkins was misinformed:

> Q. ... The problem is, if you have got a slush covered runway, there's no way, from these charts, to guarantee that you have got a balanced field; correct?
> A. Absolutely.
> ...
> Q. ... So it's very clear to you as an inspector, a Transport Canada inspector, that Captain Perkins was wrong when he said that the Fokker charts concerning takeoff from contaminated runways guaranteed a balanced field?
> A. Yes, it's surprising.
> Q. ... And – well, let's take it one step at a time. Is it clear to you that he was wrong?
> A. May I say misinformed?
> Q. All right. That's fine. It's clear to you that he was misinformed; is that right?
> A. Yes.
> Q. And does it surprise you that someone who had been granted check pilot authority could be that misinformed?
> A. It does, yes.
>
> (Transcript, vol. 128, pp. 122–23)

It is also evident from Captain Perkins's evidence that assuring a balanced field requirement where the runway is covered in slush was, to his mind, a paramount consideration. On this point he testified as follows:

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[4] Balanced field length: In general terms, a balanced field length takeoff occurs when the distance required to accelerate an aircraft to decision speed (V_1), lose the critical engine, and continue the takeoff using normal pilot techniques, climbing the aircraft to a screen height of 35 feet, is equal to the distance required to accelerate the aircraft to decision speed (V1), lose the critical engine, and stop the aircraft on the runway. The first distance deals with accelerate-go and the second distance deals with accelerate-stop. These two criteria are discussed in detail in chapter 12, Performance and Flight Dynamics.

Q. ... And even though the runway is slushy, you still as a pilot, a safety-conscious pilot, want – are you still thinking about accelerate stop and accelerate go even though the runway is slushy?
A. Certainly.
Q. ... You want those options available even though the runway is slushy, is that correct?
A. Yes.
...
Q. ... but Dryden, there was only 6000 feet of runway, and ... you'd be looking more closely at whether or not the runway length was a limiting factor in takeoff with slushy conditions, would you not?
A. I can't really say you would look more closely. Obviously it would be a paramount consideration. It would also be a consideration at Toronto, though.
Q. ... out of an abundance of caution in Toronto, you would assure that you could accelerate stop even though it's fairly obvious that you could, is that what you're saying?
A. Yes.
Q. ... but in Dryden, it becomes more of a paramount consideration, to use your word, is that right?
A. That's correct.

(Transcript, vol. 44, pp. 8–10)

It should be pointed out that the observations expressed above do not reflect the complexity of the balanced field length issue.

Since it is evident that Captain Perkins felt it important to be assured of a balanced field, and since he mistakenly believed that the Fokker chart for takeoff from slush-covered runways assured a pilot of a balanced field, the foundation for his reasoning that it was acceptable for Air Ontario pilots to refer to the Fokker slush-correction charts is seriously undermined. Further, Captain Perkins's view that pilots were not bound to follow the easy reference charts contained in the Piedmont/USAir manuals is weakened by the impracticality of the only other alternative, namely, the use of the complicated Fokker charts.

Captain Gert Andersson, a senior captain with the Swedish air carrier Linjeflyg who had more than 5000 flight hours on Fokker F-28s, testified as follows concerning slush-correction charts:

Q. ... And so it's your evidence that that [Fokker] chart, really, is only properly used by the performance people in their well-lit office when they're trying to come up with an easy reference chart for the pilots to use; is that right?

A. That is my opinion that it should be used only by experienced performance people, and they should make a simpler chart for use in the cockpit.

(Transcript, vol. 83, p. 187)

Captain Perkins conceded that in the operational environment, the use of the Fokker chart for takeoff from slush-covered runways was not desirable:

Q. ... How long would it take to use one of these complicated graphs in the Fokker manual to come up with a precise answer to a very specific scenario?
A. It depends on the scenario that you're looking for. The one in –
Q. Well, let's deal with takeoff in slush, then.
A. Okay, the one scenario we had presented yesterday, yeah, I would estimate 30 to 45 minutes.
Q. That's not the kind of procedure you would want to do in Dryden while you're faced with misconnections in Winnipeg and leaving an engine running burning up fuel on the ground?
A. Obviously not.
Q. Thank you. For that kind of scenario, what would clearly be more preferable would be a quick reference chart; is that right?
A. Yes, it would.
Q. Such as the one in the Piedmont manual?
A. Such as, yes.

(Transcript, vol. 44, pp. 89–90)

From the evidence before me, I am unable to give much weight to Captain Perkins's assertion that Air Ontario pilots were not expected to be bound by the more restrictive charts in the Piedmont/USAir operations manuals.

The draft Air Ontario F-28 Operations Manual forwarded to Transport Canada did not include a quick reference chart similar to the Piedmont and USAir slush-correction chart. Instead, it contained a statement referring Air Ontario pilots to the Fokker F-28 Flight Handbook chart and graph.

None of the Air Ontario pilots who testified had had an occasion to effect a takeoff of the F-28 aircraft with contamination on the runway. Accordingly, none of them could provide evidence as to what graph he or she had used. Most of the pilots, on the assumption that the Piedmont F-28 Operations Manual was the one to use until they were presented with an Air Ontario operating manual, testified that they would use the more restrictive and conservative weight limitations provided in their Piedmont or USAir operations manuals.

Based on their training, Captain George Morwood and First Officer Keith Mills should have been aware of the restrictive weight limitations

imposed on the aircraft by the Piedmont and USAir chart. Had they felt bound to use this chart, however, C-FONF would have been weight-restricted and the takeoff by flight 1363 at Dryden on March 10, 1989, could not have been made until the runway had been cleared of slush.

F-28 Aircraft Flight Training

Captain George Morwood

Captain George Morwood received his F-28 flight training in February 1988 on Piedmont's F-28 aircraft flight simulator at Tampa, Florida. At the completion of this training, he received a pilot proficiency check from a Transport Canada air carrier inspector, and his pilot's licence was endorsed for the F-28 aircraft on February 26, 1988. Captain Morwood did not immediately fly the F-28 in revenue service, but rather went back to flying the Convair 580 aircraft for the remainder of 1988. He attended a Piedmont F-28 pilot recurrent ground school in November 1988, which consisted of 16 hours of classroom instruction. As well, he completed a further eight hours of F-28 flight training in Piedmont's F-28 flight simulator and passed his pilot proficiency check ride on January 9, 1989.

Captain Claude Castonguay, who acted as an observer during the flight simulator training of Captain Morwood and Captain Erik Hansen, testified that Captain Morwood had no difficulty with the aircraft systems or in flying the aircraft. He stated that Captain Morwood flew the aircraft within all of the parameters, was knowledgeable with all of the systems, and was "a fairly smooth pilot while flying the aircraft." Captain Castonguay provided similar observations regarding Captain Hansen's knowledge and flying capabilities (Transcript, vol. 105, p. 107). The Piedmont training record sheets indicate that all of Captain Morwood's flying was done to the satisfaction of the Piedmont flight instructor, who trained him initially; Captain Nyman, who provided his recurrent training in January 1989; and Transport Canada inspectors. Captain Nyman's comments were as follows: "Captain Morwood has not flown the aircraft for several months yet has obviously been studying the aircraft systems and flight procedures. Good training session" (Exhibit 684).

The F-28 aircraft simulator training course conducted by Piedmont consisted of five sessions, each of four hours. During each session, the pilot flew the simulator for two hours and carried out pilot-not-flying duties for the other two hours. Captain Hansen testified that he and Captain Morwood received a part of their pilot proficiency check ride on the F-28 aircraft flight simulator, and completed the remainder in a Piedmont F-28 aircraft in Tampa, Florida.

First Officer Keith Mills

The agreement for pilot training between Piedmont Airlines and Air Ontario was terminated as a result of the merged Piedmont/USAir carrier's requirement to use the flight simulator to train its own pilots. First officer trainees, such as Keith Mills and Deborah Stoger, did not receive the benefit of flight training on an aircraft flight simulator.

After he completed his ground school course, First Officer Mills received his F-28 aircraft flight training on Air Ontario's own F-28 aircraft. His instructor was Captain Joseph Deluce, and the flight training was carried out on four consecutive nights from Winnipeg International Airport in early February 1989 and totalled 8.3 hours. First Officer Mills completed a 1.2-hour pilot proficiency check ride with Transport Canada inspector Randy Pitcher, and had his pilot's licence endorsed for the F-28 aircraft on February 10, 1989, in his designated capacity as first officer.

The pilot-training reports completed by Captain Joseph Deluce indicate that First Officer Mills satisfied his instructor, with two exceptions. Captain Deluce observed during one session that First Officer Mills tended to "get overloaded when pushed a bit" and that he briefed First Officer Mills on "chasing altitude in steep turns and approaching stalls." First Officer Mills also flew the aircraft to the satisfaction of Mr Pitcher, except for minor errors in instrument flying and loss of some altitude when recovering from a demonstrated stall.

In contrast with Captain Morwood, who received 20 hours of flight simulator training during his initial F-28 course with Piedmont Airlines and who occupied the co-pilot's seat and acted as the pilot-not-flying while Captain Hansen received his training, First Officer Mills did not serve as the pilot-not-flying while he was training with Captain Joseph Deluce. Because he did not occupy this position, he did not receive the benefit of additional F-28 flight hours observing and participating in the training of another pilot.

Aircraft Flight Simulators

Pilots who testified at the Inquiry before me all agreed that the type of training received in an aircraft flight simulator is superior to that in an aircraft. For most of the Air Ontario F-28 pilots who testified before me, the F-28 simulator flight training was their first experience using a flight simulator.

The Piedmont F-28 flight simulator was capable of simulating all modes of aircraft flight, including abnormal situations, that might reasonably be expected to occur in actual aircraft operations. The simulator was programmable to allow such factors as low ceiling and visibility, the effects of slush on the runway, and wind shear to be simulated.

When describing his flight simulator training, Captain Fox testified that it was difficult to tell "the difference between flying a simulator and the actual aircraft." The aircraft cockpits are identical, and the flight simulator could even simulate "bumps on the tarmac as the aircraft was taxiing over them." By way of example, Captain Fox described the difference between a simulated engine loss in an aircraft and an engine loss in a simulator:

> A. ... In the real aircraft, for instance, in a shutdown, they say, okay, just put your hand on this lever, do not pull it ... because that will really shut the engine down, whereas, in a simulator, you actually do pull the fuel-off handles and ... actually go through actual shutdowns.
>
> (Transcript, vol. 51, p. 43)

Captain Nyman agreed that the use of a flight simulator is desirable because:

> A. ... inherently it's safer. You can't crash a simulator. Well, you can, but the results aren't quite the same.
>
> And ... you can show the emergency procedures without endangering the aircraft and more realistically than you can in the actual aircraft. For that reason, I say that it's more suitable.
>
> (Transcript, vol. 108, p. 134)

Captain Deborah Stoger, who received her first officer flight training from Captain Joseph Deluce in one of Air Ontario's F-28 aircraft during the night hours, testified that she would have preferred to have been trained during daylight hours and on the F-28 flight simulator. She testified that after discussing with other pilots what she had learned during her training, and the "variances in the training" between what she received and what was conducted in the flight simulator, she concluded that "obviously, simulator training is better" (Transcript, vol. 93, p. 13).

From a training perspective, malfunctions can be introduced in a flight simulator that would be impossible in an aircraft during flight. All emergency procedures, many of which are too hazardous to be carried out in flight, can be duplicated and practised in the simulator. A flight simulator, as a teaching tool, can be stopped at any time during a flight sequence to review and reinforce procedures, and procedures can be repeated quickly by repositioning the simulation.

More importantly, because of the high level of risk involved in conducting some of the procedures and manoeuvres during aircraft flight, not all can be demonstrated and practised in an aircraft. For example, Captain Stoger testified that she did not actually shut an

engine down, but only simulated an engine failure. When asked what sort of manoeuvres she was required to do during her pilot proficiency check, Captain Stoger testified that she did "exactly the same as in training." Captain Fox and other witnesses on the other hand provided examples of emergencies such as fuselage rapid depressurization, total engine failure, and smoke in the cabin and cockpit, which can be demonstrated in a flight simulator but not in the actual aircraft.

Mr Pitcher testified that he was concerned when he found out that Air Ontario no longer had the use of the Piedmont flight simulator to conduct pilot training and pilot proficiency check rides. He said he was not in favour of Air Ontario conducting pilot training in the aircraft rather than in flight simulators. Mr Pitcher testified that, during the time Air Ontario conducted flight training on the aircraft, he called Piedmont and USAir on several occasions to determine if the flight simulator would be available for Air Ontario pilots. He stated that flight simulators are preferable to aircraft for training:

> A. Because in a simulator, you can cover the full range of emergency possibilities. You can really allow a pilot to fly. You can create scenarios that you couldn't even imagine doing on board an airplane.
>
> So from a purely practical point of view, you could get a far better picture, a far more comprehensive picture of a pilot's abilities, in relation to the airplane and to operating as a crew member, as a team, in the simulator under extenuating circumstances that you, in fact, created than you could in an airplane where you had to be very careful.
>
> (Transcript, vol. 127, p. 162)

Mr Ian Umbach, Transport Canada's superintendent of air carrier operations, testified:

> Q. Is it your view that simulators are a necessary part of training?
> A. Oh, absolutely.
> Q. Is it a – in your view, a mandatory requirement?
> A. In my opinion, it's mandatory, and I think it should be mandatory.
> Q. And why are you saying that?
> A. Because right now, it's not. You can train on the airplane if you want to. And I think that's unwise and unsafe.
>
> (Transcript, vol. 138, p. 141)

Mr Umbach was of the opinion that flight training in an aircraft, rather than in a flight simulator, should not be permitted. He agreed there is no legislation that prevents air carriers, operating large aircraft, from carrying out initial training in the actual aircraft. It was his view that

legislation should prevent initial flight training from being conducted in large aircraft.

I agree with both Mr Umbach and Mr Pitcher. With the advent of modern flight simulators capable of simulating virtually all flight modes, system failures, and procedures, I believe that, to the maximum extent possible, initial flight training and recurrent training required to maintain pilot proficiency should be conducted in aircraft flight simulators.

F-28 Line Indoctrination Training

ANO Series VII, No. 2, requires that, in addition to ground and flight training, a pilot crew member must complete line indoctrination on the aircraft in the air carrier's normal commercial route structure. In this training, the trainee pilot flies regular flights under the supervision of an air carrier check pilot who provides instruction in the operation of the aircraft in normal line flying, usually on scheduled routes.

Captain Morwood conducted his line indoctrination flying between January 18, 1989, and January 25, 1989, with Captain Joseph Deluce, and received his line check from Captain Robert Nyman on the last day. He had accumulated a total of 27.5 hours of line indoctrination flying. Thereafter, Captain Morwood began flying as a line captain on the F-28 aircraft, with a total of 29 hours of F-28 aircraft and 30 hours of simulator time.

First Officer Mills conducted approximately 20 hours of line indoctrination flying between February 13 and February 17, 1989, and received his pilot line check on February 17, 1989, all with Captain Perkins. He commenced revenue flying as a qualified first officer on the F-28 aircraft on February 21, 1989, having accumulated 29.5 flight hours.

There is no evidence that either Captain Morwood or First Officer Mills had any difficulty during line indoctrination flying. Both Captain Deluce, who conducted line indoctrination flying with Captain Morwood, and Captain Perkins, who conducted the line indoctrination flying with First Officer Mills, were satisfied that Captain Morwood and First Officer Mills were competent to carry out their respective flight duties. Unlike most of the other Air Ontario pilots who converted to the F-28 aircraft, both Captain Morwood and First Officer Mills had previous experience on turbojet-powered aircraft, Captain Morwood on the Grumman Gulfstream G-2 executive aircraft and First Officer Mills on the Cessna Citation executive aircraft.

Company Check Pilot

Because of the many required training and checking demands that are part of the commercial air carrier operation, Transport Canada delegates

to "approved Carrier Check Pilots" or company check pilots (CCPs), who are employed by air carriers, the authority to perform certain training and checking functions on behalf of Transport Canada. Further details regarding CCPs are dealt with in chapter 35, Company Check Pilot.

Air Ontario's Need for Company Check Pilots

In January 1988, immediately prior to Air Ontario's applying to have its operating certificate amended to allow it to operate the F-28 aircraft, there was no Air Ontario employee who could meet CCP qualifications. The first four Air Ontario pilots who were to be trained on the F-28 were Captains Joseph Deluce, Robert Murray, Erik Hansen, and George Morwood. This group attended their initial F-28 ground school course in North Carolina in early January 1988. It was not until well after that date that Captain Deluce and Captain Murray, who received line indoctrination and route flying experience on the F-28 with Norcan Air and TimeAir, were qualified to act as CCPs.

In the earliest stages of planning for the F-28 program, Air Ontario management recognized that they should bring in an individual with F-28 expertise to give line indoctrination, conduct check rides, and generally assist in the commencement of F-28 operations. As early as October 1987, in the first F-28 Project Plan, the following was noted:

> FLIGHT OPERATIONS
>
> ...
>
> 2. Director of Flight Operations will immediately recruit a F28 Specialist on a contract basis to assist and advise Air Ontario on operations of the F28. This specialist would also be available for aircraft acceptance, any airborne training and line indoctrination during our initial start-up.
>
> 3. Director of Operations would select the Check Pilot for the F28.
>
> 4. Check Pilot and Coordinator would visit and observe a number of other F28 operations and determine how Air Ontario's F28 operation should be handled. Familiarization of these operations would be useful in minimizing start-up operational problems.
>
> 5. After discussions with the Director of Operations, the Chief Pilot and the F28 Specialist, the F28 Check Pilot, Manager of Training and Coordinator will negotiate initial training package with selected training facility.
>
> ...
>
> 9&10. F28 Check Pilot will organize ground school and simulator training for management F28 pilots. 4 management pilots will be trained initially.

...

16&17. Chief Pilot and F28 Check Pilot will arrange ground school, simulator and rides for F28 pilots.

18. Line indoctrination of F28 pilots will be done by the F28 Operations Specialist and some contract line indoctrination pilots. The indoctrination will take place in the month prior to start-up, on ferry flights, promotional flights and in the first month of operation right on the line.

19. Some amendments to the flight manual will be done by the Chief Pilot and the F28 Check Pilot in order to bring it into line with an Air Ontario operation. DOT approval will be obtained.

...

21. The Director of Flight Operations will contract some experienced F28 pilots to assist in line indoctrination of pilots during initial start-up.

...

23. The F28 Check Pilot and the F28 Specialist will do the flight testing of both aircraft prior to acceptance.

(Exhibit 799, Air Ontario Inc. F28 Project Plan, 1987)

In order to meet the requirements of Transport Canada's Air Carrier Check Pilot Manual for its F-28 program, Air Ontario needed an experienced pilot qualified on the Fokker F-28 aircraft to conduct line indoctrination training and line checks. Neither of the Air Ontario pilots designated as F-28 captains by Air Ontario in the early stages of planning for the F-28 program, Joseph Deluce or Robert Murray, had any large turbojet aircraft experience and, in particular, previous F-28 experience.

Captain Nyman and Captain Joseph Deluce both testified that, in early December 1987, they were considering at least two individuals to fill the role of F-28 specialist and, in the early stages of operation, to act as the CCP. Although they intended that Captain Murray and Captain Deluce would eventually become the CCPs, neither pilot would have sufficient time on the F-28 to qualify as a CCP before the planned commencement of the F-28 operations. There was a need, then, to contract from outside the air carrier for F-28 expertise.

It is important to note that the F-28 Project Plan was considered at the Air Ontario executive committee, which included Air Canada's shareholder representative, Mr William Rowe, and that the plan was later forwarded to the senior technical officer at Air Canada, Mr Bruce Aubin, for his review. Mr Rowe testified that, from Air Canada's perspective, the planned reliance on outside expertise in the Air Ontario F-28 program was a positive development.

In the fall of 1987 Air Ontario contacted Captain Claude Castonguay, a retired senior pilot from Quebec Air and previously a captain on the

Fokker F-28 aircraft. He was asked to provide his flying expertise and experience on a contract basis, and to act as the carrier check pilot during the initial startup of Air Ontario's F-28 aircraft operations.

Captain Castonguay's résumé indicated a total flight time of 27,461 hours. His flying hours as a captain were in excess of 26,000, and his experience on large turbojet-type aircraft exceeded 11,000 flight hours. Captain Castonguay had approximately 3000 hours on the Boeing 737 aircraft, 1300 hours on the Douglas DC-8 series aircraft, 3000 hours on the Boeing 707 aircraft, 3700 hours on the BAC 1-11 aircraft, and, at the time of his nomination for carrier check pilot, 222 hours on the F-28 Mk1000 aircraft. As well, Captain Castonguay had extensive experience flying a number of piston and turbine propeller-powered aircraft such as the Fokker F-27 and Douglas DC-3. He had held an airline transport pilot licence since 1953, and most of his flying had been with Quebec Air, operating its various aircraft types in Canada, elsewhere in North America, and worldwide. Captain Castonguay had experience in line indoctrination training and had received a course in crew resource management from United Airlines. Without question, he satisfied the regulatory qualification requirements of ANO Series VII, No. 2, for a company check pilot.

Captain Castonguay entered into an employment contract with Air Ontario on January 23, 1988 (Exhibit 836). In the contract, his duties were described as follows: "Duties will include F28 simulator instructor and F28 line indoctrination of Air Ontario pilots. Assistance with preparation of manuals, W [weight] and B [balance] forms and other items connected with the introduction of the F28 will also be considered normal duties." The next day, January 24, 1988, Captain Nyman, as the Air Ontario director of flight operations, forwarded to Transport Canada Air Ontario's formal application for the inclusion of the F-28 on its operating certificate. In that application, Captain Castonguay is nominated as a company check pilot and is described as part of the F-28 implementation team (Exhibit 855).

As part of the application to amend its operating certificate to include the F-28 aircraft, Air Ontario was required to nominate a "carrier check pilot" pursuant to ANO Series VII, No. 2. Having contracted the services of Captain Castonguay, Air Ontario was able to fulfil the Transport Canada nomination requirement, and it submitted to Transport Canada, as part of its aircraft and air carrier operating certificate application, the nomination form signed by Captain Castonguay and Captain Nyman requesting that Captain Castonguay be approved as Air Ontario's check pilot. Included with the nomination form was Captain Castonguay's impressive résumé, a letter of reference from Quebec Air's vice-president of flight operations, a copy of Captain Castonguay's airline transport pilot licence containing an F-28 endorsement, together with a number of

appendices relating to the F-28 aircraft and its operation within the Air Ontario system. The application advised Transport Canada that the first two F-28 aircraft captains would be Captain Joseph Deluce and Captain Murray, pending completion of their F-28 aircraft training.

As at the date of the Air Ontario application to amend its operating certificate to include the F-28, namely January 24, 1988, Captain Castonguay was the only Air Ontario pilot who was qualified on the F-28. There is no doubt that Captain Castonguay was hired by Air Ontario to fulfil its particular requirement for a company check pilot.

Transport Canada reviewed this application and granted Air Ontario a temporary amendment to its operating certificate in May 1988 and a permanent amendment in July 1988. Included as part of the granting of an amendment to the operating certificate, Transport Canada granted approval for Captain Castonguay to act as a carrier check pilot. On March 28, 1988, Transport Canada, Ontario Region, forwarded to Air Ontario written notice of Captain Castonguay's appointment.

The Role of Captain Castonguay

Captain Claude Castonguay was in the employ of Air Ontario only from January 24, 1988, until February 29, 1988, when he tendered his resignation. Immediately after being hired, Captain Castonguay proceeded to Charlotte, North Carolina, and completed a brief recurrent ground training course with Piedmont Airlines. Thereafter, he went to Florida to commence aircraft reconversion training on the F-28 flight simulator. Captain Castonguay was given four hours of training and received a pilot proficiency check ride from Transport Canada inspector William McIntyre on February 10, 1988. Captain Castonguay's check report stated "the simulator was well flown. Thorough application and procedures only minor points for debrief" (Exhibit 841). Captain Castonguay spent the next two weeks in Tampa, Florida, learning to operate the flight simulator and observing Captains Deluce, Murray, Hansen, and Morwood conduct their flight simulator training. After observing the simulator training of these pilots, Captain Castonguay was recalled to Toronto by Captain Nyman, Air Ontario's director of flight operations. Captain Castonguay met with Captain Nyman on February 29, 1988, at which time Captain Castonguay resigned from his employment. Captain Castonguay's letter of resignation reads:

> So much as I would like to keep working to establish your FK-28 program, I have concluded that I cannot function in my duties as a check pilot when I do not get the support I need.
>
> I wish everyone good luck in the new venture.
>
> Yours truly,
> Claude Castonguay
>
> (Exhibit 805)

On March 13, 1988, Captain Nyman forwarded a CCP nomination form to Transport Canada nominating Captain Robert Murray as the new CCP. The nomination form disclosed that as of March 11, 1988, although Captain Murray had approximately 15,000 hours of large propeller-driven aircraft flight time, he had acquired only 85 hours on the Fokker F-28 aircraft and 1.2 hours on the Boeing 737 aircraft. The nomination form did not disclose that Air Ontario intended to replace Captain Castonguay with Captain Murray as the F-28 specialist. It should be noted that only a few months earlier, Air Ontario had represented to Transport Canada that it would use a seasoned large turbojet aircraft captain to assist with the implementation of the F-28 program. Captain Nyman testified that he did not advise Transport Canada of Captain Castonguay's departure. He explained as follows:

> A. I did not personally. They would have certainly – we could not introduce the aircraft without a check pilot. We would have had to have a company check pilot of some sort to introduce the aircraft, part again of the regulatory process.
>
> I can't recall exactly how it went. It was very shortly thereafter that the strike occurred. The program, the F-28 program was put, to my knowledge, on hold. It ... wasn't an item of immediate concern.
>
> Whether Transport Canada were advised that day or not, I don't know. I certainly knew that they would have to be advised before the program was implemented.
>
> (Transcript, vol. 107, p. 234)

There is no evidence to indicate that anyone from Air Ontario in fact advised Transport Canada of Captain Castonguay's departure or the reasons for his resignation.

Given the widely recognized necessity of having an experienced large turbojet aircraft specialist to assist with the implementation of the F-28 program, I find it strange that Air Ontario did not replace Captain Castonguay with another individual with similar turbojet aircraft flying experience. Instead, Air Ontario relied on Captain Murray, who had very limited turbojet experience.

At the request of Captain Joseph Deluce, Captain Castonguay rejoined Air Ontario for approximately two weeks in July and August 1988 to assist with line indoctrination and route checks on the F-28. He provided line indoctrination training and route checks for Captain Hansen, Captain Nyman, and First Officer Allan during five separate flights over the course of the two weeks, but had no further involvement with Air Ontario.

Captain Castonguay testified before this Commission about his involvement with Air Ontario, and provided his perceptions and

observations relating to flight simulator training conducted by the first four pilots he observed. He also provided his views on the air carrier's flight operating procedures generally. He was a thoughtful and credible witness whose observations regarding the operation of large turbojet-type aircraft in an air carrier environment were most instructive.

Deficiencies Identified by Captain Castonguay

During the course of monitoring the flight simulator training of Captains Deluce, Murray, Hansen, and Morwood, and from conducting line indoctrination flights on Air Ontario pilots in July 1988, Captain Castonguay identified certain deficiencies in Air Ontario's cockpit procedures and flight operations philosophies. These deficiencies were not related to these pilots' flying capabilities, but rather reflected operational procedures which, in his view, are not recommended in jet aircraft operations.

Captain Castonguay was initially requested to assist Air Ontario in preparing manuals and weight and balance forms for the F-28. However, Air Ontario did not use Captain Castonguay's expertise in preparing its own F-28 operating manual and weight and balance forms, and other documents for use in F-28 operations.

Captain Castonguay spent approximately one week observing Captain Joseph Deluce and Captain Murray conduct their initial F-28 flight training in Piedmont's flight simulator. He observed that when these captains occupied the co-pilot's seat and took the role of the pilot-not-flying, they did not assist the pilot flying the aircraft in a meaningful way. It was his perception that these pilots did not practise integrated cockpit procedures. For example, Captains Deluce and Murray used the Piedmont briefing forms, but did not follow the proper procedures for "take-off briefing and approach briefing." In Captain Castonguay's opinion, both of these pilots were using procedures which, although perhaps adequate in flying turboprop-powered aircraft, were not suited to large jet-powered transport-type aircraft. He described the lack of crew concept which he observed as "the old concept: One guy flies and the other one doesn't do anything" (Transcript, vol. 105, p. 95). Captain Castonguay stated that in modern air carrier flying, one pilot carries out flying duties while the other, non-flying pilot does other duties such as reading checklists, handling radios and communications with air traffic control, and assisting the pilot flying wherever possible. Captain Castonguay's observations of lack of crew coordination were, in his words, "too numerous" to comment upon. He testified that neither Captain Deluce nor Captain Murray was receptive to Captain Castonguay's observations, advising him instead that Air Ontario had its own "ways of doing things" (Transcript, vol. 105, p. 99).

While Captain Castonguay observed that Captain Morwood and Captain Hansen both exhibited excellent flying skills, he also observed that, during their simulator training, both men, when acting as pilot-not-flying, did not always assist the pilot flying the aircraft in areas such as cross checks and checklists.

It was Captain Castonguay's opinion that these four pilots, as senior captains with Air Ontario, were not receptive to his observations of lack of proper flight crew coordination. He said he did not have the support of critical members of the F-28 implementation plan, Captains Murray, Deluce, and Nyman, without which he did not feel he could act properly in his capacity as company check pilot. Captain Castonguay also stated that it became clear that Air Ontario did not intend to allow him to continue conducting line indoctrination training, as represented to Transport Canada, but rather relegated him to the role of conducting simulator training.

For approximately two weeks in the months of July and August 1988, Captain Castonguay carried out line indoctrination flights with Captain Hansen, Captain Nyman, and First Officer Allan. Captain Deluce asked him to assist in line indoctrination because Captain Deluce felt himself to be overworked. Captain Castonguay recounted that he advised Captain Nyman during a line indoctrination flight that, in his view, Air Ontario had to change its philosophy and procedures in operating the F-28 aircraft; in his words, "you cannot operate this [F-28] like a turboprop" (Transcript, vol. 105, p. 132). Captain Nyman advised Captain Castonguay that procedures and philosophies could not change, and that "it may take six months, a year before we do any changes" (Transcript, vol. 105, p. 132).

Captain Castonguay testified that Quebec Air used fully qualified dispatchers in their flight watch system and that he was not experienced with a pilot self-dispatch system. He observed that while he saw an Air Ontario flight release used by Air Ontario F-28 crews, he at no time saw an operational flight plan issued to the flight crews. In his opinion, based on his experience and his understanding of the provisions of ANO Series VII, No. 2, he did not consider that the flight release used by Air Ontario for the F-28 met the requirements of an operational flight plan.

Captain Castonguay observed that Air Ontario F-28 pilots did not use an aircraft flight log to record flight leg times and fuel burn, but simply made entries into the aircraft journey logbook at the end of the flight. In his view, it was insufficient simply to use a flight release and an aircraft journey logbook for jet operations. A flight crew should have in their possession an operational flight plan that meets regulatory requirements, and should have an aircraft flight log in which to record during a flight critical items such as flight times, distances, fuel burns, and aircraft weights.

Captain Castonguay recommended that Air Ontario not allow a circling approach procedure to be conducted in the F-28 aircraft for several months, at least until the pilots had more experience flying the aircraft. Neither Quebec Air nor Piedmont Airlines, he said, conducted this low-altitude manoeuvre with jet aircraft. It was Captain Castonguay's opinion that Air Ontario did not have the expertise or the experience with jet aircraft to allow immediate use by its pilots of a circling approach as an approved IFR manoeuvre (Transcript, vol. 105, pp. 176–77). This advice was not accepted by Air Ontario.

Captain Castonguay's Recommendations

Captain Castonguay, at the conclusion of his testimony, provided the following observation:

> Q. ... From your experience of the two stints that you did at Air Ontario ...
>
> Do you think that when Air Ontario put the F-28 into public service, into service as a public carrier, that Air Ontario was ready?
>
> A. They weren't ready.
>
> (Transcript, vol. 105, p. 258)

Because of his extensive aviation experience, Captain Castonguay was asked, when he appeared before this Commission, to offer for the record any recommendations he might have to improve air carrier operations in Canada. He made three recommendations.

First, he testified that individuals with experience on an aircraft type should be hired as necessary on a short-term basis to fly with an air carrier that does not have qualified people. He gave examples of Quebec Air hiring experienced Douglas DC-8 and Boeing 707 pilots to fly as co-pilots with Quebec Air pilots on its DC-8 and 707 aircraft until the Quebec Air captains had adequate experience on the aircraft type.

The testimony of Captain Gert Andersson, a veteran F-28 pilot of the Swedish airline Linjeflyg, supports this view. He testified that when Linjeflyg recently commenced flight operations with new Boeing 737 aircraft, its most experienced flight instructors, all of whom had significant F-28 experience, were sent to Boeing Aircraft for the first conversion course. Route training conducted by Linjeflyg with their Boeing 737s was done using Boeing Aircraft flight instructors as first officers. When it was determined that the Linjeflyg pilots had sufficient flight hours and experience on the new aircraft, they were released to conduct line flying. Captain Andersson testified that as the conversion program matured, there was a "slow rollover program" in order that the Linjeflyg flight instructors could eventually take over the training of Linjeflyg's own pilots (Transcript, vol. 83, p. 179).

Second, with respect to flight crew pairing, Captain Castonguay recommended that one of the flight crew members, either the captain or the first officer, should, when a transition is being made to a new or different aircraft type, have substantial experience on that aircraft type.

Captain Andersson's testimony also supports this recommendation. He stated that it was a "bad combination" to have captains and first officers paired as flight crew on a new aircraft type when they had approximately 100 hours flight time each on that type and where the training pilot responsible for line indoctrination and check rides was almost as inexperienced, with perhaps 200 hours on the aircraft type. Captain Andersson testified that pairing two pilots who are equally inexperienced on an aircraft type could not happen in Linjeflyg. Through the use of computer programming, Linjeflyg ensures that neither an inexperienced captain nor a first officer who has recently completed aircraft type training and route flying will be paired with other inexperienced pilots (Transcript, vol. 83, pp. 158–60).

Third, Captain Castonguay recommended that all air carriers embrace cockpit resource management (CRM) programs. He expressed the view that the benefits of providing CRM courses and training to pilots would, in the long run, pay dividends by promoting harmonious work habits among flight crew members.

Cockpit and Crew Resource Management Training

Experience in the United States and other countries has demonstrated the importance of CRM training in improving the effectiveness of flight crew performance. America West Airlines has extended CRM training in a program called Aircrew Team Dynamics (ATD) to include both flight crew and cabin attendants in total crew coordination concepts. In this section, while I touch briefly on the total crew resource management training concept, I focus primarily on cockpit resource management, which deals with training of the aircraft flight crews.

CRM training originally focused on flight crews, as a result of recommendations made by the United States National Transportation Safety Board (NTSB) following the United Airlines accident in Portland, Oregan, in 1978 where a captain did not listen to "rather mild protestations by a crew member" that the aircraft was running out of fuel (Transcript, vol. 157, p. 158). The aircraft subsequently ran out of fuel and crashed. The recommendations from the NTSB were that interpersonal communication training should be carried out to improve flight crew coordination. Shortly thereafter, organizations such as the United States National Aeronautics and Space Administration (NASA) began research, and major United States air carriers, such as United Airlines, started training flight crews in CRM (Transcript, vol. 157, pp. 158–59).

The United States Federal Aviation Administration (FAA) has encouraged CRM training within the United States air carrier industry and, in December 1989, published an advisory circular, AC 120-51, entitled Cockpit Resource Management Training, to provide guidelines for developing, implementing, and evaluating air carrier CRM training programs. The guidelines for CRM training programs designed by the FAA were intended for use by all air carriers in training their flight crew. Efforts are now under way in the United States to make CRM training mandatory for all air carriers operating under Parts 121 and 135 of the Federal Aviation Regulations. I have attached United States FAA Advisory Circular AC 120-51, Cockpit Resource Management Training, as appendix J to this Report.

The premise of Advisory Circular 120-51, supported by empirical research such as that conducted by Dr Robert Helmreich, who testified before this Commission, is that a single CRM training course in CRM concepts is insufficient to provide long-term changes in crew coordination, attitudes, and operating methods, and that such training must be accompanied by opportunities to practise and reinforce the concepts. The circular suggests that check pilots and pilot instructors are a critical element in the reinforcement of CRM concepts, and should be given special training in the evaluation and reinforcement of resource management issues. This is an extension of their traditional role of teaching and examining individual flight crew member's technical skills and systems knowledge. CRM evaluation and reinforcement should, according to the FAA and experts such as Dr Helmreich, occur during ground school courses, flight simulator training, and line checks.

To its credit, Air Ontario assessed CRM training and, in late 1987, had its chief pilot and chief Dash-8 training pilot attend a CRM course conducted by a major United States air carrier. Captain Nyman, the director of flight operations, testified that in his view CRM is a new concept "certainly to Canada and Canadian carriers" (Transcript, vol. 109, p. 60). After assessing the CRM course attended by two of its supervisory pilots, Air Ontario decided that this type of course "did not fit" Air Ontario's operation, and that it was of limited value and was expensive. Air Ontario pilots also attended and reviewed other CRM courses, including those conducted by Air Canada and a "pilot decision-making course" recommended by Transport Canada. Captain Nyman testified that Air Ontario has adopted and is using the pilot decision-making course and that some Air Ontario pilots have attended the CRM course conducted by Air Canada.

The view expressed by Air Ontario's pilots that some CRM training courses were of limited value to certain air carrier operations is not uncommon. Captain Castonguay testified that the United Airlines course was more suited to three-person than two-person flight crews. Dr

Helmreich agreed in testimony that some CRM training courses might not have been applicable to Air Ontario's flight operations environment. When asked to comment on the position of Captain Nyman and his pilots regarding their experience with CRM training, Dr Helmreich testified as follows:

> A. ... I think it shows a very keen evaluation of the situation by Mr Nyman and his pilots, because what we saw developing in the last few years was airlines moving to recoup some of the substantial expense involved in putting in CRM by selling their courseware to other airlines.
>
> And the first attempts of that were usually off the shelf; in other words, there was kind of an assumption that one size will fit all, buy our course and we will do it. And some of the attempts were fairly depressing. Attempts to take an U.S. course and fit it into Korean culture did not come across very well.
>
> And I think these gentlemen attended at one of the major airline courses which was offered as a turnkey operation and said, gee, this doesn't quite fit the culture we have and it was expensive. I'm familiar with the course. So I think that was a very valid perception.
>
> Q. So you view this as a positive move by Air Ontario?
>
> A. I think looking into it was an extremely positive move and one ... of course, has to feel sorry for them that there wasn't the resources available to customize a course or develop their own or used their parent's course to fit their own culture.
>
> (Transcript, vol. 157, pp. 195–96)

In Dr Helmreich's opinion, CRM or equivalent training cannot alleviate operational problems associated with lack of management stability and consistent direction.[5] CRM training will also only be effective so long as the flight crew have adequate education and have the knowledge available to them to make a reasoned assessment of operational problems.

According to Dr Helmreich, statistical and research data still suggest that certain accidents and incidents involved the failure of flight crews to operate effectively as teams. Many airlines have responded to these findings by increasing the emphasis in flight crew training and checking on the overall flight crew performance, rather than on the individual flight crew member's aircraft handling skills.

In addition to encouraging CRM training through Advisory Circular 120-51, the FAA has made CRM training a requirement for air carriers who elect to operate under the new Special Federal Aviation Regulation

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[5] Exhibit 1270, "Human Factors Aspects of the Air Ontario's Crash at Dryden," p. 10

(SFAR) 58, the Advanced Qualification Program (AQP). This new program has been developed in the United States by the FAA as an alternative means of qualifying, certifying, and training flight crew members and other flight operations air carrier personnel. A voluntary program, the AQP is intended to enhance flight crew qualifications by the development and use of innovative training and qualification techniques for flight crew and check pilots. Instead of defining specific manoeuvres that must be accomplished by individual flight crew members, the AQP contemplates, in certain instances, training and evaluating a flight crew as a unit, rather than the traditional method of emphasizing individual performance focusing on flying and technical skills. The AQP shifts the emphasis to crew coordination and to management of crew resources, communication, coordination, and decision-making skills.

One of the training approaches to be used for United States air carriers operating under the AQP is Line Oriented Flight Training (LOFT). LOFT involves all of the flight crew operating in a simulator under realistic operating conditions, using flight releases, conducting air traffic communications, and facing a variety of operational problems, including inflight emergencies. In LOFT, flight crews are allowed to experiment with a variety of behaviours and approaches without intervention by the flight instructor and without placing their licences at risk.

The Air Transport Association in the United States, in endorsing the FAA's Advisory Circular 120-51, has suggested that CRM training be extended beyond the aircraft cockpit to include flight attendants, maintenance personnel, and dispatchers. The experience of airlines such as America West Airlines has shown that efforts are being made to extend CRM training to cabin attendant crews. None of the crew on board C-FONF on March 10, 1989, had received cockpit or crew resource management training courses. According to Dr Helmreich, had both the flight attendants and the flight crew completed cockpit and crew resource management training and accepted its concepts, there might have been an exchange of information that would have precluded the last takeoff of C-FONF.

As discussed in chapter 39, Crew Coordination and Passengers' Safety Concerns, the evidence of flight attendants Sonia Hartwick and Labelle-Hellmann suggests, in the view of Dr Helmreich, an environment in Air Ontario that discouraged them from questioning a flight crew or bringing operational issues to their attention. Air Ontario flight attendant training stressed the competence of pilots and fostered a position of total reliance on the flight crew with regard to operational decisions. An example of this discouragement of crew communication was the failure of the flight crew of an Air Ontario HS-748 aircraft to respond to Mrs Labelle-Hellmann's concerns regarding contamination on the aircraft's

wings prior to takeoff from Pearson International Airport. There was also a failure of the flight attendants to relay passenger concerns to the flight crew regarding contamination on the wings of C-FONF prior to its last takeoff. Dr Helmreich explained that the concepts taught in crew resource management training courses stress the importance of unfettered information exchange between the flight crew and the cabin attendant crew (Exhibit 1270, p. 14). However, cockpit and crew resource management training can be effective only when it is based on accurate technical information and knowledge.

In light of the possible benefits of CRM training, it is my opinion that concepts described in the United States FAA Advisory Circular 120-51, which have already been incorporated into training programs by many United States air carriers and by some Canadian air carriers, should be promoted by Transport Canada and adopted by all Canadian air carriers.

New programs such as the Advanced Qualification Program should be monitored and evaluated by Transport Canada and, if found suitable, should be adopted as an alternate method of training and evaluating pilots of air carriers operating large aircraft pursuant to ANO Series VII, No. 2. Specific crew resource management training courses expanded to include both flight crew and flight attendants should also be considered. Because Transport Canada air carrier inspectors and delegated company check pilots are critical in evaluating and reinforcing CRM concepts, they should receive special instruction in resource management training issues.

Cabin Attendant Training

ANO Series VII, No. 1, subsection 45(1)(b), requires an air carrier to provide for each crew member individual instruction in the location and operation of all emergency equipment carried on board an aircraft. Parts of section 45 that require the participation of cabin (flight) attendants during emergency procedures read as follows:

> 45. (1) Emergency procedure training provided by an air carrier in respect of an aeroplane shall include, for each crew member, individual instruction in the location of and operation of all emergency equipment carried and instruction, including co-ordination among crew members, in the emergency procedures for
>
> ...
>
> (b) handling of
>
> (i) emergency decompression,
>
> (ii) fire in the air or on the ground,
>
> (iii) ditching, and
>
> (iv) evacuation; and ...

Having regard to the evidence, it is indisputable that the primary role of a flight attendant is to ensure cabin and passenger safety. This concept, which was rigorously advanced by flight attendant Sonia Hartwick and the representatives of the flight attendants' union, was endorsed by senior Transport Canada management-witnesses and was fully supported by counsel on behalf of the Canadian Air Line Pilots Association (CALPA), who stated: "I would first like to say that CALPA fully supports the concept that Mrs Hartwick has expressed that a flight attendant's primary role is safety" (Transcript, vol. 12, p. 99).

Air Ontario's Flight Attendant Manual sets out in section 2 the requirements for the initial training of flight attendants. Subsection 2.2(c) states as follows:

> During training, ALL participants will be required to have practical use of:
>
> a. Oxygen bottles & systems as carried in the fleet
> b. Fire Extinguishers as carried in the fleet
> c. Exit operations – each aircraft type
> d. Evacuation drills
> e. Shouted commands
> f. Observation/operation of an evacuation slide & participate in evacuation drill down a slide on the F28 or the CV580
> g. Operation of an evacuation slide & participate in at least one evacuation drill on the HS-748 aircraft
> h. Pilot incapacitation drill
>
> Following completion of successful training, each candidate will then be assigned to line indoctrination flights.

Initial Training: Flight Attendant Hartwick

Flight attendant Sonia Hartwick testified that her initial flight attendant training with Air Ontario Limited spanned a six- or seven-day period. Following an employment screening interview, conducted on September 14, 1986, in Sudbury, Ontario, she reported to London, Ontario, on the next day for training. Ten days later she took her indoctrination flight on the Convair 580 as a flight attendant and completed approximately seven more flights on the Convair 580 as one of the working flight attendants..

The evidence indicates that the theoretical portion of Mrs Hartwick's initial flight attendant ground school training was thorough, and examinations written by her on safety procedures, dangerous goods, and flight attendant responsibilities, as well as the aircraft pre-flight examination, show that these matters were well covered. However, when asked what stood out in her mind about her initial training, Mrs Hartwick testified that "there was indeed some emergency procedures"

training conducted during the course, but, in her opinion, "it was lacking."

Recurrent Training: Flight Attendant Hartwick

Examination records of Mrs Hartwick for 1987 and 1988 also indicate that the theoretical and written portion of the recurrent flight attendant ground school training was thorough. However, in sharp contrast to her initial flight attendant training, Mrs Hartwick was laudatory of the recurrent training she received from Air Ontario in October 1988 under the direction of Mr Roger Whittle with respect to the Convair 580 and the Dash-8 aircraft. This recurrent training involved hands-on training in simulated emergency situations. Mrs Hartwick stated that this recurrent training was very different from her initial training in 1986 and she described it as "exceptional training." She stated that having gone through the recurrent training in October 1988, she "felt like she was qualified" (Transcript, vol. 10, pp. 53–55).

Practical Training: Flight Attendant Hartwick

The term "practical use" as it appears in subsection 2.2(c) of the Air Ontario Flight Attendant Manual appears to be interchangeable with the term "hands-on." Air Ontario's flight attendant recurrent training program in October 1988, however, did not include any hands-on training on the F-28 aircraft, which had been in service since June 1988.

In February 1988 Mrs Hartwick took ground school training on equipment and procedures on the HS-748 and received hands-on training on the aircraft in March 1988 in Toronto. In June 1988 she expressed to Mr Bryan Pettman, who was at the time in charge of the in-flight service department at Air Ontario, her concern that she did not feel she was qualified and competent to work on the HS-748. It was her view that the actual hands-on training, which she took with a group of four or five other flight attendants, was not thorough, lasting only several minutes. In her memorandum of June 19, 1988, to Mr Pettman, Mrs Hartwick indicated that she was not alone in her concerns: "recently there have been several occasions where fellow YXU [London, Ontario] F/As [flight attendants] have flown the Hawker [HS-748], and who also feel as unqualified as I do."[6]

Mr Pettman, in a memorandum dated July 8, 1988, addressed the flight attendants' concerns outlined by Mrs Hartwick. He expressed the opinion that "they had received sufficient training to fully qualify them" on both the Convair 580 and the Dash-8 and that it should "not be

[6] Exhibit 121, Memorandum from Sonia Hartwick to Bryan Pettman, dated June 29, 1988

difficult to grasp a third aircraft after a few days' training." He indicated that the manuals contained all the resources needed to refresh them on equipment and that he was available to answer questions. He offered to fly with them until they felt comfortable on the equipment.

When questioned during hearings about specific problems she had regarding the practical hands-on training provided by her employer, Mrs Hartwick testified that, among other things, her major concern was the lack of hands-on training in assembling the emergency slide:

> A. With the practical hands-on training, I felt ... that not enough things were done ... we were only able to watch a girl take a light off – an emergency light because they didn't want to have to replace too many seals.
>
> I did open the cargo door in the washroom area and the main entry door a couple of times, but I was not able to actually assemble the emergency slide which is located in the rear of the aircraft ...
>
> I think ... that is more or less your most important thing on the aircraft would be an emergency slide and how to actually assemble it and this was not done with myself and, therefore, I did not feel that I was properly qualified unless I actually did this a couple of times and got the feel for actually assembling the slide, an emergency slide that is.
>
> (Transcript, vol. 10, pp. 86–87)

Flight attendant training should recognize the need for practical hands-on training in the operation of aircraft doors, emergency exits, evacuation chutes, and other emergency equipment in the course of a simulation of the various adverse conditions that might be encountered in an actual emergency. Such training should also include practical examinations in which flight attendant candidates, after initial training, and qualified flight attendants, after recurrent training, are required to demonstrate their capability of consistently carrying out their emergency-related tasks properly and within the time allotted for the evacuation of an aircraft.

While the evidence reveals that the theoretical training and examinations given by Air Ontario to the flight attendants were thorough, and while the flight attendant training did include some hands-on training, it was Mrs Hartwick's view that during her initial training on the Convair 580 and her conversion training on the HS-748, such hands-on training was not sufficiently extensive and, in her mind, was therefore not acceptable.

Mrs Hartwick testified that the only hands-on training she received from Air Ontario on the F-28 aircraft was in the opening of the main entry door. This was obviously a function that would have to be learned apart from cabin safety. She received no hands-on training with respect

to the operation of the over-wing emergency exit windows and the galley service exit door on the F-28, nor on the location of the over-wing emergency window exit rope.

Flight attendant Hartwick described her training on the F-28 aircraft as simply a line indoctrination on a return flight, Toronto–Sault Ste Marie–Toronto, in October 1988, with passengers on board. When questioned as to the particulars of her Air Ontario training for the purpose of qualifying on the F-28, she stated:

> A. I did a line indoctrination sometime in October of '88, and my line indoctrination flights consisted of two flights, Toronto–Sault Ste Marie and return to Toronto.
>
> And, at that time, the purser who was in charge, I was just boarding passengers, I opened up the door, I closed the main entry door, and I just continued to serve passengers as I normally would on any other revenue flight.
>
> (Transcript, vol. 11, p. 178)

On her own initiative, Mrs Hartwick posed a "quiz question" to several Air Ontario F-28 flight attendants regarding their hands-on training on the F-28 and their knowledge of the location of the evacuation rope for the over-wing exit windows:

> A. ... So, it is good to actually try these things. Because I spoke to flight attendants and said to them, you know, did you have hands-on on the F-28 and many of them have said, No. And then I just gave them a quiz question on my own. Do you know where the rope is by the windows on the F-28? And a few of them went to say, yeah, it is in the frame.
>
> And I said, No, it is not. It is actually in the overhead rack or the overhead where your lights are and things ...
>
> So practical use and hands-on, in my opinion, is very important.
>
> (Transcript, vol. 11, pp. 131–32)

During her testimony, Mrs Hartwick commented on her perception as to why she did not receive hands-on training:

> A. Again, the only observation I could think of is that the F-28 was too busy with revenue flights and, therefore, there was no actual ground school time for it to actually be on the ground for us to have practical training on it.
>
> (Transcript, vol. 11, p. 132)

When questioned about the term "practical use" as found in subsection 2.2 of the Air Ontario Flight Attendant Manual, Mrs Hartwick stated:

> A. Well, practical use, again, in my view, is hands-on training on the aircraft itself, and, again, I [did] not have hands-on training on the F-28.
>
> (Transcript, vol. 11, p. 145)

I agree with Mrs Hartwick's view that adequate hands-on training on specific aircraft types is an essential element of cabin crew training.

Flight Attendant Licensing: CUPE Proposal

In its formal submission to this Inquiry, the Airline Division of the Canadian Union of Public Employees (CUPE), representing flight attendants, proposed that this Commission recommend that flight attendants be licensed by Transport Canada. Although I was presented with a written brief and oral argument by counsel on behalf of the flight attendants' union in support of the union's position, its representatives declined the opportunity offered to them to call witnesses before the Inquiry. Since I have not heard any witness testimony regarding this proposal, I am not in a position to make a recommendation with respect to this issue.

Ground-Handling Personnel Training

It is essential that ground handlers and fuellers be properly trained to carry out their duties and responsibilities in support of the flight crew.

Regulatory Requirements and Guidelines

There are no Canadian regulatory requirements pertaining to training of personnel involved in the ground-handling, fuelling, or de-icing of aircraft. With respect to fuelling operations, however, Transport Canada has policy documents, which the Dryden Flight Centre was required to follow. As well, ESSO issues guidelines for the handling of its equipment and products (see chapter 9, Crash, Fire-fighting, and Rescue Services).

While there are no Transport Canada policies respecting training of ground handlers, it is, nevertheless, an area subject to inspection. Transport Canada's Air Carrier Inspector (large and small aeroplanes) manuals include under the heading "Aircraft Servicing and Ramp Safety" the following procedure to be followed by inspectors as part of in-flight inspection:

> Observe refuelling procedures and the method of determining fuel quantities. Check loading methods and security, the use of ground handling equipment and safety precautions exercised in its use,

> aircraft parking and the control of passenger traffic on the ramp. Evaluate the fire precautions and the use of the aircraft electrical and heating systems during refuelling, use of cabin "no smoking" signs, if there is a cabin attendant on board and if there are ramps at the doors of the aircraft.
>
> (Exhibits 960 and 961)

In his testimony before the Commission, Mr Martin Brayman, superintendent of air carrier inspection (large aeroplanes), Ontario Region, reiterated that inspectors were to monitor ground handlers as part of their in-flight inspections, while the airworthiness group were responsible for monitoring fuelling operations.

With respect to the Dryden Flight Centre, however, it appears that neither ground-handling nor fuelling operations of Air Ontario's F-28 aircraft were monitored by Transport Canada. Mr Randy Pitcher testified that in his capacity as lead inspector of Air Ontario's F-28 operation, he was in Dryden only on one brief occasion and did not inspect the facilities in place for servicing the F-28. Contrary to Mr Brayman's understanding, airworthiness inspector Ole Nielsen indicated that he knew nothing whatsoever about an airworthiness responsibility to monitor fuellers.

As discussed in chapter 15, F-28 Program: Planning, Air Ontario was required to amend its operating certificate prior to commencement of its F-28 operation. While there is no precondition to amendment of the operating certificate that ground handlers or fuellers meet a particular standard, Air Ontario included the following representation respecting refuelling facilities in its application to Transport Canada to amend its operating certificate:

> N) The company has determined that existing terminal facilities, buildings, lighting, ground support, power units, refuelling facilities, communications and navigation aids, dispatch, weather service and ATC are adequate for the proposed operations. However, the company may require certain improvements as F-28 operations develop.
>
> (Exhibit 855)

Dryden Flight Centre Training

Mr Lawrence Beeler was the president of Dryden Flight Centre, and Mr Vaughan Cochrane was responsible for day-to-day management. Both Mr Beeler and Mr Cochrane, along with Dryden Flight Centre employee Mr Jerry Fillier, were involved in fuel and baggage handling.

In the December 7, 1987, agreement between Dryden Flight Centre and Air Ontario, Air Ontario assumed the responsibility of training Dryden Flight Centre's ramp and ticket agents. The agreement contained

the following clause with respect to training: "Air Ontario will provide instructors and all material for the initial ramp and ticket agent training. The parties will agree to the manner of any subsequent or recurrent training" (Exhibit 177, para. 5).

In November 1987, in preparation for Air Ontario's Dash-8 service through Dryden and in expectation of concluding the December 1987 agreement, Air Ontario provided Mr Beeler and Mr Cochrane with a day-and-a-half of hands-on training on the Dash-8 series 100 aircraft at Sault Ste Marie. Despite intentions to the contrary, Dryden Flight Centre personnel never received ground-handling or fuelling training on the F-28 aircraft. In a letter dated March 8, 1988, to Mr Cochrane regarding arrangements for Air Ontario's new F-28 service, Mr Scott Tapson, Air Ontario's manager of airport services, stated that "Ground handling training for the F-28 will be arranged in the near future. Rod Coates will be contacting you with these arrangements" (Exhibit 392). On March 16, 1988, Mr Tapson again wrote to Mr Cochrane and, in addition to providing copies of the Fokker F-28 Ground Handling and Service Data Manual and the ESSO Aviation Fuelling Guide, he stated: "Formal training on the aircraft will be planned in the future. Bruce Maxim, at our London head office, will be coordinating this training" (Exhibit 398).

The evidence of Mr Cochrane and from Air Ontario's Mr Rodney Coates is in conflict as to why this planned training session never came to pass. Mr Cochrane testified that he could not recall being contacted by a representative of Air Ontario to schedule the training sessions referred to in the correspondence of March 8 and March 16, 1988. Mr Rodney Coates, in contrast, testified that he did arrange training for ground handlers from all stations through which the F-28 was to operate, including Dryden. He stated that he spoke to Mr Cochrane about the training:

> A. I explained to him when the course was, where the course was and which stations would be attending, and he declined to send any people to the course.
> Q. Did he give a reason why he was not going to send someone to the course?
> A. Yes, that being that, for a number of years, another airline had been operating an F-28 into and out of Dryden and that he felt he had sufficient experience and didn't need to attend the course.
> Q. So was it your understanding that Mr Cochrane had been handling the F-28 over an extended period of time?
> A. Well, I wouldn't say that. I would say that I felt that he had the experience. I don't know if in fact he was handling the F-28, but ... I felt that, from the conversation, that he had enough experience, and that satisfied me.
>
> (Transcript, vol. 57, pp. 19–20)

Dryden Flight Centre was the only ground-handling agent not represented at Air Ontario's F-28 training session, and Messrs Cochrane, Beeler, and Fillier received no formal training on the F-28.

There can be little doubt that the training course would have been worthwhile. Mr Cochrane agreed in his testimony before the Commission that, although the Dryden Flight Centre had received from Air Ontario copies of the Fokker ground-handling training manual and the ESSO refuelling publications, they were technical documents that would be understood best in the context of a training session. Furthermore, the testimony of Dryden Flight Centre personnel revealed gaps in their knowledge of certain refuelling safety procedures. Mr Cochrane testified as follows:

> Q. ... I questioned Mr Fillier about his knowledge concerning the proper technique and what instructions he had been given, and, under oath, he told me, for instance, that no one had suggested to him that, before doing a fuelling, the tank vent openings should be unobstructed, nobody pointed the tank vents out to him and so on.
>
> Does that testimony accord with your own recollection of his training?
>
> A. I would probably agree with that, yes.
>
> Q. ... And, also, he didn't know where the landing gear static ground wires were, so he couldn't check them for proper contact; is that the kind of thing that you even knew?
>
> A. No, I didn't – that's one I didn't know either.
>
> Q. Did you know, for instance, that the Fokker manual, at least, recommends that, before fueling is begun, one of the things that should be done is to check that the main gear inboard doors are closed; did you know –
>
> A. Yes, I knew about that one.
>
> Q. Now, Mr Fillier, however, testified that no one had instructed him in that regard. Does that testimony accord with your own recollection?
>
> A. That would be –
>
> Q. ... So these are all instances of – or these are all examples of how a proper training session on fueling that plane would have been of assistance to you and your employees; is that right?
>
> A. Agreed.
>
> (Transcript, vol. 54, p. 8)

It is unfortunate that Air Ontario did not insist that the Dryden Flight Centre personnel attend the training session. Although Mr Coates had no operational background in aviation, he accepted Mr Cochrane's position that, on the basis of the Dryden Flight Centre's track record and Mr Cochrane's own F-28 experience, training was not required. In fact, contrary to Mr Coates's understanding, Mr Cochrane's F-28 experience

was extremely limited. Mr Cochrane's own testimony revealed that he had observed only one short turnaround of an F-28 in 1987.

Mr Coates testified that, as Air Ontario's regional manager for customer service, his concern was with on-time performance and passenger service. He was not responsible for ground-handler training or the operational and safety aspects of ground handling, such as marshalling, fuelling, de-icing, and cleaning of aircraft, and he was not certain who, within his company, was responsible. In fact, according to Mr Coates, in the absence of an internal inspection system, the only means by which Air Ontario could ensure the competence of its ground handlers would be reports from flight crews to system operations Control. As the following testimony of Air Ontario pilot, Captain Keith Fox, reveals, flight crews are themselves not trained to understand or monitor all aspects of a ground handler's or fueller's duties:

> Q. ... Given the fact that you used Jet B and that Jet B has a flash point something below zero, I believe, were you familiar with all of the grounding and bonding techniques that Fokker recommended for refueling the F-28 or is that something that you relied upon the ground crew to be familiar with?
>
> A. I was not familiar with it. I would rely upon the ground crew.
>
> (Transcript, vol. 51, p. 259)

When an air carrier contracts for ground-handling and fuelling services, it should satisfy itself that the contractor is competent. This can be achieved only by thorough training and purposeful monitoring by individuals with relevant operational knowledge and experience. As I have outlined in chapters 21 and 9 on hot refuelling and crash, fire-fighting, and rescue, many ground-handling activities, particularly aircraft refuelling, are potentially dangerous. The travelling public requires the assurance that ramp activities are conducted by well-trained, competent individuals operating properly maintained equipment.

I also find it difficult to comprehend why Mr Cochrane declined the training course. Mr Paul Lefebvre, an Air Canada station attendant who appeared before me in the de-icing phase of the hearings of this Commission, testified that Air Canada's station attendants receive a five-week training course, including separate instruction on the different aircraft types, followed by a six-month period of supervision and probation. Dryden Flight Centre was an agent for Air Ontario, whose training expenses would have been covered by Air Ontario. I can therefore see no acceptable reason why Dryden Flight Centre personnel did not take the ground-handling training course for Air Ontario's F-28 aircraft.

Aircraft Fuelling: Training

Pursuant to an ESSO aviation dealer agreement dated August 1, 1985, which the Dryden Flight Centre entered into with Imperial Oil, the Dryden Flight Centre undertook to "properly train all personnel involved in loading, handling and delivery of aviation petroleum products" (Exhibit 170, para. 11).

Mr Beeler testified that although he had no training or prior experience fuelling an F-28, he reviewed the Fokker F-28 Fuelling Procedures Manual, and fuelled the F-28 aircraft with his employee, Mr Fillier, on a couple of occasions, until he was satisfied that Mr Fillier understood the fuelling system. Also, as previously noted, Mr Cochrane's only previous experience on F-28 fuelling procedures occurred when he observed the fuelling of an F-28 in 1987.

The two manuals supplied by Air Ontario do not refer to the issue of hot refuelling. The Fokker F-28 Fuelling Procedures Manual and the Fokker F-28 Ground Handling and Service Data Manual, which for the most part are identical, state that pressure fuelling while an engine or APU is running is acceptable if certain precautions are followed. There is no mention of passenger protection in the list of precautions (Exhibits 180 and 181, section 4.1.9). The ESSO Aviation Operations Standards Manual provides detailed instruction on fuelling with one engine running.

I heard no evidence that Air Ontario was involved in any way in training fuelling personnel at Dryden Municipal Airport, nor did the Dryden Flight Centre request any such assistance. As discussed in chapter 21, F-28 Program: Hot Refuelling and Ground De-icing, there is also no evidence that Air Ontario trained its flight crews in fuelling procedures to assist them in monitoring off-line fuelling effectively.

Similarly, notwithstanding the cited excerpt from Transport Canada's Air Carrier Inspector (large and small aeroplanes) manuals, Mr Beeler testified that the Dryden Flight Centre's refuelling operation had never been subject to a Transport Canada inspection. It is my strongly held view that Transport Canada must take seriously the guidelines set out in its own publication and routinely inspect the training and activities of aircraft fuellers and ground handlers.

Findings

- The Piedmont Airlines and USAir ground school course and instruction provided to Air Ontario F-28 pilot trainees were generally thorough and comprehensive in form and content.

- Training and instruction given and received on an aircraft flight simulator is more comprehensive and thorough than training and instruction given and received on an aircraft, because an aircraft flight simulator is capable of simulating abnormal situations and dangerous flight manoeuvres that are not possible to perform in an aircraft without exposing the aircraft and occupants to unacceptably high risk.

- Captain Morwood received his F-28 aircraft flight training primarily on an F-28 flight simulator, accumulating 20 hours prior to taking a pilot proficiency check ride.

- First Officer Mills received all of his aircraft flight training on an F-28 aircraft, accumulating approximately 8.5 hours prior to receiving his pilot proficiency check ride.

- Captain Morwood received 27.5 hours of line indoctrination before commencing his duties as a line captain.

- First Officer Mills received approximately 20 hours of line indoctrination before he began flying as a line first officer on the F-28.

- As a result of receiving his F-28 training in an aircraft flight simulator, Captain Morwood probably received better and more thorough training and instruction than First Officer Mills.

- Captain Morwood commenced line flying as a captain on the F-28 aircraft with 29 hours in the F-28 aircraft and 30 hours simulator time.

- First Officer Mills commenced line flying as a first officer on the F-28 aircraft with approximately 30 hours of flight time, 9.5 hours of which were acquired during aircraft flight training.

- Both Captain Morwood and First Officer Mills completed the pilot ground training, pilot flight training, and line indoctrination training requirements for the F-28 aircraft in accordance with Canadian regulations and Air Navigation Orders.

- Although both Captain Morwood and First Officer Mills were qualified to operate and carry out flight crew duties in the F-28 aircraft in accordance with Canadian regulations and Air Navigation Orders, Air Ontario did not have a policy in place to prevent the pairing of both a low time-on-type captain and first officer.

- Air Ontario's F-28 Project Plan approved by the executive committee of Air Ontario and by Air Canada contemplated that Air Ontario would have an F-28 specialist hired on a contract basis to assist and advise Air Ontario on the operations of the F-28.

- The F-28 specialist was to be available for aircraft acceptance and for airborne training and line indoctrination during initial startup of the project.

- Captain Claude Castonguay was hired by Air Ontario's director of operations to fill the F-28 specialist function and to conduct F-28 simulator and line indoctrination of Air Ontario pilots.

- Captain Castonguay has over 27,000 flight hours, 11,000 of which are on large turbojet-type aircraft. He is experienced in operating large turbojet-type aircraft in an air carrier operational environment, and was fully qualified to act as Air Ontario's company check pilot.

- Captain Castonguay was also hired by Air Ontario to fulfil its requirement to have, during the initial implementation of the F-28 aircraft into Air Ontario service, a qualified company check pilot for the F-28 aircraft acceptable to Transport Canada.

- Based on the submissions made to it by Air Ontario and on the flying experience and qualifications of Captain Castonguay, Transport Canada granted approval for Captain Castonguay to act as Air Ontario's company check pilot for the F-28 aircraft.

- Captain Castonguay was employed by Air Ontario for approximately one month, from January 24, 1988, until February 29, 1988, at which time he tendered his resignation. He was later rehired by Air Ontario for a two-week period, in July 1988, to conduct F-28 line indoctrination.

- Air Ontario failed to advise Transport Canada of the resignation of Captain Castonguay and its resultant lack of a qualified F-28 company check pilot during a critical phase of its F-28 implementation program.

- Air Ontario should have replaced Captain Castonguay as its F-28 company check pilot with an experienced and qualified F-28 pilot during a critical phase of its F-28 implementation program.

- Transport Canada, because of its failure to monitor Air Ontario's F-28 implementation program, was unaware of the fact that, after Captain

Castonguay's resignation, Air Ontario did not have an experienced and qualified F-28 company check pilot between February 24, 1988, and March 13, 1988.

- During the time that Captain Castonguay was employed by Air Ontario as a company check pilot, certain deficiencies existed in F-28 flight crew cockpit and flight operations procedures, including:
  - there was no proper crew coordination concept;
  - no operational flight plan was issued to or used by the flight crews on the F-28 aircraft;
  - no aircraft flight log was used by F-28 flight crews to keep track of flight times, distances, fuel burns, and aircraft weights;
  - Air Ontario allowed circling-approach procedures to be conducted in the operation of the F-28 aircraft before the pilots had sufficient flight experience on the aircraft.

- The operation of F-28 aircraft with contaminated wings was dealt with thoroughly in the ground school instruction and training provided by Piedmont Airlines and USAir. The instructors cautioned the pilot-trainees against operating an F-28 aircraft with contaminated lifting surfaces in all flight modes including takeoff.

- All Air Ontario pilots who took the Piedmont/USAir ground school training course, including Captain George Morwood, received thorough instruction, warning, and caution that it was of utmost importance that the F-28 be operated at all times with a clean, uncontaminated wing.

- Most of the Air Ontario pilots who testified had a general understanding of some form of the cold-soaking phenomenon, but appear to have learned about its effect largely through operational experience.

- At the time of the crash, the A.I.P. Canada: Aeronautical Information Publication, which is circulated to all Canadian licensed pilots, contained a caution regarding taking off with contamination on the lifting surfaces, but failed to deal with the phenomenon of cold-soaked wings, cold-soaked fuel, and its potential to cause contamination to adhere to wings.

- While both Captain Morwood and First Officer Mills may have had some knowledge and experience regarding wing cold soaking, they may not have been sufficiently aware of or knowledgeable about the insidious nature of the cold-soaking phenomenon and, in particular,

the effect of cold fuel in the wing tanks in contributing to or causing moisture to adhere to wing surfaces adjacent to wing tanks.

- A systematic and comprehensive discussion of the cold-soaking phenomenon does not exist in the manuals reviewed by this Commission, such as manufacturers' aircraft flight manuals, air carriers' aircraft operating manuals, and air carriers' flight operations manuals, which are normally referred to and used by flight crews on a day-to-day basis.

- Air Ontario pilots who took the Piedmont/USAir F-28 ground school training course, including Captain Morwood and First Officer Mills, received instruction in the use of the slush-correction chart for takeoff in runway contamination contained in the Piedmont and USAir F-28 operations manuals.

- Some Air Ontario pilots also received some instruction in the use of the runway slush-correction graph and chart contained in the Fokker F-28 Flight Handbook.

- Although Piedmont ground school instructors may have demonstrated to Air Ontario student pilots how to use the Fokker F-28 Flight Handbook slush-correction charts, neither Piedmont Airlines nor USAir used the Fokker chart for operational use.

- Although there was no advice or instruction by Air Ontario management to its F-28 pilots that they should use only the slush-correction chart contained in the Piedmont and USAir operations manuals, there was a general consensus among Air Ontario F-28 pilots that, because they were to use the Piedmont Airlines F-28 Operations Manual for purposes of operating the aircraft, they must also comply with the slush-correction charts contained therein.

- Both Captain Morwood and First Officer Mills should have been aware of the restrictive weight limitations imposed on the aircraft by the slush-correction chart contained in the Piedmont and USAir operations manuals.

- There are no Canadian regulatory requirements pertaining to the training of personnel involved in the ground handling, fuelling, or de-icing of aircraft, and Transport Canada has no stated policy with respect to the training of ground handlers and de-icing personnel.

- Although Air Ontario and Dryden Flight Centre contemplated the provision of instructors and materials to train ground-handling personnel, no such training was provided by Air Ontario to Dryden Flight Centre regarding such ground-handling training.

- Transport Canada air carrier inspectors, as part of an inflight inspection, are required to inspect aircraft servicing and ramp safety, including fuelling procedures, baggage and passenger loading methods, and safety and fire precautions.

- Transport Canada policy documents state that aviation regulation inspectors are to inspect and monitor ground handlers, and that airworthiness inspectors are responsible for monitoring fuelling operations.

- With respect to the Dryden Flight Centre, neither its ground-handling procedures nor fuelling operations with respect to Air Ontario's F-28 aircraft were monitored by Transport Canada at the Dryden Municipal Airport.

- The initial training provided to flight attendant Sonia Hartwick by Air Ontario in 1986, while reasonably thorough, did not include adequate practical (hands-on) emergency procedures training.

- The recurrent flight attendant training provided by Air Ontario to Mrs Hartwick in October 1988 did involve hands-on training in simulated emergency situations and was far superior to the initial training previously provided. This recurrent training, however, did not involve the F-28 aircraft.

- Air Ontario failed to provide practical (hands-on) emergency procedure training to flight attendant Sonia Hartwick, and probably to other F-28 flight attendants, with respect to the F-28 aircraft.

RECOMMENDATIONS

It is recommended:

MCR 67 That Transport Canada ensure that a systematic and comprehensive discussion of cold soaking be inserted in air carriers' flight operations manuals and/or aircraft operating manuals and in Transport Canada publications such as the Aeronautical Information Publication, to make all pilots and aviation operational personnel aware of the insidious nature of the cold-soaking phenomenon and the various factors that may cause contamination to adhere to aircraft lifting surfaces.

MCR 68 That Transport Canada ensure that all air carrier pilot flight training be conducted in aircraft flight simulators to the maximum extent possible.

MCR 69 That Transport Canada ensure that an air carrier, if it does not have pilots with the requisite and necessary flight experience on the aircraft when it introduces a new aircraft type, provide sufficient non-revenue flying time for its pilots to enable them to gain the requisite experience.

MCR 70 That Transport Canada encourage air carriers lacking pilots with sufficient experience on a new aircraft type to provide highly experienced pilots from outside the air carrier to assist in training the air carrier's pilots and to fly with them until they have gained an adequate level of flight experience on the new aircraft type.

MCR 71 That Transport Canada proffer for enactment legislation with respect to flight crew pairing, requiring that one of the flight crew members, either the pilot-in-command or the first officer, have substantial flight experience on the aircraft type.

MCR 72 That Transport Canada routinely inspect the activities of aircraft fuellers and ground-handling personnel, to ensure that they are properly performing their duties and to ensure that these personnel have received adequate training.

MCR 73 That Transport Canada ensure that all ground-handling personnel, whether employed by the air carrier or by a contract agent, receive ground-handling training on all aircraft types that they will be required to handle. If personnel are required to refuel aircraft, they should also have knowledge of proper fuelling procedures.

MCR 74 That Transport Canada proffer for enactment regulations setting the training and competency requirements for cabin attendants.

MCR 75 That Transport Canada monitor and periodically audit the cabin attendant training program of all air carriers to ensure that such training meets the standards set.

21 THE F-28 PROGRAM: OPERATIONAL PRACTICES – HOT REFUELLING AND AIRCRAFT GROUND DE-ICING

Hot Refuelling

Aircraft refuelling is always potentially dangerous, and it is essential that there be coordination of the activities of all personnel involved – the flight crew, the flight (cabin) attendants, and ground-handling personnel.

In the early phases of this Inquiry, I heard evidence regarding the refuelling of the F-28 aircraft C-FONF in Dryden, on March 10, 1989, with its right main engine running while passengers were on board.

In my *Interim Report* of November 30, 1989, I examined this issue and recommended that:

> The Department of Transport prohibit the refuelling of an aircraft with an engine operating when passengers are on board, boarding, or deplaning.[1] (p. 23)

In response to this recommendation, the minister of transport took immediate action and took steps to give effect to the recommendation by way of regulation. On August 28, 1990, section 540 of the Air Regulations was amended to read:

> 540.1 No operator of an aircraft shall permit the fuelling of an aircraft while an engine used for the propulsion of the aircraft is operating if passengers are on board or are entering or leaving the aircraft.[2]

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[1] The recommendations from my *Interim Report*, 1989, and my *Second Interim Report*, 1990, are reprinted in Part Nine of this Report, Consolidated Recommendations. This recommendation is numbered MCR 1.

[2] It is to be noted that the minister of transport gave immediate notice to air carriers of the intended regulatory change and requested that carriers voluntarily comply with the intent of the recommendation until the regulation was ultimately amended.

Subsequent to my first *Interim Report*, I heard additional evidence regarding the hot refuelling of aircraft C-FONF on March 10, 1989, and I think it appropriate to address further this issue in the context of the Commission's system investigation of the crash of C-FONF on March 10, 1989.

Air Ontario Policy

Transport Canada had no policy on hot refuelling as of March 10, 1989. Similarly, Air Ontario did not have a policy set out in its Flight Operations Manual (FOM) that would have precluded a hot refuelling with passengers on board; nor was there an established flight operations policy regarding procedures or guidelines to be followed in the event of a hot refuelling.[3]

The Air Ontario FOM, carried by all pilots of the carrier, contained a section entitled "Aircraft Fuelling Procedures." That section, however, makes no mention of refuelling with an aircraft engine running, while clearly endorsing refuelling with no engines running and with passengers on board.

> 7.19 AIRCRAFT FUELLING PROCEDURES
>
> (a) On-Line Fuelling – It is the responsibility of Air Ontario to be satisfied that refueling contractors are properly qualified and trained in refueling procedures and kept advised of any changes thereto. The Captain will not accept any aircraft which has not been fueled to the required minimum for flight dispatch. Actual departure fuel quantity will be shown in the weight and balance form displayed in the chapter "Flight Dispatch."
>
> (b) Off-Line Fueling – All procedures remain the same as at on-line stations with the exception that the flight crew must supervise the re-fueling and ensure all procedures are complied with.
>
> (c) Re-fueling with Passengers on Board – The Purser [in-charge flight attendant] must be notified that fueling is in progress. The Purser will ensure that there is absolutely no smoking; the main entrance door is open; the

[3] It should be noted that, on March 10, 1989, C-FONF was refuelled at Dryden with Jet B fuel, which, at +1°C, the ambient temperature at Dryden at that time, is within the flammability range of the fuel. That is, at that temperature Jet B fuel gives off fumes in sufficient concentration to burn if ignited. In contrast, the more common Jet A fuel would not have been within its flammability range at that temperature.

evacuation slide armed; flight attendants are in position for a rapid evacuation in case of a fire.

(d) Fuel Spill – If a fuel spill occurs the Captain will notify A.T.C. immediately and request the Airport Fire Department to immediately proceed with flushing procedures to minimize the risk of fire.

(Exhibit 146, pp. 7-15–7-16)

In contrast to the scant mention of the subject in the Air Ontario FOM, the Air Ontario Flight Attendant Manual (FAM) contained a section entitled "Refuelling Restrictions," which sets out, in greater detail, the procedures to be followed during aircraft fuelling. Although the FAM provisions specifically permitted the fuelling of an aircraft with passengers on board, with no engines running, subject to certain conditions set out therein, it clearly required the off-loading of passengers during the refuelling with one engine running:

2.31 Refuelling Restrictions

Fueling with passengers onboard or embarking/disembarking is permitted in accordance with the airport local regulations and provided the additional safety precautions as listed below are strictly complied with. The Captain or designated flight deck crew member will coordinate the requirements with the Purser and Ramp Control.

1. A flight deck crew member is on the flight deck.

2. Interphone contact between the flight deck/cabin and ground is available.

3. The flight Attendants have been advised that fueling will take place.

4. The NO SMOKING sign is on. The no smoking rule will be enforced. No striking of matches or use of flame producing devices is permitted.

5. Flash bulb photography is not permitted.

6. No oxygen is to be administered.

7. The exit doors are unobstructed at all times.

8. The Flight Deck and Cabin must be informed of any situation endangering the safety of the aircraft and its occupants.

9. The main entry door remains open with stairs in position, and on the CV580 [aircraft] the aft service door will be armed and minimum Cabin Crew limitations are met, with crew being stationed close to their assigned floor level exit(s).

10. Promptly notifying refuelling personnel if fuel vapours or any other hazard are detected in the cabin. If such conditions occur, the fueling will be discontinued.

11. When additional fuel is required after passenger boarding has been completed, the requirement for the main door to be opened with the stair in place may be disregarded under the following conditions:

    a) all loading and catering equipment is removed from the aircraft allowing room for slide deployment
    b) CV-580 aft door is armed and crew is on standby for immediate evacuation via slide
    c) interphone contact between ground and flight deck is established

12. *When refuelling is required with one engine running, all passengers are to be off-loaded and cleared from the area during the refuelling period. Flight Attendants should also leave the aircraft.*

(Exhibit 137, section 2.31; emphasis added)

In the case of a refuelling with no aircraft engines running, both the Air Ontario FOM and FAM direct that the purser be informed by the flight crew when refuelling is to take place with passengers on board the aircraft. The presumption is that once the purser is informed of the intended procedure by the pilots, he or she will ensure that the precautions listed in the FAM are carried out. The FAM provisions contemplate close cooperation among the pilots, the flight attendants, and the refuelling personnel, directing that there must be interphone capability between the flight deck/cabin and the ground. It is rather odd that these directives are included in the FAM and not the FOM, since the arrangements relating to fuelling could be made only by the pilots.

It is quite incomprehensible as to why the Air Ontario FAM addressed the required refuelling safety precautions in greater detail than the Air Ontario FOM. I am also concerned that there appears to have been no cross-referencing between the FOM and the FAM, even though, as of March 10, 1989, Air Ontario flight attendants and pilots were all part of the flight operations department, with the manager of in-flight services and the director of flight operations both reporting to the Air Ontario vice-president of flight operations.

Further to my earlier comments in chapter 19 of this Report, F-28 Program: Flight Operations Manuals, it would appear that the persons responsible for the production and amendment of the FOM and the FAM did so without reference to the other manual. This is particularly problematic in areas like refuelling, where close cooperation was required between pilots and flight attendants.

Personnel of the Dryden Flight Centre who conducted the hot refuelling of aircraft C-FONF on March 10, 1989, were given guidance on fuelling procedures from a number of sources. As discussed earlier (chapter 5, Events and Circumstances Preceding Takeoff, and chapter 9, Crash, Fire-fighting, and Rescue Services), at least four manuals related to fuelling were supplied to Dryden Flight Centre. Two were supplied by Air Ontario (Air Ontario Inc. Fokker F-28 Fuelling Procedures Manual, and Fokker F-28 Ground Handling and Service Data Manual), and two were ESSO manuals (ESSO Aviation Fuelling Guide, and ESSO Aviation Operations Standards Manual). The two manuals supplied by Air Ontario did not refer to hot refuelling.

The Air Ontario Inc. Fokker F-28 Fuelling Procedures Manual and the Fokker F-28 Ground Handling and Service Data Manual, which were substantially the same, stated that pressure fuelling while an engine or auxiliary power unit (APU) was running was acceptable if certain precautions were followed. These precautions were general in nature and were to be used when refuelling with an engine or an APU running. No mention was made of deplaning passengers or positioning the aircraft away from the terminal.

The ESSO Aviation Operations Standards Manual provided detailed instruction on fuelling with one engine running, including the following prohibition:

> Fueling must not be started until all passengers:
> - have vacated the aircraft
> - are kept at a distance of at least 46 metres (150 feet)
>
> (Exhibit 173, section AOSM 020-007, p. 2)

The evidence suggested that Air Ontario policy and procedures regarding the fuelling of its aircraft were characterized by a lack of coordination. Pilots, flight attendants, and ground-handling personnel, all of whom should have had well-defined responsibilities regarding the fuelling of Air Ontario aircraft, were instead guided by a number of uncoordinated operational manuals that were, in some respects, inconsistent.

With regard to the specific practice of hot refuelling, the evidence suggested that there was no policy communicated and understood by key operational personnel. In the absence of clear company policy, it would appear that some personnel derived their own hot-refuelling

procedures based on practical experience. By way of example, I refer to the evidence of Air Ontario Dash-8 captain, David Berezuk. Captain Berezuk was asked about his experience regarding refuelling with one engine running. He stated that such a practice was often used by pilots in the north as a means of expediting station stops. He also indicated that the pilots followed what Captain Berezuk considered to be safe procedures. He testified as follows:

> Q. ... So basically what you do is to expedite a through-trip, you stop, one engine is shut down; you leave another engine running and you refuel with one engine running, is that correct?
> A. That is correct.
> Q. And the times that you have done this type of refuelling with an engine running, have there been passengers on board?
> A. Yes.
> ...
> Q. Now, in what areas have you done this; where have you done this?
> A. Most of our operation up north in the arctic and in northern remote areas.
> Q. And when you did these refuellings with an engine on, what precautions did you take?
> A. The precautions I stated before were the main cabin door with stairs extended were left in the open position, the door was not locked as far as passenger egression or deplaning, the ... quickest means, in case there [were] any problems.
>
> There was a credited flight crew member in the cockpit in order to secure the engine to shut down the aircraft and assist in evacuation in the event of some problem.
>
> (Transcript, vol. 14, pp. 170–71)

It appears that in the absence of a company policy which placed restrictions on hot refuelling, Air Ontario pilots relied on their own experience and continued to refuel with passengers on board.

There is evidence that Air Ontario management made an attempt to provide guidance on policy and procedures regarding the hot refuelling of its F-28 aircraft. This evidence is in the form of a June 2, 1988, memorandum authored by Mr Bruce Maxim of Air Ontario and given to Captains Robert Murray, Robert Nyman, and Walter Wolfe. Air Ontario director of flight operations Robert Nyman gave evidence on the subject of the memorandum:

> Q. ... the title of this is F28 Station Operation with an Engine Running. Under the heading Important, it reads: "This is a special procedure and must only be used at those stations where ground support equipment is not provided or where the neces-

sary equipment is unserviceable." Would that apply to the Dryden Airport?

A. Yes, it would.

Q. And if you can turn the page over to Additional Procedures for Refuelling, and just reading quickly the terms:

9 The fuelling vehicle must be located at the front of the wing tip.

10 Fuelling hoses and their (connectors) must be leak-free.

11 The fuelling hose should be routed below the wing so that in case of a hose burst, the emergency fuel-spray cannot enter the engine or APU intake.

12 Fuelling operations must be monitored continuously.

13 During pressure refuelling, either (left-hand) or (right-hand) engine may be running at idle RPM.

14 During gravity refuelling, the running engine must be opposite to the overwing fuelling point.

The above assumes that these procedures occur without passengers on board. In the event that fuelling takes place with passengers on board, it is mandatory that the station fire trucks are standing by the aircraft. Otherwise, passengers must be deplaned.

Do you recall discussing so-called hot-refuelling procedures as detailed in this particular memo?

A. Do I recall discussing them? No.

Q. Did you recall reviewing the procedure as set out in the memo at the time?

A. No.

Q. Again, you were the Director of Flight Operations at that time, I believe; is that right?

A. Yes, I was.

Q. Did you adopt the recommended practices set out in this memo with respect to hot refuelling?

A. We did not.

Q. And why did you not?

A. Well, I shouldn't say we didn't adopt it. We did not advise anybody of the procedures.

(Transcript, vol. 108, pp. 56–58)

It should be noted that this proposed policy does not preclude hot refuelling with passengers on board; but if passengers are on board, then the station fire trucks must be standing by the aircraft.

I think it is instructive to review the hot-refuelling policy of Air Ontario's parent company, Air Canada.

Air Canada Policy

Air Canada's policy is that aircraft fuelling with a main engine running is not to be carried out as a planned procedure in normal operations.[4] This policy ensures that, except in rare circumstances, refuelling with an engine running is not required in normal operations. However, recognizing the possibility of being forced by peculiar circumstances to hot refuel, Air Canada has specific instructions set out in the aircraft operating manual for each aircraft type to address that contingency. Although these instructions are specific to each aircraft type, some parts of the instructions, such as the requirement to deplane all passengers and flight attendants prior to commencing the refuelling, are common to all types of aircraft. Captain Charles Simpson, Air Canada's senior vice-president of flight operations, gave the following testimony regarding his company's refuelling procedures for the Boeing 767:

> A. ... I brought an excerpt from the 767 operating manual again, the procedure that has to be used if you refuel with an engine running.
>
> And I guess the key to it is that you will take certain precautions because it's abnormal. We give the crew specific instructions of how it's to be done, even to the extent to ensure that the aircraft is positioned away from the terminal or other facility, and of course, all passengers are deplaned during the process.
>
> Q. And that was reiterated on the second page [of exhibit 911] where it says passengers and cabin crew may not be boarded until refuelling is completed?
>
> A. That's correct.
>
> (Transcript, vol. 118, p. 128)

For present purposes, three noteworthy aspects of Air Canada's policy regarding hot refuelling are:

1 It is not a normal operation, and hot fuellings are not to be planned.
2 The aircraft is to be moved some distance from the airport terminal building.
3 Passengers are to be deplaned.

On March 10, 1989, Air Ontario system operations control planned the hot refuelling that occurred at Dryden during the flight 1363 station stop; the aircraft was not positioned a safe distance from the airport terminal; and the passengers remained on board.

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[4] This policy is compatible with Air Canada's policy, discussed in chapter 16, F-28 Program: APU, MEL, and Dilemma Facing the Crew, of not dispatching an aircraft with an unserviceable APU to a station without ground-support equipment.

Findings

- Hot refuelling is not a normal procedure.

- Air Ontario, as of March 10, 1989, did not have a consistent company policy that would have precluded the hot refuelling of an aircraft with passengers on board and a main engine running (hot refuelling). The Air Ontario Flight Attendant Manual (FAM) specifically prohibited such a practice, while the Flight Operations Manual (FOM) was silent on the subject.

- The Air Ontario policy and procedures regarding the fuelling of its aircraft were contained in a number of uncoordinated operational manuals.

- Both the Air Ontario FOM and FAM permitted the refuelling of an aircraft with passengers on board with no engines running. The FAM contained more specific restrictions and much more detail on the procedures to be followed in such a situation than did the FOM.

- There were no consistent and comprehensive procedures provided by Air Ontario to its pilots and operational personnel regarding the fuelling of F-28 aircraft with a main engine running.

- The Air Ontario FOM, its FAM, and the manuals used by ground-handling personnel at Dryden were significantly inconsistent in their treatment of the hot-refuelling procedure.

- Air Ontario lacked a clear policy with respect to hot refuelling of aircraft, and such policy as existed was not properly communicated to and understood by pilots and by operational personnel.

- There was no information available in manuals or documents normally available to and used by Air Ontario F-28 pilots regarding the hot refuelling of an aircraft either with or without passengers on board.

- Because of the lack of a clear company policy and specific procedures for hot refuelling of an aircraft, Air Ontario pilots resorted to improvising individual hot-refuelling procedures based on their own practical experience, when the occasion required.

- Given that there was no F-28 ground-start facility at Dryden, one of Air Ontario's scheduled F-28 station stops, there was a reasonable

likelihood that, at some time in normal commercial operations, it might be necessary to fuel an F-28 aircraft at that station with a main engine running.

- Air Ontario senior operations management should have established, but did not establish, a procedure to accommodate such a contingency. By failing to do so, Air Ontario allowed a potentially unsafe situation to manifest itself on March 10, 1989.

- On March 10, 1989, Air Ontario F-28 C-FONF was refuelled at Dryden, Ontario, while one main engine was running.

- Although this hot refuelling was planned by Air Ontario system operations control (SOC), no instructions were given by Air Ontario SOC for the deplaning of passengers at Dryden while flight 1363 was being hot refuelled at that station.

- The surviving flight attendant was not notified of the hot-refuelling procedure and was unaware of it.

- The passengers on board the aircraft were not deplaned prior to the hot refuelling of the aircraft, contrary to the provisions of the Air Ontario FAM.

- The hot refuelling of C-FONF involved the more volatile Jet B fuel, and a small fuel spill occurred.

- The aircraft was not parked a safe distance from the Dryden terminal during the hot-refuelling procedure, contrary to the provisions of the Air Ontario FAM.

- The ground-handling personnel conducting the hot refuelling were not familiar with proper hot-fuelling procedures, including the use of the deadman switch and proper bonding and grounding.

- The hot refuelling of flight 1363 at Dryden on March 10, 1989, was carried out in a manner that exposed to unnecessary risk not only those persons on board the aircraft but also the nearby terminal and its occupants.

Aircraft Ground De-icing

The Clean Aircraft Concept: Interim Recommendation No. 2

In the first *Interim Report* of this Commission, I concluded:

> On the basis of the evidence I have heard, I am satisfied beyond any doubt whatsoever, and I find, that the critical upper-wing surfaces of the aircraft were, at all material times, severely contaminated with heavy wet snow and that such contamination was at least a contributing factor to the crash that occurred.
>
> (*Interim Report*, p. 25)

At the time of the Dryden accident, the Canadian regulation pertaining to commencement of a flight by a large aircraft with wing contamination was found in Air Navigation Order (ANO) Series VII, No. 2, section 25(3), which stated:

> No person shall commence a flight when the amount of frost, snow or ice adhering to the wings, control surfaces or propeller of the aeroplane may adversely affect the safety of the flight.

Implicit within this section of the ANO is the permissibility to commence a flight with frost, snow, or ice adhering to the aircraft's lifting surface, provided that, in the pilot's discretion, this contamination will not adversely affect the safety of flight.

Given the known hazards posed by contamination of aircraft lifting surfaces; the difficulties in accurately predicting performance decrements due to any given amount of wing contamination; and the permissive nature of the ANOs respecting takeoff with wing contamination, I recommended that:

> The Department of Transport immediately develop and promulgate an Air Navigation Order applicable to all aircraft that would prohibit takeoffs when any frost, snow, or ice is adhering to the lifting surfaces of the aircraft, and the Department of Transport provide guidelines to assist aviation personnel in conforming to the amended orders.[5]
>
> (Interim Recommendation No. 2, p. 28)

[5] MCR 2 in Part Nine, Consolidated Recommendations

I am pleased to note that this interim recommendation met with a favourable response from Transport Canada. Immediate steps were taken in the form of a letter from the minister of transport advising all Canadian carriers of Transport Canada's acceptance of my interim recommendation, along with a request for compliance with the intent of the recommendation during the period that the air regulations were being amended.[6] On November 1, 1990, section 540.1 of the *Aeronautics Act* was amended to give effect to Interim Recommendation No. 2 of this Commission.

Air Ontario's Policy on Flights in Icing Conditions

This section should be read in conjunction with chapter 12 of this Report, Aircraft Performance and Flight Dynamics, where, in the context of the performance and flight dynamics of the F-28, I discuss information and procedures available for safe operation in cold-weather operations. Specific attention is drawn to the provisions in the Fokker F-28 Flight Handbook, the Piedmont F-28 Operations Manual, and the USAir F-28 Pilot's Handbook addressing cold-weather operations. In the following pages, I address the company-specific cold-weather operations policy adopted by Air Ontario, as set out in its Flight Operations Manual (FOM).

Air Ontario's FOM states that "Take-off shall not be attempted when frost or freezing precipitation is adhering to the surfaces of the aircraft" (Exhibit 146, p. 7-3).[7] Rather than prominently displaying this critical prohibition in its FOM, Air Ontario included it in the broader operational directive dealing with in-flight operating procedures in icing conditions. Moreover, the directive is applicable to all aircraft types, including the F-28, and is not accompanied by a caution similar to those found in the Fokker F-28 Flight Handbook and the Piedmont and USAir F-28 operations manuals.

Unlike section 25(3) of ANO Series VII, No. 2, which included discretionary words permitting pilots to take off with frost, snow, or ice adhering to the aircraft, provided it does not "adversely affect the safety of the flight," Air Ontario's FOM prohibits pilots from attempting to

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[6] Under letter dated March 15, 1990, from then Minister of Transport Doug Lewis to Commissioner Moshansky, Transport Canada provided the following response to Interim Recommendation No. 2: "The Department of Transport will take action to amend the Air Regulations to state that no person shall commence a flight if frost, ice or snow is adhering to the lifting surfaces or propellers of the aircraft and will provide guidelines for the interpretation of these regulations."

[7] The Air Ontario Flight Operations Manual, Part 10.1.1, provides the following meaning of the words "may," "should" and "shall": may – permissive; should – informative; shall – imperative, compliance is mandatory.

take off with frost or freezing precipitation adhering to aircraft surfaces, but is silent in relation to snow adhering to aircraft surfaces. In this sense, Air Ontario's FOM is more restrictive than the ANO Series VII, No. 2, section 25(3), and more closely resembles the "clean wing concept" that I recommended in my first *Interim Report.*

In that the FOM represents Air Ontario's company policy, it follows that Air Ontario flight crews, including Captain Morwood and First Officer Mills, would have been bound not to attempt a takeoff when frost or freezing precipitation adhered to the surfaces of their aircraft. Because Air Ontario's FOM is more restrictive than the ANO in this regard, it would be possible for an Air Ontario pilot to contravene company policy while still being within the bounds of the Air Navigation Order. Theoretically, this situation could occur where an Air Ontario pilot attempted a takeoff with frost or freezing precipitation adhering to the surface of the aircraft, but where, in the pilot's discretion, it would not adversely affect the safety of the flight. Compliance with a company manual should guarantee compliance with the Air Regulations since the company manual can be no less restrictive than the Air Regulations.

Although the FOM is more restrictive than the air regulation in the context described above, in another respect it may be less restrictive. Where the ANO speaks of "frost, snow or ice adhering to the wings," the directive to Air Ontario pilots in the FOM mentions only "frost or freezing precipitation." The omission of any reference in the FOM to snow adhering to the wings creates the potential for uncertainty as to the intention of the directive that the company provided to its pilots. The fact that snow is not mentioned could leave the impression that takeoff may be attempted with snow on the aircraft, and even adhering to it. It is unclear whether the company is deliberately, and unscientifically, distinguishing the adhering properties of frost and freezing precipitation from those of snow on the basis that snow may be more likely to blow off on takeoff. If this is a deliberate distinction on the part of Air Ontario, it fails to take into account the phenomenon of cold soaking, which is discussed in chapter 12 of this Report, Aircraft Performance and Flight Dynamics.[8] Further, if company policy countenances the dangerous practice of attempting takeoff with snow on the wings, there is no guidance given to pilots as to how to make a judgement on whether or not snow would blow off on takeoff.

During the course of the hearings of this Commission, I heard evidence from Air Ontario pilots and flight attendants that some Air

[8] In chapter 12 of this Report, Aircraft Performance and Flight Dynamics, I found that the cold-soaking phenomenon contributed to the freezing of falling snow to the surface of the wings of aircraft C-FONF in Dryden on March 10, 1989.

Ontario pilots had, in specific circumstances, attempted takeoffs with snow on aircraft wings. There is also evidence to suggest that some Air Ontario pilots may have carried out takeoffs even when they were not certain that the snow would blow off during the takeoff run. In the context of a discussion about the Piedmont F-28 ground school training, and the absolute necessity of a clean wing on the F-28 jet aircraft, Captain Erik Hansen testified that, by way of contrast, some amount of contamination was considered acceptable prior to takeoff in propeller-driven Convair 580 aircraft. He testified as follows:

> A. ... But the four of us [captains Morwood, Reichenbacher, Maybury, and Hansen] coming out of Convairs and the Convair will take, you know, some ice and some contaminants prior to departure before, you know, you're really starting to get upset about it.
>
> (Transcript, vol. 94, p. 72)

This reference to Convair aircraft taking "some ice and some contaminants" suggests that some Air Ontario pilots were accustomed to making successful takeoffs in the Convair 580 aircraft with some degree of wing contamination, even though they knew that it would not likely blow off. This group of pilots probably included Captain Morwood, since he was one of the "four" referred to by Captain Hansen in his evidence.

During hearings of the Commission that occurred subsequent to the release of my first *Interim Report*, evidence was heard indicating that takeoffs with contaminated wings were not confined to Air Ontario pilots of Convair 580 aircraft. The evidence shows that some Air Ontario pilots of HS-748 turboprop aircraft performed takeoffs in that aircraft with contaminants adhering to aircraft surfaces. Two such incidents are reviewed in chapter 24 of this Report, Flight Safety.

In examination of the circumstances involved in a December 15, 1987, HS-748 Austin Airways incident (see chapter 24), it was discovered that Captain Joseph Deluce and First Officer Scott Jensen had used an unapproved procedure on takeoff referred to as "the 80-knot check." This unofficial procedure involved a check of the wings by the pilots upon achieving a speed of 80 knots on the takeoff roll to ensure that snow or slush, previously observed on the wings, was blowing off the wings and not continuing to adhere. The evidence with regard to the "80-knot check" further indicates that some Air Ontario (or predecessor company) pilots had attempted takeoffs under the hazardous condition of wet snow or slush contaminating the surface of their aircraft. Because other Air Ontario pilots testified that they had heard of the "80-knot check," it would appear that this was more than just a procedure adopted by Captain Deluce on December 15, 1987.

The majority of the evidence referred to in this section pertaining to Air Ontario's policy for commencing flights in conditions conducive to wing contamination was not heard until after publication of Interim Recommendation No. 2 in my first *Interim Report*. Everything I have heard has reinforced the importance of a speedy transition in policy and attitude to the "clean wing concept." I am fully aware that the "clean wing" order in the United States has not alone precluded contamination-related accidents and incidents in that country. It is therefore of utmost importance that persons at all levels of flight operations be made fully aware of the potentially disastrous consequences of wing contamination on aircraft performance. This was the tenor of my Interim Recommendation No. 3 published in the first *Interim Report*, which I repeat below for emphasis, that:

> The Department of Transport forthwith develop and implement a mandatory and comprehensive education program for all aircrew engaged in commercial operations, including an integrated program for cockpit crew members and cabin crew members, on the adverse effects of wing contamination on aircraft performance, with provision for knowledge verification; and
>
> The Department of Transport similarly develop and implement a mandatory safety-awareness program for all other personnel involved in flight operations, including managers, dispatchers, and support personnel, on the adverse effects of wing contamination on aircraft performance.[9]
>
> (Interim Recommendation No. 3, p. 29)

Winter Operations Advisories

It is vitally important that an airline maintain an efficient system for the distribution of operational information to its pilot group and other operational personnel. Given the number of changes that were going on at Air Ontario in 1987 and 1988, including the introduction of the F-28 jet aircraft into the fleet, and a pilot group new on that aircraft type, the ability to produce and disseminate information was particularly important. Evidence presented before this Inquiry revealed, however,

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[9] MCR 3 in Part Nine, Consolidated Recommendations. Under letter dated March 15, 1990, from then Minister of Transport Doug Lewis, Transport Canada responded favourably to Interim Recommendation No. 3 by agreeing to amend ANO Series VII, Nos. 2, 3, and 6, to require air carriers to establish and maintain a Transport Canada–approved training program concerning the adverse effect of wing contamination on aircraft performance and to provide this training to all crew members and to other air carrier personnel involved in flight operations. On November 1, 1990, the ANOs were amended appropriately (SOR/90-758; SOR/90-759).

that Air Ontario's response to the need to distribute operational information to its pilot group, particularly a winter operations advisory package for operation of the F-28, was deficient.

Mr Teoman Ozdener, a professional engineer employed by Air Ontario as its F-28 maintenance manager from February 1988 to February 1989, had a great deal of experience with F-28 aircraft. He testified that he was aware that an operator had to be "very careful" with the F-28 in icing conditions (Transcript, vol. 101, pp. 220–21), and that he was therefore anxious to implement special procedures for Air Ontario's F-28 winter operations.

On his own initiative, and with the initial support of Air Ontario management, Mr Ozdener had made arrangements to visit the Swedish carrier, Linjeflyg, which operated a large fleet of F-28 aircraft in a winter climate similar to that in which Air Ontario operated. By observing the experienced operator, Linjeflyg, Mr Ozdener had intended to familiarize himself with the practical aspects of F-28 winter operations and then to develop a winter operations information package for Air Ontario. This visit was to have been carried out in April 1988. However, the trip was delayed, and in late summer 1988 Mr Ozdener was told by Mr Kenneth Bittle, vice-president of maintenance, that the trip would not be authorized.

As a result of the cancellation of Mr Ozdener's trip to Sweden, Air Ontario pilots were deprived of what probably would have been a valuable and practical winter operations resource.[10]

Air Ontario Memorandum on F-28 De-ice/Anti-ice Instructions

Mr Robert Mauracher, director of maintenance at Air Ontario, prepared a memorandum, dated September 28, 1988, for the company's reliability committee, on the subject of "F-28 De-ice Anti-ice Instructions." Mr Mauracher's memorandum was based on an operation and maintenance publication produced by Fokker Aircraft, entitled, "Cold Weather Operation," which had been obtained by Mr Ozdener (Exhibit 318, "Operation and Maintenance of Fokker Aircraft, No. 3, Cold Weather Operation," February 1984). The general content of Mr Mauracher's six-page memo is apparent from the following introductory paragraph:

[10] It should be noted that in January 1988, Captain Joseph Deluce and Captain Robert Murray attended at Norcanair/TimeAir to observe its F-28 operation. However, these visits were not specifically related to winter operations, nor were winter operations procedures disseminated to the pilot group as a result of the visits. Also to be noted is that both Captain Joseph Deluce and Captain Robert Murray flew for TimeAir in February–March 1988.

> This memorandum details precautions necessary to protect the aircraft during cold weather ground conditions. Details are also given of the recommended methods for snow and slush removal, de-icing and anti-icing protection.
>
> (Exhibit 317, p. 1)

Mr Mauracher's memorandum contained very useful information for personnel connected with all aspects of the F-28 operation and maintenance, including the F-28 pilots. In fact, as indicated in the following excerpts, it appears that some passages of the memorandum are directly aimed at the flight crew:

> NEVER: Spray while main aircraft engine's are running!!!
>
> ...
>
> The following are Flight Crew or Maintenance Functions:
>
> Check all drains and vent holes are free from obstructions. At this point, remove all protective covers. Check that all control surfaces, including lift dumpers and speed brakes move freely over their complete operating range.
>
> NOTE: Airframe anti-icing system is not intended for de-icing the aircraft on the ground.
>
> WARNING: Even a slight ice roughness (or frost on the wing leading edge) may seriously [impair] the wing lift characteristics. Extreme care must be taken to clean the wing of any ice roughness.
>
> NOTE: If severe weather makes it necessary to de-ice while the APU is running, the APU bleed load control valve and air conditioning main valves must be closed to prevent glycol being blown into the cabin.
>
> (Exhibit 317, pp. 3, 4–5)

Clearly, Mr Mauracher's memorandum contained critical information that should have been required reading for everyone associated with the F-28 operation. It appears from the evidence, however, that distribution of the memorandum was extremely limited.

Mr Ozdener testified that although he was not involved with the reliability committee, he assumed that the various Air Ontario departments that were represented on it would pass the information on to their respective departments. Vice-president of maintenance, Mr Kenneth Bittle, testified that although it was the sort of memorandum that would

usually be circulated to all Air Ontario stations, he did not know if in fact the stations had received it.

It was the evidence of certain Air Ontario system operations control (SOC) personnel that they were familiar with Mr Mauracher's memorandum, and that a copy of it was kept for their reference in SOC. Messrs Wayne Copeland, Danilo Koncan, Warren Brown, and Daniel Lavery all testified that they were familiar with the memorandum. In fact, because of the operational restriction contained in the Mauracher memorandum, Air Ontario duty operations manager (formerly dispatcher) Mr Koncan testified that he would have advised the pilots to overfly Dryden had he been dispatching flight 1363 on March 10, 1989:

> Q. Could you tell the Commissioner what your understanding on the 10th of March of last year was with regard to de-icing the F-28 with engines running.
> A. Engines are to be shut down, as well as APUs are to be shut down while de-icing.
> Q. Was there any further instruction given to you about the dispatch of aircraft, F-28s, unserviceable APUs, into line stations where there was no air starts and the possibility of de-icing?
> A. No, there was not.
> Q. What would you have done in the situation where there was forecast weather and the potential for the necessity of de-icing and an unserviceable APU on an F-28?
> A. If the aircraft was en route, one would be to overfly, to either down-line station, whether it be the alternate. Or, if the aircraft was already on the ground and engines shut down with an unserviceable APU, and the aircraft is parked until such time as a ... portable air start ... can be provided or actually flying a Convair or other aircraft into that station and giving him a buddy start, which consists of hoses for the start capabilities.
>
> (Transcript, vol. 47, pp. 38–39)

The evidence revealed that the F-28 pilot group did not have the same familiarity with the Mauracher memorandum as did the SOC personnel. Several F-28 pilots testified that they had not received a copy of Mr Mauracher's memorandum or, what would have been more appropriate, a pilot bulletin with similar content. While F-28 pilot Christian Maybury testified that he had received the Fokker cold-weather operations publication – the document from which Mr Mauracher derived his memorandum – and understood that it had been provided to all F-28 pilots on the line at that time, F-28 pilots Deborah Stoger, William Wilcox, and Erik Hansen all testified that they had not seen the Fokker publication. Based on the evidence of pilots Stoger, Wilcox, and Hansen, which I accept, I find that the Mauracher memorandum was not distributed to all Air Ontario F-28 pilots.

This issue is further clouded by the evidence of the director of flight operations, Captain Robert Nyman. With respect to Mr Mauracher's memorandum, Captain Nyman recalled having seen it at a meeting of the reliability committee, but he did not believe it was ever distributed to the pilots. However, with respect to the Fokker publication, Captain Nyman testified that, through Air Ontario's internal mailing system, he had personally sent it to all F-28 pilots in August or September 1988, and that he could not explain why Captain Hansen had not received it. Moreover, Captain Nyman believed that he would have sent Captain George Morwood a copy of the Fokker cold-weather operation publication. Captain Nyman confirmed the importance of distributing this material to the pilot group:

> Q. Do you have any knowledge as to whether the memo was disseminated to the pilot group?
> A. I never saw it in the form of a pilot bulletin. I certainly never distributed it to the pilot group.
> Q. Now, the information contained within this particular document, would it be the sort of information that ought to be included either in a standard operating procedure for an aircraft type or the flight operations manual?
> A. Yes, indeed. It should probably be included in either the flight – well, not the flight operations manual. Probably more particular ... an SOP [manual].
> Q. So you are saying that this particular type-specific information ought to be included –
> A. It's the kind of information that you are interested in getting, yes.
>
> (Transcript, vol. 108, p. 124)

The body of evidence on this point does not support a conclusive finding, one way or the other, as to whether Captain Morwood and/or First Officer Mills received the Fokker cold-weather operation publication or the Mauracher memorandum, which contained, among other important information, the crucial proviso, "NEVER: Spray while main aircraft engine's are running!!!" (Exhibit 317, p. 3). What is clear is that a specific pilot bulletin was never disseminated on this point, and there is strong doubt, based on the above-mentioned evidence of Air Ontario pilots, as to whether pilots Morwood and Mills had received the Fokker cold-weather operation publication.

Air Ontario pilots Hansen, Wilcox, Stoger, and Monty Allan testified that they were not aware of specific restrictions against spraying the F-28 for the purpose of de-icing while one engine was running. Only Captain Maybury, who had received the Fokker publication, was aware of such restrictions. In the absence of specific instruction or a company policy on this point, Air Ontario pilots who were questioned in this regard (in

particular, pilots Hansen, Wilcox, and Allan) testified that they considered the practice of de-icing with a main engine running unsafe, because of the risk of ingesting glycol into the engine and the danger of having a person in a de-icing bucket in close proximity to a running engine. However, the evidence of experts in the fields of aircraft ground de-icing, aircraft engines, and cold-weather operations indicated that aircraft ground de-icing is routinely performed in Europe and the United States with engines running. Clearly, an operational matter of such importance requires a standard company policy that is made explicitly known to all pilots and operational personnel. What is to be avoided are situations where crew members, faced with the stresses of their operating environment, are without the support of a company policy to assist in their decision making. This most likely was the situation facing Captain Morwood and First Officer Mills on March 10, 1989.

De-icing of Aircraft Nearer to Runway End: Interim Recommendations – Second Interim Report

I recommended in my *Second Interim Report* (Recommendation No. 1)[11] that Transport Canada design and construct permanent de-icing/anti-icing facilities near to runway ends, at Lester B. Pearson International Airport (LBPIA) in Toronto, to satisfy both safety and environmental concerns. I wish to deal briefly with events that have subsequently occurred.

By a letter dated June 6, 1991, the minister of transport, Jean Corbeil, wrote to me in response to the 13 recommendations made in my *Second Interim Report* (see appendix K at the end of this Report). Referring to Recommendation No. 1 of my *Second Interim Report*, he confirmed that Transport Canada accepts the need for dedicated facilities for de-icing of aircraft, and that there was general agreement between Transport Canada and the air carriers that dedicated de-icing facilities are required at LBPIA. I have subsequently been informed that Transport Canada, on August 13, 1991, published an Invitation to Tender for construction at LBPIA of a dedicated touch-up de-icing facility and has announced plans for the construction at LBPIA of a major permanent de-icing centre, with provisions for recovery of fluids, located near the takeoff ends of the runways that are primarily used in bad weather. Transport Canada and the air carriers are to be commended for this initiative.

[11] MCR 5 in Part Nine, Consolidated Recommendations

National Resource Specialist – Aircraft Ground De-icing/Anti-icing

In my *Second Interim Report*, I noted at page 1 that Mr Richard Adams, an aeronautical engineer and aviation consultant, was, until recently, the national resource specialist for aircraft icing with the Federal Aviation Administration in the United States. Mr Adams testified that this position was established as a result of a recommendation by a United States commission, similar to this Commission, based on a finding of a lack of technical expertise in certain areas. Mr Adams described the function of the national resource specialist as follows:

> A. .... Now, very briefly, the National Resource Specialist is intended to be a specialist who is a national resource or whose talents and capabilities can be tapped by anyone; in other words, they put us there, ask us to stay abreast of technology, and then they took turns using us, basically.
>
> (Transcript, vol. 80, p. 12)

In my view, the concept of a highly qualified national resource specialist within Transport Canada, dedicated to matters pertaining to aircraft surface contamination and de-icing/anti-icing of aircraft in its broadest sense, including methods, procedures, fluids, and advances in relevant technology, to name the most obvious, based upon the United States model, would be worthy of consideration by Transport Canada.

Findings

- The F-28 aircraft, because of its critical wing, required an operator of such aircraft to be very careful in conditions conducive to wing contamination to ensure that the aircraft's wings were clean for takeoff. (See discussion in chapter 20 of this Report, F-28 Program: Flight Operations Training.)

- The Air Ontario Flight Operations Manual (FOM) prohibited takeoff with frost or freezing precipitation adhering to the surfaces of an aircraft. Thus, the Air Ontario FOM was more restrictive than section 25(3) of Air Navigation Order Series VII, No. 2, which included the discretionary words "does not adversely affect the safety of flight."

- The Air Ontario FOM, however, did not prohibit takeoff with snow adhering to the aircraft wing, as was the case at Dryden on March 10, 1989.

- The omission by Air Ontario of any reference in its FOM to takeoff with snow adhering to the wings could have given Air Ontario pilots the mistaken impression that it was acceptable to take off with snow adhering to the wings of an aircraft.

- The Air Ontario FOM did not adequately address the phenomenon of cold soaking. (See the discussion of cold soaking in chapter 12, Aircraft Performance and Flight Dynamics.)

- Air Ontario did not issue a specific pilot bulletin to its F-28 pilots containing F-28 cold-weather operations information or de-icing and anti-icing information for the F-28 aircraft.

- A memorandum dated September 28, 1988, based on a Fokker Aircraft publication entitled "Cold Weather Operation," on the subject of "F-28 De-ice Anti-ice Instructions," was issued by Air Ontario's director of maintenance, Mr Robert Mauracher, for the company's reliability committee. This memorandum received limited distribution among Air Ontario system operations control (SOC) personnel.

- Although the Mauracher memorandum contained specific F-28 cold-weather operational restrictions and information of interest to F-28 pilots, it was distributed to few, if any, Air Ontario F-28 pilots.

- Had the operational restrictions contained in Mr Mauracher's memorandum been followed by the Air Ontario SOC dispatcher on March 10, 1989, the pilots of flight 1363 would have been advised to overfly Dryden on that date because of the potential necessity of de-icing with engines shut down and the unserviceable auxiliary power unit (APU) and lack of ground-start facilities at Dryden.

- Some of the Air Ontario F-28 pilots, probably including Captain Morwood, had in the past made takeoffs in propeller-driven Convair 580 aircraft and/or HS-748 aircraft with some wing-surface contamination. (See the discussion in chapter 12, Aircraft Performance and Flight Dynamics.)

- Prior to March 10, 1989, some Air Ontario pilots flying the HS-748 propeller-driven aircraft used a dangerous and unapproved procedure during the takeoff roll, referred to as the "80-knot check." The procedure involved a check of the wings upon achieving a speed of 80 knots, to determine whether snow or slush observed on the aircraft wings prior to commencement of the takeoff roll was blowing off the wings.

- Air Ontario's ground-handling agent at Dryden, Dryden Flight Centre, did not have its personnel attend a ground-handling training course for the F-28 aircraft, sponsored by Air Ontario, although invited to do so.

- It is of utmost importance that all pilots and all operational personnel be made fully aware of the potentially disastrous consequences of wing contamination on aircraft takeoff performance.

- Aircraft ground de-icing with a main engine running is routinely performed in the United States and Europe.

- Aircraft ground de-icing with a main engine running is an important operational matter requiring a standard company policy that is made explicitly known to all pilots and operational personnel.

- An Air Ontario internal memorandum was circulated throughout the Air Ontario SOC facility, prohibiting the de-icing of the F-28 aircraft with main engines running.

- The information contained in the memorandum, including the prohibition against de-icing with a main engine running, was taken from a Fokker publication that had limited circulation among pilots.

- Air Ontario dispatchers were familiar with the company prohibition against de-icing with main engines running, while some Air Ontario F-28 pilots were not familiar with it.

- Air Ontario failed to have in place an effective system for distributing information regarding the de-icing of F-28 aircraft to all pilots and operational personnel, including information regarding de-icing procedures with a main engine running.

- There should have been an operational policy in place at Air Ontario, and understood by all pilots and operational personnel, regarding the de-icing of the F-28 aircraft and, in particular, the de-icing of the F-28 aircraft with a main engine running.

- Captain Morwood may have been aware of the Air Ontario prohibition against de-icing the F-28 aircraft with its main engines running.

- The Air Ontario prohibition against de-icing its F-28 aircraft with main engines running may have been an influencing factor in Captain Morwood's decision on March 10, 1989, not to de-ice the aircraft in

Dryden because of the circumstances that confronted him, including the non-functioning APU and the lack of ground-start facilities.

RECOMMENDATIONS

It is recommended:

Hot Refuelling

MCR 76 That Transport Canada ensure that the flight operations manuals of all air carriers specify that hot refuelling is an abnormal and potentially dangerous procedure and that they outline in detail the appropriate procedures to be followed in order to conduct hot refuelling safely.

MCR 77 That Transport Canada, during the process of approval of air carrier manuals, ensure that the provisions of the proposed manuals are consistent and, specifically, that they coordinate the duties of the cabin crew with those of the flight crew concerning hot-refuelling procedures, with appropriate cross-referencing between the manuals.

MCR 78 That Transport Canada ensure that all aircraft fuellers are adequately trained to standards set by Transport Canada.

MCR 79 That Transport Canada ensure the adequate monitoring of aircraft fuelling procedures at Canadian airports.

Aircraft Ground De-icing

MCR 80 That Transport Canada encourage air carriers to adjust their operational procedures and policies, where technically feasible, to permit the de-icing of an aircraft with a main engine running.

MCR 81 That Transport Canada ensure that the intention of the "clean-wing" concept, as embodied in Interim Recommendations 2 and 3 of this Commission (Consolidated Recommendations MCR 2 and 3) and in recent amendments to the Air Regulations (SOR/90-757) and the Air Navigation Orders (SOR/90-758, and SOR/90-759), be incorporated into and

given effect in the appropriate operational manuals of Canadian air carriers.

MCR 82 That Transport Canada ensure, during its normal certification and inspection of Canadian air carriers, that the air carriers have well-organized and effective systems in place for the coordinated distribution to all pilots and operational personnel of comprehensive operational information – including, but not limited to, information regarding aircraft ground de-icing procedures.

MCR 83 That Transport Canada give serious consideration to appointing an appropriately qualified person as a national resource specialist dedicated to all matters pertaining to aircraft surface contamination and the ground de-icing and anti-icing of aircraft in Canada, in the broadest sense, based upon a similar position in the Federal Aviation Administration of the United States and with similar objectives and responsibilities.

22 THE F-28 PROGRAM: FLIGHT ATTENDANT SHOULDER HARNESS

Throughout the course of the hearings there were a number of occasions when evidence arising directly out of the Dryden crash prompted inquiries into larger questions of flight safety. Evidence regarding the forward flight attendant station of C-FONF prompted one such inquiry.

Mrs Katherine Say, an Air Ontario employee for 10 years and the senior flight attendant assigned to flight 1363, did not survive the crash of C-FONF. During the takeoff from Dryden she was seated in the forward flight attendant station.

Post-mortem and accident reconstruction evidence revealed that Mrs Say's chances of surviving the crash may have been enhanced if the flight attendant seats on C-FONF had been upgraded to standards existing in the United States. I heard, with considerable consternation, testimony that Canadian regulations permit the operation of the F-28 Mk1000 with flight attendant seats that are below United States safety standards for the same aircraft.

The rationale behind increasing the crash survivability of flight attendant seats is straightforward and obvious. The surviving flight attendant, Mrs Sonia Hartwick, gave testimony on the subject. Her words need no embellishment:

> Q. And why is it important for a flight attendant to be secure?
> A. So that, in the event of an emergency ... we are able to assist our passengers once the impact has occurred and able to assist our passengers with a quick evacuation as we are, again, a piece of an emergency equipment on that airplane and we are trained in order to assist in a rapid evacuation through our exits.
>
> (Transcript, vol. 12, p. 127)

The forward flight attendant seat on C-FONF (and also on C-FONG) consisted of a forward-facing pedestal to the right of the aircraft's centre line, in the galley and adjacent to the starboard service/emergency exit.[1]

[1] The other flight attendant seat, of similar construction, was at the back of the passenger cabin and was unoccupied on March 10, 1989. Flight attendant Sonia Hartwick was seated in seat 8D, which was adjacent to the overwing emergency exit.

The seat was equipped with a lap belt but not with armrests, side restraints, rigid back, or shoulder harness.

Canadian regulations have never required the installation of a flight attendant's shoulder harness on aircraft of C-FONF's certification vintage. Such requirements have existed in the United States since 1980. The relevant United States regulations regarding flight attendant seats are as follows:

> 14 Code of Federal Regulations (CFR) 25.785:
>
> **Seats, berths, safety belts, and harnesses**
>
> (h) Each seat located in the passenger compartment and designated for use during takeoff and landing by a flight attendant required by the operating rules of this chapter must be:
>
> ...
>
> (5) Either forward or rearward facing with an energy absorbing rest that is designed to support the arms, shoulders, head, and spine.
>
> (6) Equipped with a restraint system consisting of a combined safety belt and shoulder harness unit with a single point release. There must be a means to secure each restraint system when not in use to prevent interference with rapid egress in an emergency.
>
> 14 CFR 121.311:
>
> **Seats, safety belts, and shoulder harnesses**
>
> (f) Each flight attendant must have a seat for takeoff and landing in the passenger compartment that meets the requirements of 25.785 of this chapter, effective March 6, 1980.
>
> [Note: The section goes on to list exceptions not relevant to the present case.]

Despite the lack of a Canadian regulatory requirement, the absence of a shoulder harness was specifically referred to in the notes of Mr Ole Nielsen of Transport Canada, who inspected C-FONF in France in March 1988. In his notes, Mr Nielsen wrote: "Flight attendant seats require approved shoulder harness" (Exhibit 1000, p. 4). Similar comments were made by Mr Nielsen in May 1988, immediately prior to the aircraft's importation and its addition to the Air Ontario operating certificate. This and other evidence, described below, indicate that both Transport Canada and Air Ontario were well aware of the cabin safety implications of inferior flight attendant seats installed in C-FONF.

At times, the regulator's primary role of protecting the travelling public is thwarted by what may be described only as bureaucratic lassitude and pliancy. The evidence before this Inquiry offers no other reasonable explanation as to how this inferior level of cabin safety was allowed by Transport Canada to persist in Canada.

Accordingly, I feel bound to review the evidence on this issue in some detail to illustrate how such failures in the regulatory and operational sectors of the air transportation system can occur.

The Forward Flight Attendant Station of C-FONF

The "Cause of Death" section in the report of the post-mortem examination of Katherine Say reads simply: "Generalized body burns" (Exhibit 23, "Compilation of Post-Mortem Records of Air Crash Victims"; tab 22). In the same report, however, the following significant notation was included under the heading "Summary of Abnormal Findings":

> The only impact injury found was the metal foreign body which had embedded itself in the frontal bone. The presence of soot in the respiratory passages indicated some respiratory activity during the fire.
>
> (Exhibit 23, tab 22, p. 5)

There were two metal objects that caused the head injury to Katherine Say. These were examined and photographed in the early stages of the investigation; however, at some point during or after the post-mortem examination, they were misplaced.[2] The Commission's human factors and crash survivability investigative group used its best efforts to determine the origin of the metal pieces, comparing the photographs with the galley configuration on the sister aircraft, C-FONG. Unfortunately, the source of the pieces of metal could not be identified.

The evidence disclosed that Mrs Say's body was found in the wreckage some distance from her seat.[3] This evidence and toxicological evidence reported by the Ontario Region aviation medical officer of

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[2] Mr David Adams, chairman of the Commission's human factors and survivability investigative group, testified that he was quite annoyed when he learned that the metal objects were misplaced. For present purposes, it is sufficient to note that I share Mr Adams's chagrin at the careless handling of this significant forensic evidence.

[3] Flight attendant Hartwick confirmed that in fact Mrs Say was in the forward flight attendant's seat at commencement of the takeoff. See figure 22-1, Pre- and Post-Accident Locations of Individuals Seated in Forward Positions on Flight 1363.

Transport Canada led to the following finding by the human factors and survivability group:

> *Survival time* was likely **less than a minute** but this value could vary and post impact voluntary movement cannot be ruled out! It appears that some evidence suggests minimal respiratory activity after impact and that death was probably less than a minute, however body location may suggest some form of post impact, voluntary movement. The head injury, Katherine Say received, may not have resulted in a loss of consciousness. The latter would be supported by the fact that this head injury did not cause any internal cerebral damage. In summary, Katherine Say may have died shortly after impact and never regained consciousness or she may have been conscious enough to make a vain attempt at egressing the aircraft before losing consciousness.
>
> (Exhibit 1258, Human and Survival Factors Group Chairman Report; tab 2, p. 24)

Because of the extensive post-crash burns to her body, it was impossible to determine whether Katherine Say suffered other impact injuries.

There was evidence as to the location in the aircraft of the "male" portion of a buckle from Mrs Say's seat belt. Because the investigators were unable to locate the buckle's "female" portion or any other part of the seat belt, it could not be determined conclusively whether the flight attendant's seat-belt buckle opened on impact or was undone before or after the crash.[4]

Attempts to draw inferences from the physical evidence remaining after a crash and fire of this magnitude are naturally fraught with uncertainty. There are a number of possible explanations for the location of Katherine Say's body after the crash.

The only impact injury revealed at autopsy was the penetration injury to her forehead, from which area the two metal objects were extracted. If one assumes that Katherine Say was seated in her flight attendant seat at the time of impact, then the natural forces at work on impact would have thrown her upper body forward. There is therefore a high probability, based on all of the evidence, that the head injury suffered by Mrs Say resulted from the forward impact of her head against a metal object located immediately adjacent to her cabin attendant seat.

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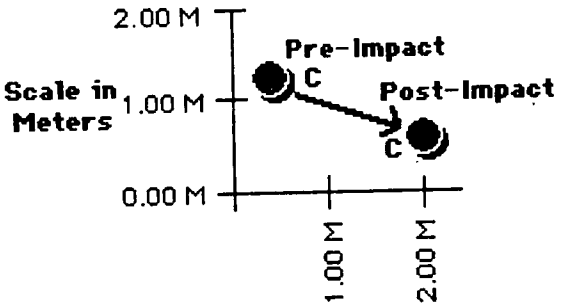
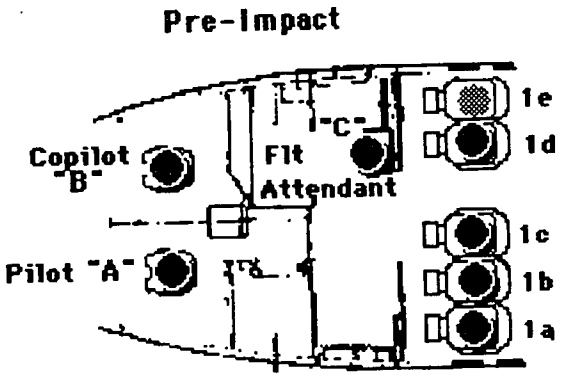
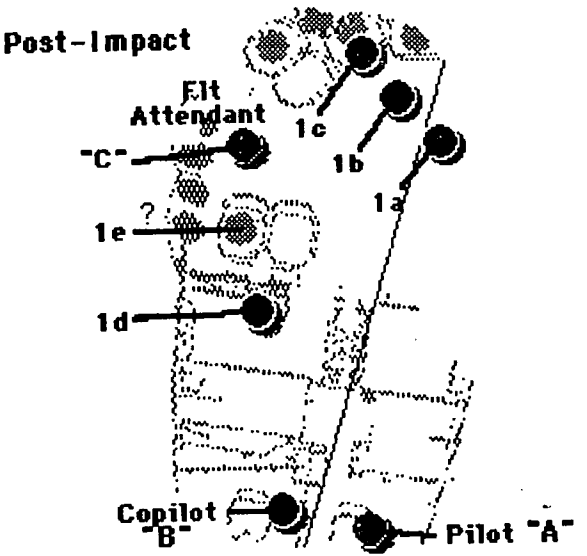
[4] Mr Adams was able to determine with a high degree of probability that the "male" portion of the buckle located was in fact Mrs Say's. It was the testimony of Mr Adams that flight attendant seat-belt buckles are different from those on regular passenger seat belts. The "insert" and "latch" portion of the buckle has two holes in the flight attendant buckle and only one hole in the passenger buckle. The buckle attributed to Mrs Say's seat belt was the only two-hole buckle found in the forward section of the cabin (Transcript, vol. 156, pp. 149–51).

Figure 22-1 Pre- and Post-Accident Locations of Individuals Seated in Forward Positions on Flight 1363







Source: Exhibit 1258

Although other factors may have intervened to cause her head injury during the breakup sequence, it is beyond dispute that, had she been secured by a shoulder harness, her upper body would have been markedly better restrained and protected from injury caused by forward motion on impact. This, after all, is the function of a shoulder harness.

Whether Mrs Say would have been able to aid passengers or eventually to make her way out of the wreckage had she not sustained the head injury cannot be stated. What can be said is that her chances for survival may have been enhanced if she had had the protection of a shoulder harness.

If C-FONF had been a United States–registered aircraft, there would have been, pursuant to United States law, a shoulder harness in place for Katherine Say. Instead, this Canadian-registered aircraft, because of the lack of Canadian regulatory requirements, was legally flying without this critical piece of flight safety equipment.

I now turn to the relevant Canadian and United States legislation: design and manufacturing criteria; operational standards and regulations. A review of the history of the flight attendant shoulder harness issue will then follow.

Governing Legislation

To enhance the safe carriage of passengers in transport category aircraft such as the F-28 Mk1000, regulatory authorities stipulate criteria under which aircraft are to be designed, manufactured, and operated. Design and manufacturing criteria are generically referred to as "certification standards" or "airworthiness standards." Only if these certification standards are met will a type certificate and a certificate of airworthiness be issued and the aircraft type be allowed by law to fly in commercial service. Operational standards are defined by the regulations and orders governing air carriers.

Design and Manufacturing Criteria

Aircraft meeting the airworthiness standards of design and manufacture of a particular jurisdiction will typically be permitted to operate by way of some form of certification process. Various jurisdictions have, over time, developed a system of bilateral and multilateral acceptance of one another's certification criteria. The most common certification criteria to which transport category aircraft are designed and manufactured are those of the United States. Because the United States has historically been the largest manufacturer of transport category aircraft, there is wide acceptance of its certification criteria.

Canadian regulators accept, for the most part, United States design and manufacturing criteria when granting "type approval" to an aircraft for operation within this country.

The United States certification criteria for transport category aircraft are set forth in Part 25 of the Federal Aviation Regulations (FAR 25).[5] These criteria must be met before the Federal Aviation Administration (FAA) will grant a United States type certificate to a model of aircraft. FAR 25 is a vast compendium of certification requirements addressing everything from engines and electrical systems to passenger and crew member seats.

Prior to the enactment in the United States of FAR 25 in 1964, the United States criteria for the certification of transport category aircraft were contained in a certification regime designated as Civil Aviation Regulation (CAR) 4(b). According to the testimony of Mr Ole Nielsen, the Transport Canada inspector who supervised the importation of C-FONF into Canada, it was under CAR 4(b) that the F-28 Mk1000 aircraft received its United States type certification. CAR 4(b) did not require the installation of either flight attendant seat shoulder harnesses or energy-absorbing seats. In fact, until 1980, FAR 25 did not require such installation.[6]

In 1972 the Canadian Department of Transport granted the F-28 aircraft type approval, thereby authorizing its operation by Canadian air carriers. By granting the F-28 type approval, the Canadian authorities accepted the United States certification of the aircraft. At the time of the granting of the type approval in 1972, neither Canada nor the United States required the installation of flight attendant shoulder harnesses on the F-28.[7]

By the late 1970s, however, the issue of cabin safety had undergone a comprehensive review in the United States, resulting in a number of significant improvements. In 1980, FAR 25 was amended to require the installation of flight attendant seats of a safer design. All transport category aircraft designed and manufactured after the effective date of the amendment to FAR 25 (March 6, 1980) had to meet the new criteria in order to receive a United States certificate of airworthiness. United States aircraft of older design were permitted to continue in commercial operation provided that they conformed with another Federal Aviation

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[5] FAR Part 25 is cited as 14 CFR 25. These regulations are promulgated and administered by the Federal Aviation Administration of the U.S. Department of Transportation.

[6] FAR Amendment 25-51, "Airworthiness Review Program – Amendment No. 8: Cabin Safety and Flight Attendant Amendments"

[7] Exhibit 679, "Aircraft Type Approval, A-108, Fokker F-28 Mark 1000 and Mark 2000" (February 27, 1973)

Regulation specifically directed at the operational accommodation of the new technology in older aircraft. These "operational requirements" were set out in FAR Part 121.[8]

United States Operational Standards

Application of Standards to New Aircraft

The certification standards set out in FAR 25 delineate requirements for aircraft design and manufacture. The operation of aircraft is governed by operational regulation. In the United States the operational regulations are contained in FAR 121. In Canada they are dealt with in the Air Navigation Orders.

One significant purpose of the certification standards outlined above is to inform aircraft builders of the criteria that their products will have to satisfy before such products will be permitted to be operated in private or commercial service. In short, the certification standards represent conditions precedent to the entry into the marketplace of new aircraft.

The certification criteria in FAR 25 are amended from time to time to incorporate new technology in aircraft design and materials. Aircraft designed and manufactured after an amendment to a certification criterion will thereafter be built to the new standard.

Application of New Standards to Existing Aircraft

FAR 25 does not accommodate the problem of incorporating new technology into existing aircraft. The application of new technology to old aircraft is typically addressed through operational regulation, which, if appropriately drafted, will complement the certification regime.

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[8] 14 CFR 25.785:

Seats, berths, safety belts, and harnesses

(h) Each seat located in the passenger compartment and designated for use during takeoff and landing by a flight attendant required by the operating rules of this chapter must be:

... (5) Either forward or rearward facing with an energy absorbing rest that is designed to support the arms, shoulders, head, and spine;

(6) Equipped with a restraint system consisting of a combined safety belt and shoulder harness unit with a single point release. There must be means to secure each restraint system when not in use to prevent interference with rapid egress in an emergency ...

[Note: The "operating rules" in section 25.785(h) refer to FAR Part 121; specifically, FAR 121.311 (cited as 14 CFR 121).]

New Seat, Safety Belt, and Shoulder Harness Requirements (1980) In 1980, the FAA incorporated various developments in cabin safety technology into both the FAR 25 certification criteria as well as the FAR 121 operational criteria. New requirements for flight attendant seat construction in existing aircraft were set out in FAR 121.311, which states:

> **121.311 Seats, safety belts and shoulder harnesses**
>
> ...
>
> (f) Each flight attendant must have a seat for takeoff and landing in the passenger compartment that meets the requirements of FAR 25.785 of this chapter, effective March 6, 1980, except that –
>
> (1) Combined safety belt and shoulder harnesses that were approved and installed before March 6, 1980, may continue to be used; and
>
> (2) Safety belt and shoulder harness restraint systems may be designed to the inertia load factors established under the certification basis of the airplane.

The result of this operational requirement was, in essence, that the requirements set out in FAR 25.785, including the provision of flight attendant shoulder harnesses, were made mandatory for all transport category aircraft, regardless of their date of manufacture.

Canada has never adopted the United States operational requirements of FAR 121. The applicable Canadian operational standard that was in place on the date of the accident was Air Navigation Order (ANO) Series II, No. 2, the Aircraft Seats, Safety Belts and Safety Harnesses Order. This order had been in force since May 1966.

ANO Series II, No. 2, contains no provision specifically dealing with flight attendant seating, seat belts, or shoulder harnesses.

The Canadian Approach to the Shoulder Harness Issue

In July 1987, some seven years after the promulgation in the United States of FAR 121.311, the Canadian authorities published a proposed amendment to the Aircraft Seats, Safety Belts and Safety Harnesses

Order.[9] The proposed amendment addressed, among other things, the issue of flight attendant seats. The relevant amendment to the existing requirement was the following:[10]

> s. 4 (4) After January 1, 1988, no person shall operate an aircraft on a commercial air service unless it is equipped with an approved safety belt, consisting of a lap strap combined with a shoulder harness, for each flight attendant seat.

An additional concern in the proposed amendment was that regarding "Use of Safety Belts." The relevant section stated:

> s. 8 (1) Except as provided in subsection (2)[11] or (3), every person carried on board an aircraft, other than an infant or a passenger or parachutist referred to in Section 6 or 7, shall keep a safety belt, including the shoulder harness, if any, properly fastened about him while the aircraft is taxiing, taking off or landing, and at any other time when so directed by a crew member or by a safety belt sign displayed in the aircraft.
>
> ...
>
> (3) A crew member is not required to comply with subsection (1) when the aircraft is being operated otherwise than on take-off or landing and the crew member is performing assigned safety related duties.

The proposed implementation date of January 1, 1988, came and went with no approval of the amendment to ANO Series II, No. 2, and, therefore, there was no compliance required by Canadian operators.

The delay in the implementation of the proposed ANO is attributable, in part, to protracted discussions between Transport Canada and the Air Transport Association of Canada (ATAC). ATAC is the national service organization for the Canadian commercial air transport industry. Its membership, comprised of individuals and companies involved in the

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[9] *Canada Gazette*, Part 1, July 18, 1987, pp. 2311–15. *Canada Gazette* is the publication through which the Government of Canada provides notification of proposed regulatory change. After the government has considered comments arising out of the notice of proposed regulation, the public is notified of the promulgation of the regulation by its publication in *Canada Gazette*, Part 2.

[10] In addition to addressing flight attendant seats, the proposed amendment considered passenger seats and seat belts; pilot seats and seat belts; seats and seat-belt requirements for "special purpose operations" (e.g., aerial spraying); seats and seat belts for parachutists; approved child restraint systems; crew member activities while the aircraft is operating and the seat-belt sign is displayed; and the use of seat belts by pilots.

[11] Subsection 2 refers to the use of child restraints.

Canadian airline industry, includes airlines accounting for approximately 95 per cent of Canadian commercial air transport revenue. Among its many other roles, ATAC reviews developments in legislation that could potentially affect the aviation industry. There is regular contact between ATAC and the Government of Canada regarding aviation-related legislation, and, for this reason, ATAC has been variously described as an industry interest group and an industry lobby group.

Amending the Aircraft Seats, Safety Belts, and Safety Harnesses Order

The Role of ATAC

When faced with the operational changes that would be necessitated by the amendment to ANO Series II, No. 2, ATAC appears to have marshalled its forces, effectively forestalling its implementation. The concern of the industry was not with the necessity of installing safer flight attendant seats; rather, the industry was concerned primarily with the proposed restrictions on flight attendant activities when the safety belt sign is displayed in the cabin. The debate over the wording of the proposed amendment appears to have commenced more than a year following its July 1987 publication.

On October 11, 1989, Mr Donald E. Lamont, ATAC vice-president of flight operations, met with the ATAC cabin operations subcommittee with regard to the proposed amendment. Certain concerns were expressed regarding the proposed restriction on the ability of flight attendants to provide passenger services while the safety belt sign is illuminated. On October 20, 1989, Mr Lamont met with Mr Weldon Newton, the director-general of aviation regulations, and Mr William Slaughter, the director of flight standards, Transport Canada, to discuss the ATAC concerns. Mr Lamont reported to the ATAC cabin operations subcommittee on his meeting with Transport Canada:

> The concern was expressed that if the Order as written became a regulation, attendants would be compelled to be seated and strapped into a seat while the safety belt sign was illuminated except while performing assigned safety related duties.
>
> Transport Canada has agreed to revise these paragraphs to permit the performance of other related duties (meals, service, etc) while the seat belt light is turned on. The qualification will be that the Captain has approved of such service(s) taking place while the seat belt sign is displayed.
>
> Transport Canada will consult with ATAC on the revisions and I will keep you advised of developments as they occur.
>
> (Exhibit 1168, tab 3)

There was, apparently, no discussion between ATAC and Transport Canada regarding the proposal that flight attendant seats be equipped with shoulder harnesses. The industry was concerned primarily with in-flight service.

On October 24, 1989, Mr Slaughter wrote a memorandum to Mr Arthur LaFlamme, also of Transport Canada, stating that, following his meeting with Mr Lamont and Mr Newton, there was agreement that the wording of subsection 8(3) of the amendment to ANO Series II, No. 2, was too restrictive. Mr Slaughter suggested the following alternative amendment to the order:

> A crew member is not required to comply with subsection (1) where the aircraft is being operated otherwise than on take off or landing and the crew members performing assigned duties related to the safety of passengers, or other duties as approved by the Captain.
>
> (Exhibit 1168, tab 5)

Mr Slaughter stated further that this amendment would enable the "in-charge" flight attendant to make decisions as to whether to continue or discontinue passenger service during periods when the "fasten seat belt" light is illuminated.

On December 11, 1989, Mr LaFlamme, exercising, in my view, good judgement, replied to Mr Slaughter that making changes relevant to flight attendants' in-flight activities would delay the requirement for safer flight attendant seats. Mr LaFlamme wrote:

> Any changes to the order at this time can delay publication in Canada Gazette, Part II and may require the document to be republished again in Part I for consultation. The order also contains the requirement for shoulder harnesses on flight attendant seats, permits use of infant/child restrain[t] devices, securing of stretchers, etc., all highly sensitive regulatory safety issues which will not be resolved until the proposed rule change is published as a final rule.
>
> For all the foregoing reasons, it is requested that the revised wording of subsection 8(3) as contained in your memorandum be reconsidered in favour of the paragraph contained in the present amendment.
>
> (Exhibit 1168, tab 6)

I heard evidence that, following Mr LaFlamme's advice to Mr Slaughter, there were many communications between Canadian air carriers and Transport Canada regarding the proposed amendment to the Air Navigation Order. These communications, which persisted until as late as April 1990, all addressed the subject of permissible flight

attendant activities. None appeared to canvass the subject of safer flight attendant seats.[12]

Mr Slaughter, in his evidence before me, seemed to have grasped the essential point, albeit belatedly. His testimony was as follows with regard to the issue of the proposed amendment to ANO Series II, No. 2:

> A. ... there's three major and independent regulations in being, and for the sake of discussions over one line in one area of it, we have held up the whole Air Navigation Order.
>
> And perhaps that should be separated in some way so that we can examine one in isolation without impeding the progress of the other two.
>
> (Transcript, vol. 145, p. 55)

The issue of mandatory flight attendant shoulder harnesses is still unresolved, some four years after the initial proposed amendment to ANO Series II, No. 2, and twelve years after the issue had been carefully considered and resolved by the United States regulator and industry.

This is the bureaucratic lassitude and pliancy referred to earlier. In light of the evidence, I offer no apologies for my choice of language.

One final note on the subject that is worthy of mention came to light during the evidence of the director of flight standards for Transport Canada, Mr Slaughter. The Air Transport Association of Canada is often called upon by the carriers, whom it represents, to lobby Transport Canada in support of positions being advanced or favoured by air carriers regarding the content of existing or proposed legislation. In certain instances, such as with the shoulder harness issue, such legislation may have financial implications for the carriers as well as having aviation safety implications. Transport Canada officials responsible for the development and implementation of such rule changes therefore must be vigilant to ensure that the safety component of the legislation is not effectively diluted or neutralized as a result of industry pressure.

It was therefore surprising to discover during Mr Slaughter's evidence that the selection board, which was put in place by Transport Canada in early 1989 to hire Transport Canada's new chief of air carrier standards, included the vice-president of operations of the industry lobby group, the Air Transport Association of Canada, Mr Donald Lamont. The successful candidate was Mr Arthur LaFlamme.

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[12] Exhibit 1168, tabs 8-17: A series of memoranda and notes regarding permissible flight attendant activities while the seat belt sign is illuminated, and the proposed amendment to ANO Series II, No. 2

I do not in any way question the integrity of either Mr Lamont or Mr LaFlamme. Certainly, Mr LaFlamme's actions regarding the shoulder harness issue and ANO Series II, No. 2, following his selection as chief of air carrier standards, were in my view not only entirely appropriate but indeed commendable. However, the Transport Canada practice of appointing, or acquiescing in the appointment of, individuals to its hiring-selection board who may subsequently be required, by the very nature of their own aviation industry positions, to bring pressure to bear on the future decisions of the successful candidates is, in my opinion, an unacceptable practice that should be discontinued. Mr Slaughter was questioned on the appearance of a conflict of interest arising under these circumstances, and he agreed that such was to be avoided:

> Q. All right. Well, if you can, you should avoid even the appearance of conflict so as not to call the integrity of Transport Canada into disrepute; isn't that right?
> A. I agree. When you put it in this light, I certainly agree.
>
> (Transcript, vol. 145, p. 248)

The Role of Air Ontario

I would not like to leave the impression from the foregoing that Air Ontario is itself without a measure of responsibility for allowing substandard flight attendant protection in its aircraft.

Both Air Ontario's own employee Mr Teoman Ozdener, and its outside consultant Mr Derek Hicks, noted the flight attendant shoulder harness deficiency during the survey of sister aircraft C-FONG and reported the deficiency to Air Ontario management.[13] Mr Hicks, in his survey report to the company, made the following comments:

> Front Stew seat considered unsatisfactory as is and is not to be used on take off or landing. Rear seat is satisfactory if and when a shoulder harness is fitted. Seat not to be used for take off and landing until shoulder harness is fitted.
>
> (Exhibit 832, Derek Hicks, M.L.B. Associates, to Douglas Christian, Air Ontario, March 28, 1988)

The approach suggested by Mr Hicks would seem to be a sensible compromise. Until the shoulder harness/flight attendant retrofit could have been completed, both flight attendants would have been required

[13] Although Mr Ozdener and Mr Hicks initially inspected aircraft 10070 (C-FONG), it was acknowledged by witnesses Mr Ozdener and Mr Bittle that the inspection comments regarding the absence of a flight attendant shoulder harness on C-FONG were equally applicable to aircraft C-FONF.

to take seats in the passenger compartment on takeoff and landing. Although the passenger seats did not offer an equivalent protection to a proper flight attendant seat with a shoulder harness, they were superior to the flight attendant seats that were in place on C-FONF. The passenger seats provided back and lateral support while the flight attendant seats did not. Having stated this, I would add that ANO Series VII, No. 2, requires all cabin attendants to be seated at their approved stations with safety belts fastened on takeoff and landing (sections 19(2), 19(3)).

Transport Canada and Air Ontario therefore created a predicament for the senior flight attendant on the F-28. A greater level of safety could have been achieved by sitting in a passenger seat; however, for the senior flight attendant, in the absence of any authorization from Transport Canada, it was illegal to be seated in any but the approved flight attendant station.[14] Ironically, in the case of the F-28 C-FONF, the approved flight attendant station was the substandard forward jump-seat. Transport Canada could have readily designated an appropriate passenger seat as the approved flight attendant station, had Air Ontario so requested.

In March 1988 Mr Ozdener reported to Mr Kenneth Bittle, the Air Ontario vice-president of maintenance, on the progress of the F-28 importation. With regard to the present issue, Mr Ozdener noted: "Shoulder harnesses for flt. attendants are on order by TAT" (Exhibit 811, p. 5).

Mr Bittle testified that he initially thought that the installation of the shoulder harnesses was a regulatory requirement and that TAT would be assuming the cost of installation. He testified further that, when TAT informed Air Ontario that it was not going to install the harnesses, he made inquiries regarding the cost of the installation. When Mr Bittle became aware that there was no regulatory requirement for the shoulder harnesses, he recommended to the Air Ontario flight operations department that they not be installed. Mr Bittle's recommendation was based largely on economic considerations. He testified that the shoulder harness modification on the F-28s would have cost approximately U.S.$90,000, and, because Air Ontario was leasing the aircraft, he was of the opinion that it would have been a poor business decision to incur the cost. Mr Bittle's evidence clearly indicated that Air Ontario took advantage of the laxity in the regulation in order to avoid the expense

[14] The Air Ontario Flight Attendant Manual required the junior flight attendant in the F-28, when there were fewer than 65 passengers, to be seated in seat 8D, adjacent to the mid-aircraft emergency exit. When the aircraft had 65 passengers, the junior flight attendant was required to be seated in the rear flight attendant jump-seat. The senior flight attendant, in all instances, was to be seated in the forward jump-seat.

of replacing the substandard flight attendant seats and the installation of the shoulder harnesses in the F-28:

> Q. It was not necessary to have the front harness, in your opinion?
> A. That's right, in my opinion. And I stand to be corrected, but I still don't think it has been put through.
>
> I think it was published in the Canada Gazette and has ceased any activity since then, but I could be proved wrong on that.
>
> But at that time, certainly my understanding that was not a requirement, and we were pretty familiar with what was a requirement, due to us having to research all this stuff, floor track lighting, seat flammability, GPWS. You name it, it was all covered by ANOs. This was not.
>
> So at that time, we elected to wait on ordering. We were also trying to see if there was another way to do it. Maybe we would redesign the whole front of the airplane ourselves.
>
> But you have to keep in mind that this airplane was not the long-term airplane for Air Ontario. It was a one-year lease, and when we received our permanent airplanes, then you would be much more interested in investing some heavy money into modifications that would stick with you.
>
> Because this would go back – this airplane ... will go back to TAT at some point, and anything we had done to it, it would be money wasted.
>
> (Transcript, vol. 103, pp. 172–73)

Mr James Morrison assumed the position of vice-president of flight operations in July 1988, shortly after the commencement of the F-28 operation. He was informed by Mr Bittle of the flight attendant seat deficiency, and he accepted Mr Bittle's assessment of the situation (Transcript, vol. 116, pp. 36–37).

From the period of the importation of the aircraft in May 1988 to the addition of the F-28 on Air Ontario's operating certificate in June 1988, the issue was considered by both Air Ontario and Transport Canada. Mr Ozdener, who was supervising the importation for Air Ontario, informed Mr Nielsen of Transport Canada of the status of certification requirements for the two F-28 aircraft. Mr Ozdener noted the following in one communication to Mr Nielsen:

> Shoulder Harnesses F/A seats S.B. ordered. Seats not to be occupied until shoulder harness installed[:] N/A: not mandatory until 89/06.
>
> (Exhibit 1001, p. 1)

Mr Nielsen noted on his own "aircraft importation check sheet" for C-FONF that the seat belts for the aircraft were acceptable "except F/A

seat belts" (Exhibit 1002, "Aircraft Importation Check Sheet," May 1988). Mr Nielsen explained that he discussed the matter with Mr Ozdener and Mr Hicks and was under the impression that the flight attendant shoulder harnesses were required. Subsequently, Mr Nielsen consulted the Engineering Branch of Transport Canada and was advised that there was no requirement for flight attendant shoulder harnesses on the F-28 Mk1000. Air Ontario took the position that it would not install the shoulder harnesses until it was a regulatory requirement (Transcript, vol. 130, pp. 198–99).

Mr Nielsen was asked whether, as the inspector in charge of the certification of the F-28 C-FONF, he had any discretion to insist upon the installation of the shoulder harnesses, regardless of the state of the amendment to ANO Series II, No. 2. Mr Nielsen acknowledged that the shoulder harnesses would enhance the safety of the aircraft, but, absent any legislative authority, he would not insist upon their installation. Mr Nielsen testified:

> A. ... The shoulder harness had been a FAR 25 requirement for many years before this airplane ever came into the country, so it was obviously deemed to be a safety factor prior to this airplane ever arriving.
>
> But as far as advising the carrier to install it, we are not going to do that unless we've got some legislative background to do it on.
>
> (Transcript, vol. 129, p. 139)

As late as December 1988, Mr Ozdener wrote to Mr Bittle about the installation of the shoulder harnesses on the F-28 (Exhibit 812). This was the last documentary reference to the shoulder harnesses at Air Ontario until the crash of C-FONF. Mr Ozdener left the employ of Air Ontario in January 1989.

In May 1989 Air Ontario flight safety officer Captain Ronald Stewart noted the absence of flight attendant seat shoulder harnesses during an inspection of C-FONG. He addressed the issue to Mr Bittle in a memorandum dated May 19, 1989, recommending installation of the harnesses.

On May 29, 1989, two and one-half months after the accident, chief inspector Douglas Christian of Air Ontario wrote to Fokker Aircraft (United States) requesting information regarding the cost of the installation of shoulder harnesses on the remaining F-28, C-FONG. Shortly thereafter, Air Ontario discontinued its F-28 program.

From the evidence it was clear that both Transport Canada and Air Ontario were fully aware of the flight safety implications of introducing C-FONF into commercial service without the flight attendant shoulder

harnesses. Air Ontario made a commercial decision not to enhance the standard of safety of the flight attendant seats above the minimum standard required by Transport Canada.

The aircraft was "legal" according to the witnesses; however, if the regulatory component of the air transportation system had not failed, a law requiring flight attendant shoulder harnesses would have been enacted in a timely fashion.

I must emphasize that it is the job of the regulator to look after the safety interests of the travelling public, not the commercial convenience of the carrier. Only with this appreciation of the regulator's role will the air transportation system function properly. Having stated this and regardless of the standards set by the regulator, I am of the view that the carriers should do what they are reasonably able to by way of securing the safe air carriage of their passengers and employees. It was acknowledged by a number of witnesses, including Mr Bittle, that the short, one-year lease of the aircraft inhibited the substantial expenditure for the shoulder harness installation. The chief executive officer, Mr William Deluce, testified that he became aware of the shoulder harness issue when an accommodation for the installation of shoulder harnesses appeared in Air Ontario's 1989 revised capital budget. Apparently, in December 1988 Air Ontario had budgeted for the eventual installation of the shoulder harnesses.

I am of the view that, had Air Ontario properly prepared for the introduction of the F-28, surveying the aircraft well in advance of accepting its delivery, then the flight attendant seat retrofit and shoulder harness installation could easily have been achieved prior to the start of commercial service. Air Ontario committed itself to the terms of the aircraft lease on November 19, 1987. The lease contained specific provisions for the mutual inspection of the aircraft in advance of aircraft acceptance, and Air Ontario commenced its comprehensive survey of the aircraft in early March 1988, with the expectation that the lease period would commence on March 15, 1988. The pilot strike intervened, and the Air Ontario importation team was ordered back to Canada. Upon Mr Ozdener's return to Canada, Air Ontario management was informed of the flight attendant shoulder harness deficiency. Air Ontario management equivocated on the necessity of the shoulder harnesses. The Air Ontario vice-president of maintenance and engineering, Mr Bittle, recommended initially that, in the absence of a regulatory requirement, Air Ontario not effect the installation.

Had Air Ontario properly planned the implementation of the F-28 program, it should have anticipated the cost of rectifying the deficiency of the flight attendants' stations. Even in the absence of such foresight, at the very least Air Ontario should have made application to Transport Canada for the designation of appropriate passenger seats for flight

attendant stations. This action, as an interim measure, albeit not desirable, would have resulted in a higher degree of safety for the flight attendants, pending completion of the flight attendants' shoulder harness retrofitting.

It should be noted that much later, after the introduction of the jet into commercial service, the carrier budgeted for the installation of the harnesses by May 1989.

Air Ontario had at least a six-month window of opportunity, from November 1987 to the commencement of commercial service in June 1988, to resolve the shoulder harness issue. The failure to do so reflects very poorly upon the planning and implementation of the Air Ontario F-28 program. This observation has been made repeatedly in assessments of other operational deficiencies arising directly out of the investigation of the crash of C-FONF.

This air carrier safety deficiency is not mitigated by the fact that the amendment to the Aircraft Seats, Safety Belts and Safety Harnesses order had stalled in Transport Canada. Air Ontario managers testified that they believed that approval of the shoulder harness order was in fact imminent and, more importantly, that the installation of the shoulder harnesses was a significant safety benefit to its cabin crews and passengers. In my view, it was inappropriate for Air Ontario to rely on an argument that C-FONF was "legal" and therefore "safe." A corporate commitment to flight safety requires more than a simple dependence on the regulator to set standards.

Findings

- Flight attendant Katherine Say was seated in the forward flight attendant station at the time of the crash. This forward-facing seat was not equipped with a shoulder harness, armrests, side restraints, or a rigid back.

- During the crash sequence, Mrs Say suffered an impact injury to her forehead: two small pieces of metal became embedded in her forehead.

- There is uncertainty about whether Mrs Say died shortly thereafter, having never regained consciousness, or whether she made an attempt to egress the aircraft before succumbing.

- Mrs Say's chances for survival may have been enhanced if she had been afforded the protection of a shoulder harness.

- Had C-FONF been a United States–registered aircraft on the date of the crash, United States law would have required the flight attendants' seats to be equipped with shoulder harnesses.

- United States law requiring a retrofit of shoulder harnesses and other safety-enhancing features for flight attendant seats in older aircraft such as the F-28 has existed in relation to United States–registered aircraft since 1980.

- Canadian efforts to legally require a retrofit of shoulder harnesses and other safety-enhancing features for flight attendant seats in older aircraft such as the F-28 were not formally proposed until 1987, some seven years after similar United States law had been enacted.

- The proposed Canadian law, which, if passed, would require a retrofit of shoulder harnesses and other safety-enhancing features for flight attendant seats, has been stalled for more than four years and remains unresolved twelve years after this same issue was carefully considered and resolved by the United States regulator and industry.

- Transport Canada airworthiness personnel were aware of the safety deficiencies of the flight attendant seats on C-FONF but felt powerless to require that such safety deficiencies be remedied in the absence of legislative authority.

- The delay in implementation of proposed amendments to Canadian law regarding flight attendant seats is due in part to bureaucratic pliancy and lassitude on the part of certain sections of Transport Canada.

- Air Ontario management was aware of the safety deficiencies on C-FONF prior to the importation of that aircraft into Canada.

- For economic reasons, Air Ontario decided not to incur the cost of retrofitting the flight attendant seats with shoulder harnesses and other safety-enhancing features until such time as it was a regulatory requirement.

- A consultant hired by Air Ontario suggested that, until a shoulder harness retrofit could be accomplished, flight attendants be required to be seated in the passenger compartment during takeoff and landing.

- The retrofit of flight attendant station shoulder harnesses could easily have been achieved prior to the start of commercial service if Air Ontario had properly prepared, in a timely way, the introduction of the F-28 program.

- Although passenger seats were not equipped with shoulder harnesses, they were superior to the flight attendant seats. Passenger seats provided back and lateral support. Flight attendant seats did not provide such support.

- Canadian law requires that flight attendants be seated at their "approved" stations during takeoff and landing. In the case of C-FONF, the approved flight attendant station was the substandard forward jump-seat.

- No request was ever put forward to Transport Canada by Air Ontario to have any passenger seats approved for seating flight attendants during takeoff and landing.

- As an interim measure, Air Ontario should have made application to Transport Canada for the designation of appropriate passenger seats as approved flight attendant stations.

- Transport Canada could readily have designated an appropriate passenger seat as an approved flight attendant station, had Air Ontario so requested.

- The Air Transport Association of Canada (ATAC), among its many other roles, acts as an industry interest group on behalf of air carriers in its dealings with Transport Canada.

- The delay in the implementation of legislation that would enhance the safety requirements for flight attendant seats is attributable in part to protracted discussions between ATAC and Transport Canada.

- In 1989 a promotional competition for the Transport Canada position of chief of air carrier standards was presided over by a three-person selection committee that included the ATAC vice-president of operations as one of the committee members.

RECOMMENDATIONS

It is recommended:

MCR 84 That Transport Canada immediately press ahead with appropriate amendments to Air Navigation Order Series II, No. 2, that would require the retrofit of shoulder harnesses and other safety-enhancing features for flight attendant seats on older aircraft types such as the F-28 aircraft.

MCR 85 That Transport Canada assess and amend, as necessary, the procedures required to enact aviation safety–related legislation so as to avoid the bureaucratic process that has delayed the enactment of flight attendant shoulder harness and other important aviation safety–related legislation for the 12-year period since similar legislation was enacted in the United States.

MCR 86 That Transport Canada ensure that individuals from aviation industry positions are not placed on Transport Canada hiring or selection committees where there is any appearance of those individuals having a conflict of interest between their industry positions and their positions on the selection committee.