16 THE F-28 PROGRAM: THE AUXILIARY POWER UNIT, THE MINIMUM EQUIPMENT LIST, AND THE DILEMMA FACING THE CREW OF FLIGHT 1363

By way of introduction to the discussion of the operational deficiencies facing the crew of flight 1363 on March 10, 1989, it is necessary to return to the circumstances leading up to the dispatch of the aircraft into Dryden. As described in Part Two of the Report, the evidence revealed that aircraft C-FONF was scheduled for operation on the day of the accident with its auxiliary power unit (APU) unserviceable. In this section there is a full explanation of the importance of the APU on C-FONF and the use of the minimum equipment list (MEL) by Air Ontario pilots, system operations control (SOC), and maintenance personnel.

The APU

Description

An APU is a small gas turbine engine installed on an aircraft to provide auxiliary power independent of the aircraft main engines or ground power sources. The APU can supply compressed air for engine-start purposes. It can also supply electrical power for the aircraft's electrical systems by way of a generator. On the F-28, the APU generator is designated as the number 3 generator, and it is used as a backup to generators 1 and 2, which are powered by the main aircraft engines.

The APU on C-FONF was manufactured by Garrett-Air Research Company. It was designated as model GTCP-36-4A with serial number P-37531.

The APU on the F-28 Mk1000 is installed at the rear of the aircraft fuselage behind the rear pressure bulkhead in a fireproof enclosure that

is ventilated during APU operations (figure 16-1). APU operation is virtually automatic, and it may operate unattended because of an automatic shutdown capability in the case of an "overspeed" situation,[1] low oil pressure, or fire.

The APU normally supplies compressed air for starting the aircraft engines and supplies the air-conditioning system while the aircraft is on the ground. The APU can be used in flight as a standby power source in the event of main generator failure.

Engine Starts

As previously stated, a source of compressed air is required to start the engines on the F-28. Normally this compressed air is supplied by the APU; however, when the APU is unserviceable, an external source of compressed air is required.

External compressed air can be supplied by three sources. First, an air bottle can be used (figure 16-2). This is a rechargeable source of compressed air which is often used at outlying stations where there may be only an occasional need for compressed air. Once spent, an air bottle may take several hours to recharge to a point where it can again start a jet engine.

Second, a ground air cart can be used. This is the method most often used at large airports. A ground air cart normally contains a small turbine engine from which compressed air can be bled to start an aircraft turbine engine.

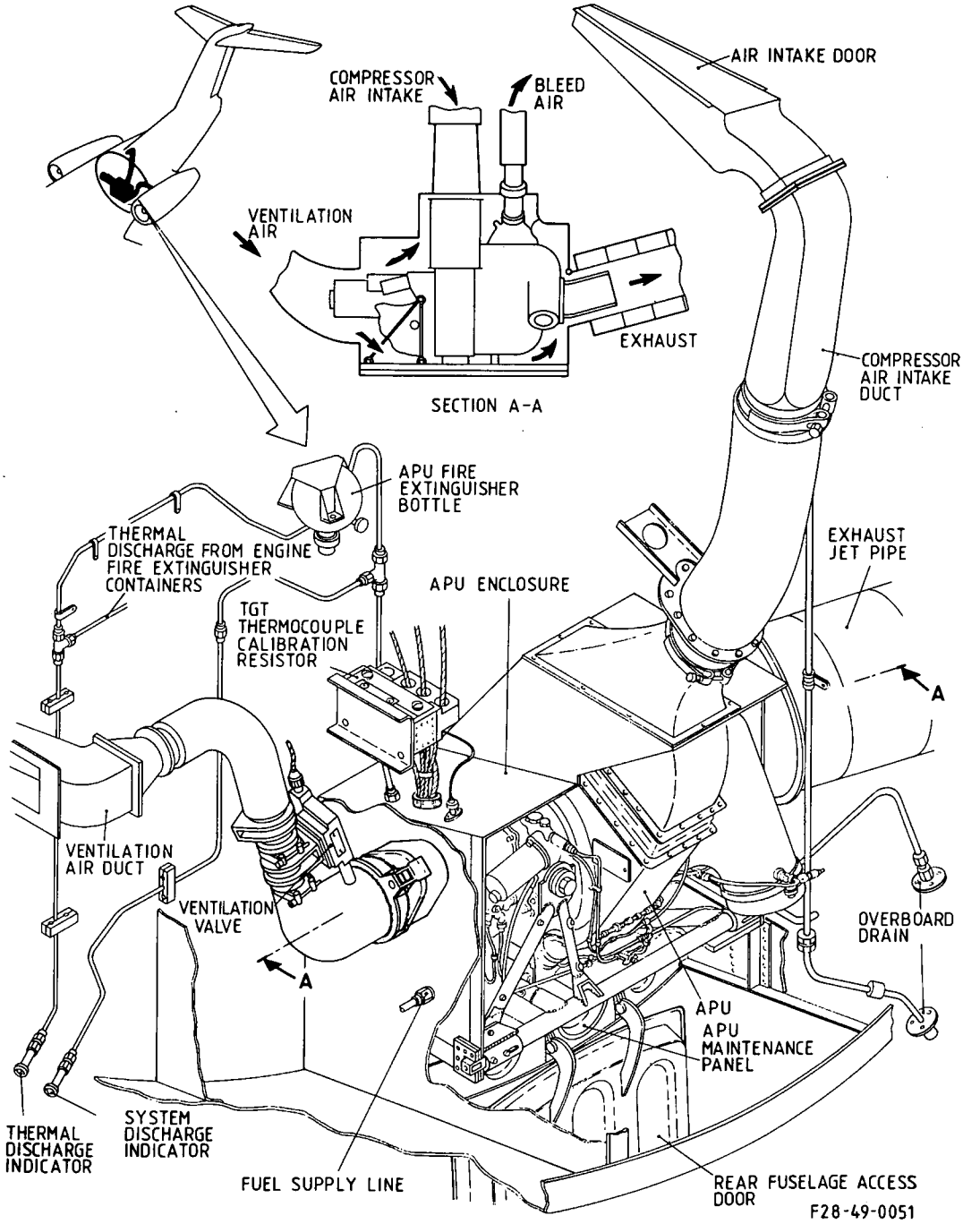
Finally, in the absence of an air bottle or an air cart, another turboprop or turbojet aircraft can supply compressed air to an aircraft by way of a "buddy-start" method. The already running jet engines can be connected, with appropriate hoses and couplings, to an engine of another aircraft to provide the necessary compressed air for startup. Such hoses and couplings are not usually carried on board the aircraft and were not available to the crew of C-FONF at Dryden.

Auxiliary Electrical Power: Anti-Skid System

One important function of the APU is the provision of backup electrical power to the aircraft anti-skid system – particularly for landing or for a rejected takeoff on a contaminated runway. If there is a possibility of an overrun in either situation, an F-28 pilot will immediately reduce power to idle and apply full braking. If this procedure will not stop the aircraft before it reaches the end of the remaining runway, the pilot will shut down the main engines to eliminate the residual thrust of the idle

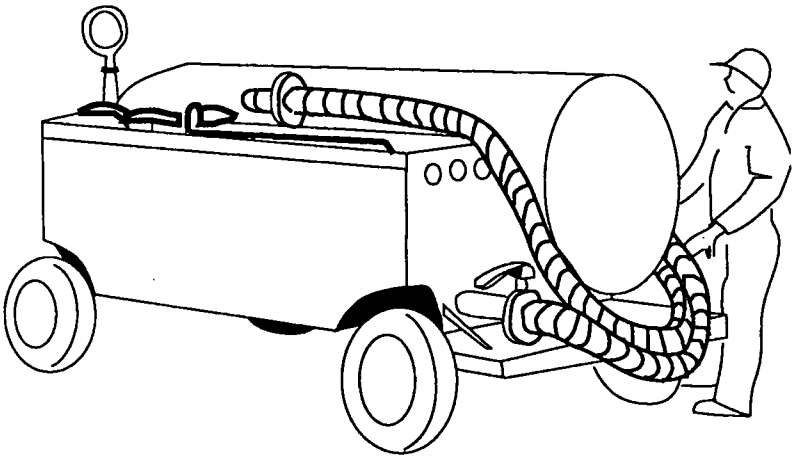
[1] When the APU exceeds 100 per cent of rated RPM

Figure 16-1 APU Installation



Source: Exhibit 322

Figure 16-2 Air Bottle: Single-Engine Air-Start Unit



power.[2] Shutting both engines down will result in a loss of electrical power from generators 1 and 2. In this critical situation, the electrical power from generator 3, which is powered by the APU, is necessary to operate the aircraft anti-skid system.

The significance of idle thrust to emergency stopping is specifically addressed in both the Piedmont F-28 Operations Manual and the USAir F-28 Operations Manual:

> When braking action is poor it is recommended to have the APU running and generator 3 on during takeoff and landing. When during a rejected takeoff or during landing skidding occurs which may result in a possible overrun of the available stopping distance consider shutting down the engines (idle thrust is approximately 800 lbs). In this case, generator 3 supplies the necessary electrics.
>
> (Exhibit 307, Piedmont F-28 Operations Manual, p. 3A-24-4; Exhibit 329, USAir F-28 Operations Manual, p. 3-125-7)[3]

A rejected takeoff or a landing on a contaminated runway where there is a possibility of an overrun is potentially more hazardous with an unserviceable APU. In the final moments of preparation for takeoff or

---

[2] On a dry runway, the normal application of brakes on the F-28 will more than overcome the effects of residual idle thrust.

[3] The Piedmont manual and the USAir manual were used, respectively, by Captain Morwood and First Officer Mills. The use of F-28 manuals at Air Ontario is discussed in chapter 19.

for landing, the flight crew must assess its options in anticipation of a potential overrun. With an unserviceable APU, this assessment would include a choice between an anti-skid capability or the elimination of residual idle thrust to prevent overrun.

Fire Protection: Fire Detection versus Fire Extinguishing

Fire protection for the APU is provided by two independent systems. First, there is a fire-detection system, consisting of a continuous detector loop within the APU unit that activates an electrical relay when it is exposed to excessively high temperatures within the APU enclosure or the unit itself. Second, there is a fire-extinguishing system, consisting of an extinguisher bottle that is discharged into the unit. The extinguisher bottle can be discharged either by the automatic activation of the fire-detection relay or, manually, by way of the pilot's activation of a guarded APU fire switch located in the cockpit.

In the case of the fire-detection relay being activated, a fire-warning lamp on the glare shield of the cockpit will illuminate; a cockpit fire-warning bell will ring; the APU will shut down; the air intake door and ventilation valve of the APU will close; and, after five seconds, the extinguisher bottle will discharge.

Fire-Protection System Test

Prior to starting the APU, there is a procedure for ensuring that the fire-detection and fire-extinguishing systems are operable. The test is performed in the cockpit by means of a "test/reset" toggle switch located on the cockpit secondary instrument panel. The switch is spring-loaded and, when held in the "test" position for five seconds, the APU fire-warning light illuminates and the APU fire-warning bell rings, indicating that the system is serviceable. If the fire-protection system proves serviceable, the system is reset and the APU start sequence can commence.

In the absence of a successful check of the APU fire-protection system, the APU cannot be operated except under the conditions specified in the minimum equipment list (MEL). Simply stated, an MEL is a Transport Canada–approved document that permits air carriers to operate aircraft with certain "essential equipment" inoperative. In order to fly an aircraft with such inoperative equipment, the air carrier must make certain operational accommodations that are clearly specified in the approved MEL.

Significance of an Unserviceable APU for Flight 1363

An unserviceable APU, when considered in conjunction with the unsettled area weather on March 10, 1989, and the fact that the Dryden line station did not have a ground-start capability for F-28 aircraft, caused operational irregularities that had to be considered by the flight crew of Air Ontario flight 1362/1363 and Air Ontario system operations control (SOC). These operational considerations were:

- The unsettled weather necessitated the use of a more distant than normal alternate,[4] Sault Ste Marie. Because of the greater distance, a scheduled fuelling in Dryden was necessary.
- In the absence of a ground-start capability at Dryden and the unserviceable APU, the fuelling in Dryden had to be performed with one of the F-28's main engines running.
- Because one main engine had to remain running, any extended ground delay at Dryden would necessitate ongoing revision of fuel consumption calculations.
- If for any reason both engines on the F-28 had to be shut down, the only readily apparent way the aircraft could be restarted would be to transport into Dryden air-start facilities or an air cart from another airport, as well as qualified personnel to make the appropriate hose connections and to support the start.[5]
- Air Ontario policy stipulated that main engines on the F-28 had to be shut down during de-icing.[6]
- During takeoff from a contaminated runway, the APU generator provides backup power to the aircraft anti-skid system. A rejected

---

[4] "Alternate" or "alternate airport" is a required alternative landing location to accommodate an en route change in conditions at the destination airport such that landing is not possible. By law, flight crews that file IFR flight plans must specify, among other things, at least one alternate (Air Navigation Order Series VII, No. 2, s.21). A turbojet aircraft must carry sufficient fuel to execute an approach and a missed approach at the destination airport, then fly to an alternate airport, and thereafter fly for a period of 30 minutes (ANO Series VII, No. 2, s.26). Further, the aircraft must carry sufficient reserve fuel to take into consideration meteorological conditions, anticipated air traffic control routings, and any other conditions that may delay the landing of an aircraft (ANO Series VII, No. 2, s.29).

[5] Although Air Ontario had performed "buddy starts" using air from a running Convair 580 aircraft to start another Convair aircraft, the necessary equipment to perform such a start on an F-28 was not readily available.

[6] Exhibit 317, Air Ontario F-28 de-icing memorandum, dated September 28, 1988, contained the following statement: "NEVER: Spray while main aircraft engine's are running!!!" The limited dissemination of this memorandum and the issue of whether pilots Morwood and Mills were aware of it are discussed in chapter 21, F-28 Program: Hot Refuelling and Ground De-icing.

takeoff from a contaminated runway with an unserviceable APU is more hazardous given that the anti-skid system would be inoperative in a two-engine shutdown situation. The stopping performance of the aircraft is less without the benefit of anti-skid.

- When Captain Morwood and First Officer Mills commenced their takeoff roll on the contaminated runway 29 in Dryden, they did not have the benefit of the APU generator backup to the anti-skid system. Prior to the takeoff roll, they would or should have known that in a rejected takeoff their stopping capability would have been diminished, either because of the inoperative anti-skid or the residual main-engine thrust.

Events Leading up to the Unserviceability of the APU

March 5 to 9, 1989

On the evening of Sunday, March 5, 1989, aircraft C-FONF arrived in Toronto after returning from a weekend charter flight to the western United States. The aircraft was under the command of Captain Bradley Somers. During one of his station stops of the trip, Captain Somers experienced difficulty getting sufficient air pressure from the APU to start the aircraft's main engines.[7] Captain Somers made the following entry in the aircraft journey log book for March 5, 1989: "For first start in morning air pressure was only 14 PSI with pack on and would not start engines. In MSP the pressure was normal and start was okay" (Exhibit 309, p. 09647). The entry would be interpreted by maintenance personnel to mean that, although Captain Somers had difficulty on his first start in the morning of March 5, the APU did produce sufficient air pressure to start the main engines later in Minneapolis–St Paul (MSP).

[7] The aircraft C-FONF was scheduled to "turn-around" in Idaho Falls, Idaho, on the evening of March 4. The aircraft was late in arriving and, because of a misunderstanding, the tour operator sent the passengers back to their hotel. As a result, their departure was delayed until the following morning and the aircraft remained out on the tarmac in Idaho Falls throughout the night with its APU running. Captain Somers testified that he kept the APU running because it was a very cold night and he wanted to keep the interior of the aircraft warm. This procedure was authorized by SOC. On the morning of March 5, when the return trip was to get under way, the APU was not producing sufficient air pressure to start the main engines. Aircraft C-FONF departed Idaho Falls on the morning of March 5 and overflew its scheduled fuelling stop at Sioux Falls, Iowa, because there was no air-start unit there. Because of the lack of air start at Sioux Falls and the unserviceable APU, Captain Somers rerouted to Minneapolis–St Paul, where ground start was available, for his refuelling.

Captain Somers noted one other problem with the aircraft that day. His second entry in the journey log read: "On first takeoff of morning cabin fills with oily smell from air pack after approx. 5 min. smell dissipates and normal for rest of flight" (Exhibit 309, p. 09648).[8]

The aircraft, C-FONF, with these two noted defects, arrived in Toronto at 4:33 p.m. on March 5. The aircraft was to be "turned around" quickly since it was scheduled to depart from Toronto to Winnipeg. In fact, from the journey log, the "turnaround" in Toronto took 57 minutes.

As a matter of course, the defects entered by Captain Somers would be examined by Air Ontario maintenance personnel. In this case, Mr John Jerabek, a line maintenance supervisor, considered the snags. Mr Jerabek testified that he discussed the two journey log entries with Captain Somers. With regard to the first entry, Mr Jerabek confirmed that Captain Somers used an air cart to start the main engines on the Idaho Falls station stop because the APU was not producing sufficient air pressure. After conferring with Captain Somers, Mr Jerabek examined the APU. He could not duplicate the snag because he found that the air pressure output and pressure gauge readings were normal. Accordingly, he made the following entry under the "defect rectified" section of the journey log: "APU was left running all night. Suspect stuck valve. Normal in YYZ" (Exhibit 309, p. 09647).[9]

With regard to the second journey log entry, that dealing with an oily smell, Mr Jerabek made the following entry in the "defect rectified" section: "Suspect residual oil in air ducts after ACM change. Please advise future operation" (Exhibit 309, p. 09648).[10] By checking previous snags, Mr Jerabek found that the air-cycling machine had been changed because it was leaking oil, and he suspected some of this residual oil found its way into the ducting that connects the ACM with the cabin ventilation system. He believed this residual oil was being heated and causing an oily smell in the cabin.

Mr Jerabek did not actually check the ducting for residual oil. A check of this nature would take many hours of work and the aircraft had a scheduled departure out of Toronto at 5:30. Moreover, because Captain Somers had reported that the oily smell dissipated after five minutes, Mr Jerabek felt it sufficient to advise subsequent crews to notify mainten-

---

[8] Flight attendant Sonia Hartwick also referred to an oily haze in the cabin at the beginning of flights on March 6 and March 8, 1989. She reported that the oily haze activated the smoke detectors in the rear of C-FONF.

[9] The designator YYZ indicates Toronto. Although Mr Jerabek had suspicions about the cause of the noted APU defects, it is inconclusive whether the low air-pressure production on the morning of March 5 was in any way related to the operation of the APU throughout the night of March 4.

[10] The acronym ACM stands for air cycle machine, which is part of the aircraft air-conditioning system used to cool the very hot air coming from the engines.

ance if the problem recurred. Mr Jerabek did no other work on C-FONF between March 5 and March 10, 1989.

Mr Jerabek's suspicion that residual oil may have leaked into the ducting may have been well founded; however, a review of the aircraft journey log would have revealed that a similar problem had been reported on two previous occasions. On January 21, 1989, smoke in the cabin of C-FONF was attributed to the air-conditioning system (the maintenance of the noted defect was deferred); and on February 27, 1989, thick oily smoke filling the cabin was again reported (the defect was rectified by correcting an oil leak in the duct work) (see chapter 10, Technical Investigation). The recurrent nature of this defect should have warranted the serious attention of Air Ontario's maintenance department.

What is even more troubling was what occurred after Mr Jerabek released the aircraft into service. The next day, on March 6, Captain Morwood noted in the aircraft journey log that the cabin became smoky, a passenger complained, and the smoke detector went off. He noted further that after 5 to 10 minutes the smoke dissipated. These observations were confirmed by the surviving flight attendant, Mrs Hartwick:

> Q. Shortly after takeoff, what happened?
> A. Right after takeoff, the smoke detector sounded from the back of the aircraft ... it is in the lavatory ...
> Q. And was this a fairly loud sound?
> A. Yes, it's a very high-pitched noise.
> Q. And, when you heard that sound, what did you do?
> A. At that time, I turned around to look for the light, and it was flashing, and I [rang] my chime system to get Katherine Say's attention, and she automatically looked at me, and I told her I was going to the back, because she noticed and heard the sound of the smoke detector.
>
> So I ran to the back to fight a fire.
>
> ...
> Q. Now, when you proceeded to the back of the aircraft, did you observe any kind of smoke or smell in the aircraft?
> A. Yes.
> Q. And could you describe that to the Commissioner, please.
> A. Yes, there was a smokeyish haze throughout the cabin. You could see from the back of the aircraft all the way to the front, it was like a haze, smoky haze, and there was a horrible smell to this smoke.
>
> ...
> Q. Now, when you got to the back right at the start, what did you do?

A. When I got to the back, the first thing I did was grabbed my Halon extinguisher, and then I felt the lavatory door with the back of my hand.
Q. With the back of your hand?
A. That's correct.
Q. Would you tell the Commissioner why you felt it with the back of your hand?
A. So that ... if I were to feel it with the front of my hand, meaning my palm, and if it were hot, I could possibly burn my hand, and then I would ... have problems holding my extinguisher and actually using my extinguisher, so I felt it with the back of my hand so that, if I did burn anything, it was on the back and I could still use the palm of my hands in order to hold it.
Q. Now, did Kathy Say relay to you what her understanding was of this smoke and smell? Was something indicated to her by the captain?
A. Yes, the captain had mentioned to her that, apparently in the captain's log book, the mechanics had made a little notation saying that they had changed the oil on the compressor – or some sort of droplets or something may have fallen on the compressor and that they could assume that, if a little bit of smoke came about because of this, that that was a good possibility ...
Q. And it was her understanding – and she conveyed this to you – that this was noted in the captain's log book; is that correct?
A. That's correct.
Q. And was there also a notation that possibly smoke could result from what was happening?
A. That's correct.
Q. Now, you feel the door with the back of your hand, and you have this Halon extinguisher with you. Was the door hot?
A. No, it was not.
Q. And what did you then do?
A. I opened up the door just a crack to peek in to see if I could see a lot of smoke or flames or anything, and there was nothing, so I opened it a little further until I finally opened it, and, at that point, I threw some ice cubes down the trash can and down the toilet.
Q. Why did you do that?
A. Just in case there was something in there that was burning.
...
Q. ... Did either Captain Morwood or First Officer Mills leave the cockpit to come to the back to see what was going on?
A. No, they did not.
Q. They did not, okay. And did they indicate any instruction to Kathy Say on what she should do?
A. Not to worry about it, that we can go about our duties.
Q. Okay. And how long did you stay at the back of the aircraft?

A. I stayed there about ten minutes, until the smoke cleared.
Q. What did you then do?
A. I then reset the fire alarm – or the smoke detector system.
(Transcript, vol. 10, pp. 126–32)

Maintenance rectified this snag as noted in the aircraft journey log by cleaning oil out of the APU outlet duct (see chapter 12, Aircraft Performance and Flight Dynamics).

Mrs Sonia Hartwick testified that on the morning of March 8, 1989, shortly after takeoff from Winnipeg to Dryden, the aircraft C-FONF, piloted by Captain Robert Nyman and First Officer Keith Mills, again filled with an oily smoke that triggered the smoke detector. Captain Nyman testified that he attributed the cause of the oily smoke – which he described as an "oily haze" – to the APU, and stated that it was a fairly common problem with that aircraft. He adopted the evidence of Mrs Hartwick that a circuit breaker was pulled to deactivate the smoke detector and that the circuit breaker was inadvertently not reset until they reached Thunder Bay, two flight legs later. Mrs Hartwick testified that smoke filled the cabin and the alarm again sounded during the return flight from Thunder Bay to Winnipeg. Captain Nyman did not note the cabin smoke incidents in the aircraft journey log because, as he put it, it was a recurring, intermittent problem of which maintenance was aware.

On five separate occasions – January 21, February 27, March 5, March 6, and twice on March 8, 1989 – an oily smoke, smell, or haze was reported in the passenger cabin of C-FONF. Maintenance attempts at rectifying the problem were obviously unsuccessful, and I am not at all confident that maintenance ever properly identified the cause of the problem.

I am not satisfied with Captain Nyman's explanation for not reporting the March 8 cabin smoke problems in the aircraft journey log. His failure to report the defects suggests that there may have been a breach of Air Navigation Order (ANO) Series VII, No. 2, the Aircraft Journey Log Order. The deactivation of the smoke detector on the morning of March 8 was a poor practice, and the evidence of Captain Nyman operating the aircraft with this essential aircraft equipment inoperative suggests that there may have been a violation of ANO Series II, No. 20, the Aircraft Minimum Equipment List Order.

I found Captain Nyman's characterization that the deactivation of the smoke detector was against "the legal letter of the law" (Transcript, vol. 109, p. 130) to be flippant and, at the least, ill-advised. While Captain Nyman was not the director of flight operations on March 8 when the incident occurred, he was recognized and respected among Air Ontario pilots as one of the most senior and experienced pilots in the company. All of the Austin Airways pilots would have worked for Captain Nyman

at one time or another, and First Officer Mills had worked in Captain Nyman's flight operations department for years prior to the incident. This mishandling of the cabin smoke incident reflects shoddy, lax flight-operations practices, and, coming from a pilot of Captain Nyman's stature, it most certainly would have sent the wrong signal to First Officer Mills, flight attendants Katherine Say and Sonia Hartwick, and anyone else in the organization who learned of it.

At the time of the occurrences, it was mandatory to report any in-flight incident involving smoke or fire to the Canadian Aviation Safety Board pursuant to sections 2 and 5 of the *Canadian Aviation Safety Board Act*. There is evidence that none of the described cabin smoke incidents were reported to CASB (Transcript, vol. 64, pp. 135–37).

The low APU air pressure for engine starts was again noted on March 8, 1989, while the aircraft was flown by Captain Robert Nyman and First Officer Mills. Captain Nyman made the following journey log entry: "[Entry] 164 APU air press low (MC042)" (Exhibit 309, p. 07104).[11]

Captain Nyman passed the aircraft over to Captain Alfred Reichenbacher in Winnipeg at the noon hour on March 8. Captain Reichenbacher carried on with First Officer Mills, flying the balance of the scheduled route for March 8. After arriving at Winnipeg, First Officer John Robinson replaced First Officer Mills. From Winnipeg, Captain Reichenbacher flew to Dryden, to Thunder Bay, to Sault Ste Marie, and finally to Toronto. The aircraft arrived at the Toronto maintenance base at 9:23 p.m. In the aircraft journey log, Captain Reichenbacher made the following notation regarding his March 8 flying segment: "Further to snag #164: engine starts are becoming more and more difficult (TGT 450°, normally would be 300–350°)" (Exhibit 309, p. 07105).

This journey log entry elaborates on Captain Nyman's earlier entry on low APU air pressure.[12] The entry describes an abnormally hot turbine gas temperature (TGT) during main engine start. This may have been symptomatic of an engine start where the engine compressor was not rotating fast enough at the point the fuel was ignited. The result would be an insufficient cooling airflow during the start sequence, causing high turbine gas temperatures. A reason that the compressor blades were not rotating fast enough may have been insufficient APU startup air pressure. Therefore, the observed high turbine gas temperatures were

[11] The notation MC042 denotes the assignment by Air Ontario Maintenance Control in London of a maintenance control number. This allows the aircraft to be flown back to the Toronto maintenance base with the APU unserviceable. This procedure is laid down in the Air Ontario Maintenance Control Manual (Exhibit 319).

[12] Defect number 164 was addressed by maintenance personnel in Toronto on March 8 and 9.

apparently a result of deficient air pressure generated by the APU on startup.

The Events of March 9, 1989

The aircraft, C-FONF, arrived back at the Toronto maintenance base at 9:23 p.m. on March 8, 1989. It was scheduled to fly on the morning of Thursday, March 9.

Mr Channan (Ken) Ramnarine, a maintenance crew chief at Air Ontario Toronto maintenance base, gave evidence regarding the rectification of the low APU air-pressure defect. He testified that he arrived for work at approximately 7 a.m. on March 9. After having reviewed the APU problem, he proceeded to change the APU load control valve. This valve controls the pneumatics of the APU, and it was believed that a replacement of the valve would rectify the low-pressure problem. After changing the valve, he made the following entry in the aircraft journey log: "Control valve replaced SN ON P92 SN OFF, P-515" (Exhibit 309, p. 07104).[13]

Mr Ramnarine and Mr Steven Korotyszyn, an Air Ontario lead inspector at the Toronto maintenance base, then started the APU. Mr Korotyszyn testified as to the APU startup:

A. Well, the aircraft was towed out of the hangar, and it was parked. Ken [Ramnarine] and I walked over, and I did a walk-around, got in the airplane, and we prepared to start the APU.
Q. And where were you physically located when the APU was started?
A. I was in the co-pilot's seat.
Q. And where was Mr Ramnarine?
A. Ken was in the captain's seat.
Q. Was the fire shield on the APU at this time?
A. The fire shield was off.
Q. So was there a fire picket outside?
A. Yes, there was.
Q. Now, did you proceed or Mr Ramnarine proceed to fire up the APU?
A. Well, we went through the checklist, and we did the fire test first.
Q. Right, and what happened when you did the fire test?
A. Well, we got the light and the audible horn.
Q. Right. And then did you commence to fire up the APU?
A. We started to – we fired up the APU.
Q. And did it run successfully?

[13] The entry means that the existing valve – serial number P-515 – was removed and replaced by valve serial number P-92.

A. It did not.
Q. Now, we're talking sometime after 10 o'clock in the morning at this point?
A. Yes.

(Transcript, vol. 42, pp. 17–18)

The APU was still delivering the low air pressure, and Mr Ramnarine and Mr Korotyszyn continued troubleshooting. They electrically disconnected the load control valve, and the APU ran successfully. When they reconnected the load control valve, the APU did not operate successfully. On the suggestion of Mr Korotyszyn, Mr Ramnarine reinstalled the original load control valve, and the APU then ran successfully. He shut the APU down and had one of the maintenance helpers reinstall the fire shield to enclose the APU compartment. Mr Ramnarine noticed that three camlock fasteners were missing from the fire shield. He again performed a fire test and restarted the APU. Then he put a load on the APU by starting one of the F-28 engines. This would be the last time that the APU and the APU fire-detection system on aircraft C-FONF both tested serviceable.

After running the engines, Mr Ramnarine instructed his men to reinstall the fire shield. With his confirmation that the fire shield was installed with all fasteners in place, Mr Ramnarine and his crew completed their work on C-FONF on the morning of March 9, 1989.

Mr Kostas (Gus) Athanasiou was an Air Ontario crew chief at the Toronto maintenance base and an aircraft maintenance engineer (AME) endorsed by Transport Canada to work on the F-28 aircraft.[14] Mr Athanasiou was on duty at the base from 7:30 a.m. until 7:30 p.m. on March 9. His first involvement with C-FONF occurred at approximately 4:00 p.m., when he was asked to proceed to the hangar and to pick up the F-28 aircraft for a scheduled departure. Prior to startup he reviewed the aircraft journey log and satisfied himself that there were no outstanding defects. He then commenced the startup procedure. When he performed the preliminary step of testing the APU fire-detection system, Mr Athanasiou found that it was not operable – he testified that "it would not fire test at all" (Transcript, vol. 42, p. 90).

Mr Athanasiou then attempted to rectify the observed defect in the fire-detection system. He opened the APU enclosure and discovered a loose wire. After spending some time reconnecting the wire, he still could not get the APU fire test to work. He did not perform a systematic

[14] In order to get an F-28 endorsement, Mr Athanasiou took a course of approximately two weeks in duration at Piedmont Airlines in Winston-Salem, North Carolina, as did both Mr Korotyszyn and Mr Ramnarine. The amount of time on the course dealing with the APU was, to Mr Athansiou's recollection, about half a day.

tracing of this electrical defect, explaining that the electrical trouble-shooting could have taken hours and the aircraft was scheduled to depart. In his testimony, Mr Athanasiou was not able to identify the function of the loose wire or confirm whether it related at all to the serviceability of the APU fire-detection system. He simply explained that he observed a loose wire and he tightened it.

There was some speculation during the course of the hearings that, when Mr Ramnarine's crew tightened the fire shield for the final time, they may have pinched a wire in the fire-detection loop, which would render the fire-detection system unserviceable. Mr Ramnarine testified that, while he did not think this was the case, it did provide a possible explanation for the unserviceability observed later by Mr Athanasiou.

Given that Mr Athanasiou was not able to rectify the malfunctioning APU fire-detection system, Air Ontario maintenance and the scheduled flight crew were left with two options. They could ground the aircraft until the problem was solved. This option would have involved getting a substitute aircraft and crew for the displaced passengers. Alternatively, they could defer the maintenance of the APU fire-detection system pursuant to the minimum equipment list (MEL).

The option to defer the maintenance of the APU fire-detection system was discussed by Mr Athanasiou, Mr Korotyszyn, and Captain Robert Perkins in Toronto. They also discussed the matter by telephone with both Air Ontario system operations control (SOC) and maintenance control in London.[15]

The decision was to defer rectification of the APU fire-detection system malfunction pursuant to section 49-04 of the MEL, and an appropriate entry was made by Mr Athanasiou in the aircraft journey log. Mr Athanasiou's defect description reads, "APU will not fire test." He added under the "defect rectified" section, "Deferred as per MEL 49-04" (Exhibit 309, p. 07108).[16] After making the deferral entry,

---

[15] Maintenance control and SOC perform complementary functions within the maintenance and flight operations departments of Air Ontario. It is the responsibility of Maintenance control to monitor the state of serviceability of the aircraft and to ensure that the required scheduled maintenance programs for the various aircraft are followed. It is the responsibility of SOC to coordinate crew, aircraft, and station facilities. Maintenance control and SOC work closely together to coordinate commercial scheduled service with scheduled and unscheduled maintenance of the company's aircraft. Reflecting this close integration is the fact that maintenance control and SOC are located in adjacent offices at Air Ontario.

[16] There were two possible deferral numbers under the APU section of the MEL (Exhibit 310): 49-01, which was a general section appropriate for an unserviceable APU; and 49-04, which was specifically designated for an unserviceable APU fire-extinguishing system. Mr Korotyszyn explained that because the unserviceability was the *fire-detection* system, 49-01 would have been a more appropriate deferral number than 49-04.

Mr Athanasiou placed a red placard on the cockpit APU panel of C-FONF that read "INOP."

It must be noted that Mr Korotyszyn, who was responsible for the deferral of the maintenance of the APU, was under the misapprehension that Dryden did have ground-support facilities. His testimony in this regard is significant:

> Q. You are the only one that is clothed with the responsibility of deferring this maintenance, right?
> A. That is right.
> Q. That is your decision?
> A. Right.
> Q. And I am putting it to you, in order to do that, in order to reach that decision, on an informed basis, you have to ask questions of other people such as the captain and SOC; don't you?
> A. I would have.
> Q. ... And specifically now on March the 9th, you did put questions to Captain Perkins about what kind of conditions the F-28 might run into, is that right?
> A. Well ... I made sure that there was equipment to support the aircraft.
> Q. ... Did you ... know that the aircraft might be going into Dryden where there was no air start?
> A. I knew the aircraft was going into Dryden. I did not know there was no equipment there.
> Q. ... Were you under the impression that there was equipment there?
> A. Yes.
>
> (Transcript, vol. 42, pp. 68–69)

Although Captain Perkins accepted the aircraft with the deferred maintenance of the APU fire-extinguishing system, he in fact used the APU to start the aircraft engines in Toronto prior to his departure. This was permitted by MEL section 49-04, which required that, with an inoperative fire-extinguishing system, the captain must arrange for constant monitoring by ground crew. In this case Captain Perkins had maintenance personnel standing by to act as a "fire picket."

It is clear, therefore, that when Captain Perkins accepted aircraft C-FONF on the afternoon of March 9, 1989, the APU was producing sufficient air pressure to start the main engines, although the APU fire-detection system was inoperative.

Events Following the Departure of C-FONF from Toronto

The aircraft, with Captain Perkins in command, left Toronto for Winnipeg via Sault Ste Marie, Thunder Bay, and Dryden at 6:49 p.m. EST on March 9. The aircraft was to remain overnight in Winnipeg and

to commence flying under the command of Captain Morwood at 7:30 a.m. on March 10.

Though he used the APU to start the engines on the aircraft in Toronto, Captain Perkins testified that, because the fire-detection system was inoperative, the APU was to be regarded as unserviceable and not to be used on line operations. Captain Perkins was questioned on his flight planning for the evening of March 9, 1989, given that his aircraft had an unserviceable APU and he would be flying through Dryden, where there was no ground-starting capability:

> Q: And maybe you can tell us at this point in time that being aware of no ground start capability in Dryden, did that have any bearing on your thought process at the time?
> A: It had not a lot, because we were not going to be required to fuel in there. As long as the ground people were aware of the fact that they were going to be operating through there with the one engine in operation. It was more of an advisory state for that station as opposed to a request for ground support.
> Q Assuming that weather would remain constant and favourable?
> A: Yes.
> Q: And you didn't have to de-ice?
> A: Yes.
> Q: Right?
> A: The weather was quite reasonable for our trip out, yes.
> Q: So essentially, Captain ... provided that the aircraft would be released from maintenance, you made a conscious decision that you would take it out on that flight, knowing that there was no ... ground serving capability at Dryden?
> A: That's correct.
>
> (Transcript, vol. 43, pp. 144–45)

Captain Perkins arrived with C-FONF in Winnipeg at 10:53 p.m. CST. He testified that he did not phone Captain Morwood to advise him of the problem with the APU because it was late and he did not want to wake him to "tell him something that he theoretically should already know" (Transcript, vol. 43, p. 182). He testified further that he would have expected SOC to have relayed the details of the APU unserviceability to Captain Morwood. I note that Captain Perkins, having been involved with the APU problem throughout the afternoon of March 9, was in the best position to give Captain Morwood a complete and accurate briefing regarding the APU problem. Instead, Captain Morwood had to rely on the limited and somewhat conflicting notations in the aircraft journey log and on a brief telex message from SOC the following morning.

The Role of SOC

As previously mentioned, one of the options available to Air Ontario SOC on the evening of March 9, 1989, was to replace the aircraft C-FONF with another aircraft. In fact, while maintenance grappled with the APU problems, a Convair 580 had already replaced C-FONF on its scheduled morning return flights to Sudbury and its afternoon return flight to Sault Ste Marie. According to Mr Danilo (Dean) Koncan, SOC duty manager working the afternoon and evening of March 9, the same Convair was available to carry on as a replacement for the balance of the day's flying to Winnipeg, but its crew would have exceeded its maximum duty day by the time they reached Dryden and therefore could not have completed the segment. Mr Koncan testified further that he would have had some difficulty in getting two Convair crews – a replacement crew to fly to Winnipeg on the night of March 9, and an additional crew to fly the aircraft back to Toronto the next morning – on short notice at that time.

The F-28 was not replaced for the evening flight to Winnipeg; instead, the decision was made to dispatch the aircraft with the unserviceable APU. Mr Koncan stated that prior to SOC and the flight crew agreeing that C-FONF would be dispatched to Winnipeg, they telephoned the line stations at Sault Ste Marie, Thunder Bay, and Winnipeg to confirm that ground-support equipment was serviceable. Mr Koncan testified that, because he was aware that there was no ground-support equipment at Dryden, he did not call Dryden prior to the dispatch of the aircraft on March 9.

The aircraft left Toronto for Winnipeg via Sault Ste Marie, Thunder Bay, and Dryden. Prior to the aircraft landing at Thunder Bay, Mr Koncan checked the Dryden weather. He explained his reasons for doing this:

> A. Prior to the aircraft landing in Thunder Bay from Sault Ste Marie, we had looked at Dryden weather, pulled up the last eight-hour history on it and alternates down line as far as Winnipeg and Thunder Bay still being the alternate for the last flight, all conditions were good. And based on the fact that as a standard on that particular flight between Thunder Bay and Winnipeg via Dryden, we tankered fuel ... in Thunder Bay.
> Q. By tankering fuel, could you just explain that for the record, please?
> A. Tankering fuel was carrying in excess of what was required so that in Dryden, no fuel uplift was required, based on economics of Thunder Bay being cheaper than Dryden.
> Q. That is, cheaper fuel in Thunder Bay than Dryden?
> A. That is correct ... And based on the passenger count and cargo that it would not exceed the max payload carrying so much fuel.

Q. ... Now, you say you were checking the weather for Dryden. Why?
A. Any indications that we would have any problems as a standard going so far down line to review the operation if there were any operational problems with the weather that we would not be dispatching it to Dryden, we would be overflying it.
Q. And what operational considerations would come into your mind with regard to dispatching to Dryden with no air start?
A. Runway conditions, the weight of the aircraft, adverse weather, the equipment available at Dryden.
Q. ... Did the possibility of having to de-ice in Dryden ever enter your calculations?
A. On that particular flight, no, it did not.

(Transcript, vol. 47, pp. 22–24)

Mr Koncan was asked about the dispatch of the F-28 aircraft under circumstances where there was the possibility of having to de-ice the aircraft. In particular, he was shown an Air Ontario memorandum of September 28, 1988, addressing the subject and asked for his comment on its contents. The document, a memorandum from Mr Robert Mauracher of London maintenance to the reliability committee of Air Ontario, dealt with winter operations generally and with de-icing of the F-28 specifically. A copy of the document was kept in London SOC and had been seen previously by Mr Koncan. Mr Koncan understood the document to be an instruction from Air Ontario management regarding de-icing practices for the F-28 aircraft. On page 3 of the document there is the following warning:

NEVER: Spray while main aircraft engine's are running!!!

(Exhibit 317)

Mr Koncan explained his understanding of F-28 de-icing policy:

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, [with] unserviceable APUs, into line stations where there was no air starts and the possibility of de-icing?
A: No, there was not.

(Transcript, vol. 47, p. 39)

Based on this understanding, Mr Koncan testified that he would not dispatch a jet aircraft with an unserviceable APU into a station where there was no ground-start unit if there was any possibility that the aircraft had to be de-iced.

With regard to the operation of C-FONF on March 10, 1989, Mr Koncan testified about the possibility of repairing the APU during the Winnipeg overnight stop:

> Q: ... Was the repair or maintenance to this APU on C-FONF in Winnipeg ever discussed?
> A: Yes, it was.
> Q: Could you describe that for the Commissioner, please.
> A: The Maintenance Controller had advised us that the trouble-shooting portion of that APU was not completed, they still were looking for the component, and, because of lack of parts, they were going to see if, overnight, maintenance in Winnipeg could repair.
>
> (Transcript, vol. 47, pp. 31–32)

It appears that Mr Koncan was misinformed. Mr Steven Brezden, the Air Ontario aircraft maintenance engineer on duty that evening in Winnipeg, testified that when he noted the APU snag in the aircraft journey log he considered no further action. He explained that "Winnipeg, being a line station and the type of job we were doing, we didn't normally do deferred defects" (Transcript, vol. 46, p. 116). Mr Brezden stated that his work on the F-28 was limited to routine service checks.

Prior to leaving work at 11:30 p.m., Mr Koncan left a note for Mr Martin Kothbauer, duty operations manager on the morning of March 10. This note advised Mr Kothbauer that the aircraft C-FONF was in Winnipeg and that he should confirm with maintenance control that the APU was serviceable. Alternatively, Mr Kothbauer should get in touch with Air Canada station operations control (STOC) in Winnipeg to ensure that an air start and AC ground power for the aircraft were available for the departure on flight 1362 on the morning of March 10.

Events of March 10, 1989

On the morning of March 10, 1989, Mr Daniel Lavery was on duty at Air Ontario SOC as a dispatcher, and Mr David Scully was on duty as a maintenance controller. When Mr Kothbauer reported for work at 5:00 a.m., he looked at the duty operations manager log that contained the note from Mr Koncan written the previous night. Further to these instructions, he asked Mr Scully to telephone Winnipeg to check on the status of the APU of C-FONF. Mr Kothbauer testified that Mr Scully made the call and advised him that the APU would be unserviceable for the balance of the day while Winnipeg maintenance awaited the arrival of a replacement part.

Mr Kothbauer then telephoned the Winnipeg, Thunder Bay, and Sault Ste Marie stations to confirm that they were able to provide air starts for the aircraft throughout the day. He provided further confirmation by sending a message to the same stations via the Reservac computer communications system. The message advised that air starts would be required in Winnipeg, Thunder Bay, and Sault Ste Marie, and that the aircraft would be operating with one engine running at the Dryden station stop. A similar message was sent at 10:57 a.m. for the afternoon operations of the aircraft. That second message read, in part:

> THE R/H ENG WILL AGAIN BE LEFT RUNNING WHILE THE ACFT OPS THRU YHD. IF [YOU] ARE UNABLE TO PROVIDE AIRSTARTS PLS ADVS US ASAP AS WE WILL THEN HAVE TO SET UP HOT-REFUELLING.
>
> (Exhibit 349)[17]

Mr Kothbauer testified that he looked at the Dryden area weather forecasts and, although they called for a risk of light freezing rain, he did not take any special steps regarding the dispatch of the aircraft into Dryden. He was aware of the company procedure not to de-ice the F-28 aircraft if its main engines were running, and he was aware of these de-icing restrictions on March 10 when he was preparing the line stations for C-FONF:

> Q. Did it come into your calculations or considerations that day with regard to the aircraft landing in Dryden?
> A. Not – not really. I was thinking later in the day, by the looks of the weather moving in from the west, that we might have a problem operating through Dryden in the evening, but not that morning.
> Q. You stated that you didn't have a concern, and what concern are you speaking of, the probability of the aircraft having to be de-iced in Dryden?
> A. Yes.
>
> (Transcript, vol. 49, pp. 39–40)

Mr Kothbauer was asked why he assumed that the freezing precipitation would occur later in the day on March 10:

> Q. Why, then, did you assume that this light freezing rain would occur later in the day?
> A. Just by the overall view that I got from the weather system that day.

[17] A copy of the first message was never located by Commission investigators. Mr Kothbauer testified that the second message (Exhibit 349) was similar to the first.

Q. And your view of the overall weather system, I take it, included some other data than these two area forecasts in front of you?
A. The first terminal forecast that was issued for Dryden just had light rain in the forecast.[18]

(Transcript, vol. 49, p. 41)

The first terminal weather forecast for Dryden would have been received in London at SOC at about 8:45 a.m. EST. It would not have been available for consideration in the dispatch of flight 1362 out of Winnipeg at 7:35 a.m. CST.

Mr Kothbauer was questioned about the significance of forecasted freezing precipitation at a line station into which an aircraft with an unserviceable APU was operating:

Q. If, in your opinion, there was freezing precipitation or snow or some other precipitation phenomenon that could have contaminated the wings of an aircraft, what would you do on the dispatch of that aircraft with no serviceable APU through a line station with no air start?
A. I would have considered overflying that station.

(Transcript, vol. 49, p. 43)

Events at Thunder Bay

Mr Kothbauer was informed by dispatcher Wayne Copeland of the 11:55 a.m. departure of flight 1363 from Thunder Bay Mr Kothbauer then accessed the latest station actual weather observation for Dryden (issued at 11:00 a.m. EST), which indicated VFR weather with scattered cloud at 4000 feet and overcast cloud at an estimated 8000 feet. This station actual observation would have been 55 minutes old by the time the aircraft left Thunder Bay.[19]

Significantly, an amended terminal weather forecast issued at 10:02 a.m. EST called for light freezing rain at Dryden (Exhibit 313, p. 10). Mr Kothbauer did not recall seeing the amended terminal forecast. He testified that this 10:02 a.m. amended weather forecast should have been available to him at the London SOC via the Reservac computer system prior to the departure of C-FONF from Thunder Bay at 11:55 a.m.

Mr Kothbauer was asked what the significance of the amended terminal forecast would have been had he seen it:

---

[18] The first terminal weather forecast for Dryden issued at 1330Z (7:30 a.m. CST) did not indicate freezing rain (Exhibit 360).

[19] In fact, the next station actual weather observation at 12:00 EST indicated no significant difference in the observed weather.

Q. ... If you would have had occasion to look at that document, would this amendment including ... light freezing rain ... have influenced your decision one way or the other with regard to the continuation of Flight 363 to Dryden with an unserviceable APU?
A. Yes, sir, it would have.
Q. And what ... conclusion would you have come to?
A. Normally, if it was just an occasional as it is in that terminal forecast, I would at least confer with the captain to see what his thoughts on it were, but I would plan a no-stop or to overfly the station.

(Transcript, vol. 49, p. 75)

Mr Kothbauer acknowledged that there was a breakdown in the Air Ontario SOC weather watch/flight following procedure with regard to the dispatch of aircraft C-FONF on the morning of March 10. He and Captain Morwood should have had the benefit of the amended terminal weather forecast at 10:02 a.m. calling for freezing rain at Dryden. The evidence indicates that, with this information, the flight crew may have and SOC would have taken steps to overfly Dryden. The "overfly option" is discussed at greater length in chapter 23, Operational Control.

The MEL: Use and Approval

The previous section revealed a significant error in the dispatch of the aircraft C-FONF. Given that the APU was unserviceable, the aircraft should not have been dispatched into Dryden, where there were no ground-start facilities – particularly in a situation where freezing rain was in the forecast for the Dryden area. This error, which was acknowledged in evidence by the Air Ontario personnel involved, raised serious questions in my mind regarding the ability of Air Ontario to exercise proper operational control over its scheduled flights and led to a review of the dispatch function at Air Ontario (see chapter 20, F-28 Program: Flight Operations Training). The release of the aircraft from the Toronto maintenance base with an unserviceable APU gave rise to a deeper inquiry into Air Ontario maintenance practices.

The Role of Maintenance in the Commercial Air Transportation System

The Aviation Regulation Directorate of Transport Canada is charged with the responsibility of ensuring that air carriers comply with the Air Regulations and Air Navigation Orders. This responsibility encompasses

both the approval of new air carrier maintenance operations and the ongoing monitoring of existing maintenance functions.

The approval process involves the regulator reviewing the air carrier's maintenance organization, practices, and key personnel as a precondition to the granting of an operating certificate or an amendment to an operating certificate. Among the conditions precedent to the granting of an operating certificate, Transport Canada specifically requires that air carriers satisfactorily show that the director of maintenance and the chief maintenance inspector of the carrier are competent and qualified to carry out their functions. In addition, the regulations require that the regulator satisfy itself that the air carrier has sufficient ground-support equipment, parts, and adequate facilities to provide "the proper maintenance" of its aircraft (ANO Series VII, No. 2, s.12(1)).

An air carrier is required to submit to Transport Canada for approval a maintenance control manual (MCM) that

> shall contain a description of his maintenance system including the maintenance organization, inspection schedule and maintenance personnel responsibilities relating to servicing, rectification, inspection and certification.
>
> (ANO Series VII, No. 2, s.12(1))

Once approved, the MCM is intended to serve as the yardstick against which the maintenance of aircraft by an individual maintenance department is assessed and audited. In this regard the regulations state:

> No air carrier shall release for flight or operate an aeroplane unless that aeroplane has been maintained and released in accordance with the approved *Maintenance Manual* [MCM].
>
> (ANO Series VII, No. 2, s.12(3))

The regulator is able to revoke an air carrier's operating certificate for maintenance practices that contravene its MCM and hence the Air Regulations, but this sanction is extreme and not often used by Transport Canada.

As is the case with the flight operations component within the air transportation system, a strong interface between the regulator and the air carrier is required for the maintenance component to function effectively. The efforts of the carrier and the regulator meet first at the approval or certification stage and then during the ongoing monitoring of the carrier by the regulator.

In the certification stage, the regulator approves (or disapproves) a particular operation on the basis of the carrier's representations in its application for an operating certificate and on that of the regulator's independent evaluation of the carrier's ability to operate safely. This

approval is finalized by the granting of the operating certificate or the amendment of an existing operating certificate to reflect a change in the carrier's operations.

After the granting of the operating certificate, the regulator must ensure compliance with the terms of the approval by way of audits and inspections. In the case of the maintenance organization, the approved MCM is the basis for audit and inspection. Throughout the hearings of this Commission, the evidence confirmed for me that a greater emphasis on regulatory approval and certification will reduce the effort required for post-certification monitoring.

Once approval for an operation has been granted and the operation is under way, the maintenance function within the carrier assumes its responsibility to ensure the airworthiness of the aircraft fleet in accordance with the MCM. Essentially those functions divide into "scheduled" and "unscheduled" maintenance.

Scheduled maintenance consists of major and minor routine checks and overhaul of aircraft components that must be done pursuant to a set schedule prescribed by the aircraft manufacturer. This maintenance represents a benchmark around which the use of the aircraft must be scheduled. The program for the Air Ontario F-28 aircraft was the Fokker "Post Analysis Program" that was approved by Transport Canada.[20]

Unscheduled maintenance encompasses the rectification of defects that result from the day-to-day operation of aircraft. The rectification of these unexpected defects may require taking an aircraft out of service, with the obvious economic consequences. It is understandable that maintenance organizations are often under implicit or explicit pressure to do whatever it takes to get aircraft back into service. This conflict between safety and profitability is addressed directly in the introduction to the Air Ontario Maintenance Control Manual, which reads:

> The standards, practices and procedures as promulgated in this Manual are provided to attain the highest standard of aircraft maintenance in keeping with safety and efficiency. Economic requirements shall not take precedence over safety in the inspection and maintenance function.
>
> (Exhibit 319, p. 1.1)

Unscheduled Maintenance:
Defect Rectification and Maintenance Deferral

Unscheduled maintenance, according to the Air Ontario MCM, falls into two broad categories: defects entered into the aircraft journey logbooks by either flight crew or maintenance personnel, which had to be rectified

[20] Exhibit 319, Air Ontario Maintenance Control Manual, p. 4.18A

prior to the release of the aircraft into service; and defects whose maintenance could properly be deferred.

Maintenance deferrals are exceptions to the general rule that defects must be reported as soon as detected and rectified prior to further flight. Deferred maintenance is (or should be) taken very seriously by the regulator, since it represents regulatory permission for an operator to carry revenue passengers in aircraft that are less than completely serviceable. Maintenance deferrals of essential aircraft equipment are permitted within the Canadian regulatory scheme only if the carrier is in possession of a document known as a minimum equipment list (MEL), which is specific to each aircraft type and which must be approved by Transport Canada.

The subject of MEL approval and use received considerable attention during the course of the hearings, since the evidence disclosed not only that Air Ontario maintenance had incorrectly used the MEL in the deferral of the APU prior to the accident, but also that the F-28 had operated for the first six months of its revenue service without an approved MEL.[21] The evidence on the subject raised several questions:

- Why did it take so long for the MEL to gain Transport Canada approval?
- Bearing in mind that there is no legal requirement for an air carrier to have an approved MEL, should there have been approval of the amendment to the Air Ontario operating certificate to include the F-28 aircraft without an approved MEL in place?
- How effective was Transport Canada in monitoring Air Ontario's F-28 operation during the six-month period when there was no approved MEL in place, and the probability existed that the aircraft was being operated with unserviceable components and perhaps without a valid certificate of airworthiness?
- When the MEL was finally approved, were operational personnel at Air Ontario using it properly?
- Were Air Ontario personnel sufficiently trained on MEL use?

Description

In chapters 22, F-28 Program: Flight Attendant Shoulder Harness, and 34, Operating Rules and Legislation, I review the process behind the

[21] Air Ontario commenced its commercial F-28 service in June 1988 with one aircraft, C-FONF. The sister aircraft, C-FONG, arrived in Canada to begin service in November 1988. The MEL for the Air Ontario F-28 was verbally approved by Transport Canada on an interim basis in December 1988 and formally approved by Transport Canada in June 1989.

certification of aircraft types in Canada and how, after certification or "type approval" by Transport Canada, carriers may operate such type-approved aircraft subject to the Air Navigation Orders.

It has long been recognized by regulatory bodies that modern transport category aircraft are designed and certified with sufficient redundancies in their systems to ensure a margin of safety in their operation. It has also been recognized that, with such redundancies, it is within acceptable bounds of safety for carriers to operate an aircraft with some unserviceable components. If regulators insisted on complete aircraft serviceability prior to each flight, unnecessary groundings would occur, with a resulting loss of income to the carrier. Therefore, out of necessity and common sense, some leeway has been granted to air carriers in the operation of their aircraft with non-essential equipment in less than a completely serviceable state.

The carriers, for obvious reasons, would prefer this departure from complete serviceability to be generous and flexible. The role of the regulator within the air transportation system is to restrict variances from complete aircraft serviceability as narrowly as is necessary to ensure an acceptable level of safety in commercial air carriage.

A minimum equipment list (MEL) is a Transport Canada–approved document that authorizes an air carrier to dispatch an aircraft with specified essential equipment inoperative under the conditions specified therein. A functional definition of the MEL is provided by an internal Transport Canada policy document entitled MMEL/MEL (Master Minimum Equipment List) Policy and Procedures (January 1, 1990):

> The MEL is a joint operations and maintenance document prepared by an operator to:
> a) identify the required essential equipment to maintain the Certificate of Airworthiness in force and to meet the operating rules for the type of operation;
> b) define operational procedures necessary to deal with inoperative equipment; and
> c) define maintenance procedures necessary to maintain the required level of safety and procedures necessary to secure any inoperative equipment.
>
> (Exhibit 962, p. 21)

In order to fly an aircraft with inoperative essential equipment, the air carrier must make certain operational and/or maintenance accommodations that are clearly specified in the approved MEL.

The governing order on MEL approval and use is Air Navigation Order Series II, No. 20, CRCc.-25, *Aircraft Minimum Equipment List Order* (ANO Series II, No. 20). The essence of the order is contained in section 7, which states:

> s.7 No air carrier shall operate an aircraft if any essential aircraft equipment is inoperative unless he does so in compliance with a minimum equipment list.

A slight qualification is provided in section 8 of ANO Series II, No. 20:

> s.8 Notwithstanding section 7, no aircraft shall be operated where, in the opinion of the pilot-in-command, flight safety is or may be compromised.

"Essential aircraft equipment" is defined as:

> ... an item, component or system installed in an aircraft, that
> (a) has a primary role of providing information or performing a function required by regulation or order; or
> (b) is directly related to the airworthiness of the aircraft.
> (ANO Series II, No. 20, s.2[22])

In the absence of an approved MEL, a transport category aircraft cannot operate unless 100 per cent of its essential aircraft equipment is serviceable.

Using the Air Ontario F-28 MEL

An aircraft can operate on a revenue flight only if qualified maintenance personnel release it or "sign it out" as being airworthy. It is then the responsibility of the flight crew to satisfy itself that the maintenance personnel have appropriately addressed the defects noted in the aircraft journey log and either to reject or accept the aircraft for revenue service.

In the case of a defect or unserviceability, such as the problem with the APU, maintenance personnel will read the description of the problem in the journey log and assess whether the defect is one that must be fixed prior to release of the aircraft or one that can be deferred to be fixed at a later time. To determine whether defect rectification can be deferred, the MEL must be consulted.

Compliance with an MEL allows an operator to defer the repair of an aircraft component or system and to fly without all of the essential equipment operative, either to complete a flight segment or until repairs can be made. At the date of the accident on March 10, 1989, there were no specific limits on the length of time that the rectification of a defect

---

[22] There was considerable testimony regarding the lack of clarity in the definition of "essential equipment" and the absence of definition of the term "airworthiness." This language of the ANO is discussed below.

could be deferred.[23] Instead, the Aircraft Minimum Equipment List Order puts the onus on the carrier to "establish, obtain approval for and publish internal procedures for making repairs or replacements to equipment specified in the minimum equipment list to ensure that the aircraft does not operate for an unacceptable period of time with specific aircraft equipment inoperative" (ANO Series II, No. 20, s.10).

In the preamble to the Air Ontario Inc. Minimum Equipment List F-28, the matter of persistent or indefinite deferrals was addressed as follows:

> The MEL was never intended to provide for continued operation of the aircraft for an indefinite period with inoperative items. The basic purpose of the MEL is to permit the air carrier to operate an aircraft with inoperative equipment within the framework of a controlled and sound program of repairs and parts replacement. It is important that the operator consider making repairs at the first airport where repairs or replacements may be made, but, in any case, repair should be accomplished at the first opportunity, since additional malfunctions may require the airplane to be taken out of service.
>
> (Exhibit 310, pp. ii–iii)

The most important consideration when using an approved MEL is prudence. To this end maintenance departments are cautioned not to have multiple deferrals; and, when there are deferrals, they should be rectified as soon as possible. Overriding these considerations is the necessity of having personnel who are well trained in the use of the MEL. On this latter point, each of the maintenance personnel involved in the subject deferral of the APU had received the F-28 course given by Piedmont Airlines and were F-28 qualified. Their mistake, described below, was one of misinterpretation of the MEL and not necessarily one of incompetence as aircraft maintenance engineers. I was impressed with the openness with which they acknowledged their oversight; I also took note of the fact that the deferral was done with the assigned flight crew waiting to get the F-28 into service after it had already missed several scheduled departures on March 9, 1989, because of the attempted repairs of the APU.

When interpreting an MEL, maintenance personnel must be aware not only of the function of the aircraft system being deferred but also of any operating restrictions imposed because of the deferral. Even though many individual systems may be deferred separately, there are restric-

---

[23] In the wake of the accident, and after considerable evidence had been heard on the deferral of the APU on C-FONF, Transport Canada published its new MMEL/MEL Policy and Procedures Manual (Exhibit 962), which establishes specific limits on the length of time that a maintenance deferral can persist. I find this to be a sensible initiative which, if enforced, should all but eliminate indefinite maintenance deferrals.

tions on the deferral of multiple components and systems that are complementary. The MEL specifies what systems are needed as a minimum to dispatch the aircraft.

The MEL also describes the conditions under which the aircraft may be operated with specific unserviceabilities. Some operating conditions require action by maintenance personnel and are listed as maintenance (M) procedures. Other conditions require action by the pilots and are listed as operational (O) procedures. Not all items of aircraft equipment are included in an MEL. Obviously nonessential equipment such as galley equipment and interior trim are not listed. However, some essential items are also not included, as described in the preamble to the Air Ontario Inc. Minimum Equipment List F-28:

> For the sake of brevity, the MEL does not include obviously required items such as wings, rudders, flaps, engines, landing gear, etc. However, it is important to note that ALL ITEMS WHICH ARE RELATED TO THE AIRWORTHINESS OF THE AIRCRAFT AND NOT INCLUDED ON THE LIST ARE AUTOMATICALLY REQUIRED TO BE OPERATIVE.
>
> (Exhibit 310, p. ii)

What guidance exists that provides a clear definition as to which items are directly related to the airworthiness of the aircraft? This issue is addressed in detail later is this chapter in the section, MEL Approval and Use: Governing Legislation.

Deferring the Repair of the APU

The decision on March 9, 1989, to defer the repair of the APU fire-detection system pursuant to MEL number 49-04 rather than 49-01 was made collectively by aircraft maintenance engineer Kostas Athanasiou, maintenance inspector Steven Korotyszyn, and F-28 check pilot Captain Robert Perkins (see figure 16-3).

Mr Korotyszyn's evidence indicated a certain amount of confusion in his mind as to the operability of the APU, given the problem with the fire-detection system. On March 9 he agreed with Mr Perkins and Mr Athanasiou that 49-04 was the appropriate deferral number, but he advised Captain Perkins not to use the APU.

Figure 16-3 Excerpt from Air Ontario's F-28 MEL

SYSTEM & SEQUENCE NUMBERS	1. ITEM	2. NUMBER INSTALLED	3. NUMBER REQUIRED FOR DISPATCH	4. REMARKS OR EXCEPTIONS
49-01	APU	1	0	*(M)(O)May be inoperative for: (a) Air only, or (b) Electric only, or (c) Both, provided: (1) Inoperative function(s) not required for ground or flight operation, and [M] or [O] (2) If electrically inoperative, automatic bus transfer system is checked prior to each flight and found to be operating normally. (After both engines running, alternately switch generators 1 and 2 off and observe that remaining generator picks up the load.)
...				
49-04	APU Fire Extinguishing System	1	0	*(O) May be inoperative. [O] (1) Use APU for engine start only. (2) Pilot to arrange constant monitoring of APU by ground crew when operating. (3) Shut down APU immediately after engines started. (4) No passengers may be on board while APU operating.

Source: Based on Exhibit 310

Mr Korotyszyn was also concerned that some stations might not have fire pickets available, ground crew who stand by during startup with fire-extinguishing equipment. This would seem to be an operational consideration that would more properly be the responsibility of the captain. Mr Korotyszyn stated in testimony:

> Q. ... Did you obtain some information from Captain Perkins that in fact there may be somewhere along the path where there's no ground start? Did you obtain that information?
> A. I did not.
> Q. Why did you tell him not to use the APU, then?
> A. He may not have been able to get a fire picket at some of the stops.
> Q. Did you tell him that?
> A. I did not.
> Q. Was he supposed to know that?
> A. Well, he would – he would know that, yes.
>
> (Transcript, vol. 42, pp. 51–52)

During the hearings, all three individuals involved in the decision testified that the APU should have been deferred under MEL item 49-01. Mr Athanasiou explained the basis of his error:

> Q: ... In retrospect today ... after viewing the MEL and the entry in the journey log, do you remain of the opinion that 49-04 is the correct entry that the APU should have been deferred under?
> A: No, it's incorrect.
> ...
> The detection system and the extinguishing systems are actually two different systems.
>
> Now they fall under different ATA[24] chapters or the same ATA chapters but different subsections. So it is actually the wrong deferral, 49-04.
>
> (Transcript, vol. 42, pp. 107–108)

Mr Korotyszyn also acknowledged that, in the absence of any specific MEL provision regarding the APU fire-detection system, the appropriate deferral would have been under the general APU section, 49-01:

> Q. And 49-04 says what under the Item column?
> A. "APU fire extinguishing system."
> Q. It does not say, I take it, "APU fire detection system"?
> A. No, it does not.
> Q. Is there anything in section 49 relating to APU fire detection system?
> A. There is not.
> Q. And the information passed to you by Mr Athanasiou, I take it, was APU ... will not fire test; is that correct?
> A. That is correct.
> Q. And that document is the only document you relied upon that day to make the deferral; is that correct?
> A. Yes, it was.
> Q. And now, in retrospect, you say that 49-04 is not the appropriate item; is that correct?
> A. That is correct.
> Q. And is the reason you say it is not appropriate in that it doesn't say "fire detection system"; is that correct?
> A. That is correct.
>
> (Transcript, vol. 42, pp. 41–42)

[24] The Air Transport Association, which determines technical aircraft standards

It was normal procedure for Air Ontario pilots to operate the APU during every takeoff and landing. This was done because the APU provides electrical power backup in the case of an engine failure. Electrical power is normally provided by two generators that are driven by the main engines. The bus transfer system is designed to transfer all electrical loads automatically to the remaining generator should one generator fail. In the event of a problem with the transfer of electrical load when there is an engine or generator failure, the APU generator would be available as a backup.

When the APU is electronically inoperative or otherwise unserviceable, its maintenance may be deferred pursuant to MEL section 49-01, which requires the pilots to make certain that the bus transfer system is working prior to each flight. An F-28 cannot operate if both the APU and the bus transfer system are unserviceable.

A deferral of the maintenance of the APU fire-extinguishing system pursuant to MEL section 49-04 allows the APU to be used for engine starts only with conditions. This effectively eliminates the use of the APU to provide backup electrical power on takeoff and landing. Apart from the use of the APU on engine startup, a deferral pursuant to MEL section 49-04 renders the APU as inoperable as does a deferral pursuant to section 49-01; yet there is no provision under 49-04 requiring a pre-flight check of the serviceability of the bus transfer system.

Captain Perkins recognized the deficiency in the section 49-04 deferral and, on his own initiative, carried out a check of the automatic bus transfer system, which he referred to as a "cross-tie check." He explained this procedure:

Q. And you operated the APU as if it was MELed under 49-01?
A. We operated the APU as if it was not there.
Q. All right, you did the cross-tie check as if it was MELed under 49-01?
A. It's mentioned in 49-01, yes.
Q. And could you tell me, then, again why you did this cross tie-check before every leg of that flight?
A. Under a normal operation, the APU is considered in a standby mode; in other words, the number 1 engine generator and the number 2 engine generator are providing all the power supply for the aircraft.

In the event that one of those generators or, in fact, one of the engines should stop producing electrical power, then the standby generator, which is attached to the APU, would pick up that load from that failed engine ...

Q. And indeed, that third generator, sir, is a bit of a safety factor, is it not?
A. It is. It is a safety factor.
Q. And it is a safety factor particularly on takeoff?

A. It's a safety factor at any time that it's on. It's an added buffer.
(Transcript, vol. 43, pp. 166–67)

The aircraft could have been dispatched out of the Toronto maintenance base under either deferral number. However, the operational limitations facing Captain Morwood were different under 49-01 and under 49-04. A deferral under 49-01 means that the APU can be inoperative as a source of air or electricity or both only if

(1) inoperative functions of air or electricity or both are not required for ground or flight operations; and
(2) if electrically inoperative, the bus transfer system is checked prior to each flight and found to be serviceable.
(Exhibit 310, s.49-01)

Section 49-04 does contemplate APU use under the following stated circumstances:

(1) Use APU for engine start only.
(2) Pilot to arrange constant monitoring of APU by ground crew when operating.
(3) Shut down APU immediately after engines started.
(4) No passengers may be on board while APU operating.
(Exhibit 310, s.49-04)

Finally, to complete the deferral after the journey log entry was made, an "INOP" placard was stuck to the APU panel in the cockpit. An INOP placard is used by maintenance to ensure that the pilots or other maintenance personnel do not activate the affected system without checking the journey log for a description of the snag.

The INOP placard would have directed Captain Morwood to the aircraft journey log, where he would have noted the snag and the deferral via MEL item 49-04. On reading the journey log he may have discovered the inconsistency between the description of the snag ("will not fire test") and the deferral number ("Fire Extinguishing System"). How he would have reacted to this inconsistency is uncertain. It is possible he would have appreciated that the deferral was incorrect and favoured the instructions provided by 49-01 that the APU was not to be used except in the very limited circumstances described. What is known is that he did not contact SOC or maintenance to seek clarification. Further, he made no attempt at any time to use the APU. I am of the view that this latter point is most determinative of his state of mind. Had he considered that the APU was operable under the conditions described in 49-04, he would have had good reason to use the APU during the fuelling in Dryden and for de-icing if needed. Any thoughts Captain Morwood may have had that the APU was inoperable may have

originated or at least been reinforced by the SOC instruction that the APU was unserviceable and that the right engine was to remain running through Dryden.

Findings

After reviewing all of this evidence, I am left with the following conclusions:

- After a protracted approval procedure during which both Air Ontario and Transport Canada supposedly examined the MEL line by line, the resulting MEL was nevertheless misunderstood and misused by two experienced maintenance engineers and an experienced airline captain.

- Two further implications are suggested by the misuse of the MEL:

  First, prudent practice would dictate that aircraft C-FONF should not have been repeatedly dispatched out of the maintenance base with the APU unserviceable.

  Second, SOC personnel should have understood (a) that there would be no rectification of the defect until the aircraft returned to Toronto, and (b) that they should have planned to cancel all operations into Dryden until the APU was operational.

I will now examine the MEL approval process, which, as it turned out, was one of the most disconcerting aspects of this investigation.

MEL Approval

In its application to include the F-28 on its operating certificate, Air Ontario represented to Transport Canada that an MEL would be in place prior to the F-28 commencing revenue service. One such representation is the following:

> Prior to the assignment of the F-28 type to Revenue Service, each Operations Officer will receive a conversion course to familiarize him/her with the F-28 with emphasis on flight planning, performance, and minimum equipment list requirements.
>
> (Air Ontario Application To Amend Operating Certificate To Include F-28 Aircraft (Jan. 24, 1988), Exhibit 855, p. 41)

The amendment to the Air Ontario operating certificate was granted as of June 1988, immediately prior to the commencement of its F-28 commercial service. The F-28 was operated commercially without an approved MEL until December 1988.

An approved MEL is at present not a requirement in Canada for transport category jet operations; however, without an approved MEL,

an aircraft must be operated with 100 per cent of its essential equipment serviceable. If an air carrier does not have an approved MEL, and it operates an aircraft with unrectified defects in essential equipment, then the carrier, the aircraft maintenance engineer (AME) who released the aircraft, and the pilot who accepted the aircraft are in breach of the law. In such a situation, the carrier's operating certificate and the licences of the pilot and the AME are at risk of revocation.

The Air Ontario F-28, C-FONF, was an older aircraft[25] that had been mothballed in Turkey for two years prior to its importation to Canada. The aircraft was part of a new service that Air Ontario management – which was under some competitive marketing pressure – was intent to put in place as soon as possible. Transport Canada officials knew or ought to have been aware of these facts.

The continued commercial operation of the F-28 without any defects in its essential equipment was for all practical purposes impossible. It should have been similarly obvious that there would be a great temptation on the part of the carrier to keep the aircraft flying in spite of such inevitable unserviceabilities – even if that meant deferring the maintenance of the unserviceabilities in the absence of an approved MEL. The evidence revealed that such deferrals did indeed occur in the Air Ontario F-28 operation.

I am of the view that, from a practical flight safety perspective, the amendment to the operating certificate permitting F-28 operations should never have been granted without an approved F-28 MEL in place. In this regard, as in other instances, I found the explanation of Transport Canada and Air Ontario witnesses that it was "legal" to operate without an MEL to be entirely unsatisfactory. If an air carrier operation is not as safe and sound as the experience of an individual carrier or regulator would indicate that it should have been, then, in recognition of the duty owed to the travelling public, it is unacceptable for either the carrier or the regulator to justify its own inaction by relying upon a characterization of such an operation as "legal."[26]

The Role of the Regulator in Approving the MEL

A typical MEL approval requires the carrier to prepare an MEL for its particular operation, referencing the master minimum equipment list (MMEL) prepared by the aircraft manufacturer. The air carrier MEL

---

[25] Aircraft C-FONF was manufactured and delivered by Fokker to its first owner, THY, in January 1973.

[26] It is significant that these deferrals, in the absence of an approved MEL, would not have occurred within the parent company, Air Canada. Approved aircraft MELs are always in place at Air Canada prior to the approval of operating certificate amendments authorizing commercial service.

must at least comply with the minimum standards set out in the MMEL and be "tailored to the carrier's specific operating environment."[27]

The MMEL is approved by Transport Canada during the aircraft type certification process. The MMEL serves essentially the same function as the MEL, representing what the manufacturer considers to be a level of aircraft systems serviceability required to maintain a necessary standard of airworthiness. Because the MMEL represents the standard against which all carrier MELs will be compared, the MMEL is scrutinized with great care by Transport Canada before its approval is granted.

Transport Canada's MMEL/MEL Policy and Procedures Manual provides the following explanation regarding the prohibition against carrier use of the MMEL:

> While the MMEL is for an aircraft type the MEL is tailored to the carrier's specific operating environment and may be dependent upon the route structure, the geographic location, and number of airports where spares and maintenance capability are available etc. It is for this reason that a MMEL cannot be approved for use as a MEL by an air carrier.
>
> (Exhibit 962, p. 21)

As described by Mr Martin Brayman of Transport Canada's Ontario Region, once the air carrier completes the MEL in the prescribed form, two copies are then submitted to Transport Canada, where it is reviewed by airworthiness personnel, who review the maintenance aspects of the MEL, and air carrier personnel, who review the flight operations components. In addition, some input is provided from passenger safety personnel.

In the case of the approval of the Air Ontario F-28 MEL, Mr Brayman was the principal air carrier inspector from Ontario Region who was involved in the approval process. The Air Ontario F-28 MEL was first submitted for approval on February 3, 1988, by Captain Robert Nyman, Air Ontario's director of flight operations. Within Ontario Region, the MEL was reviewed by Mr Brayman and Mr Ole Nielsen of the Airworthiness Branch. Shortly after the initial submission, the document was returned and Air Ontario was informed that the MEL had to be amended to conform with the required form. On September 15, 1988, more than seven months later, Air Ontario submitted a second draft of the proposed MEL to Transport Canada's Ontario Region. By this time, Ms Jacqueline Brederlow, the passenger safety superintendent, Mr Randy

[27] ANO Series II, No. 20, section 5, and Exhibit 962, Transport Canada MMEL/MEL Policy and Procedures Manual, January 1, 1990

Pitcher of the Air Carrier Branch, and Mr Alexander Brytak, an inspector in the London office of Ontario Region, became involved in the process.

On December 13, 1988, after Ontario Region and Air Ontario eventually agreed on its form and content, the MEL was forwarded to Transport Canada headquarters for final approval. At headquarters, Mr Ian Umbach and Mr William MacInnis reviewed the document. Shortly thereafter, Captain Nyman of Air Ontario and Captain Joseph Deluce received a verbal "interim" approval of the F-28 MEL from Mr Pitcher. Captain Deluce then issued a memorandum dated December 19, 1988, to Air Ontario F-28 pilots advising that the F-28 MEL had received interim approval and that MEL manuals had been placed on board the two aircraft.

The precise status of the interim approval was unclear from the evidence. Captain Nyman testified that, in December 1988, on the request of Captain Joseph Deluce, he took steps to amend an earlier draft of the MEL to satisfy the concerns of Mr Brytak of Transport Canada. While this amendment process was continuing, Mr Pitcher telephoned to indicate that the earlier draft of the MEL was approved. This incongruous situation of one Transport Canada employee requesting changes to the MEL while another Transport Canada employee provided interim approval was apparently of no concern to Captain Nyman and Captain Deluce. After many months of waiting, they understandably seized upon Mr Pitcher's "interim approval" and, without question or criticism, took immediate steps to place the MEL in their two F-28s for the use of their crews.

Formal approval of the MEL came in the form of a teletype message dated June 9, 1989, sent from Mr Umbach, via Mr B. MacLellan of Air Carrier Operations in Ottawa, to Transport Canada's Ontario Region. A copy of the message was sent to Mr James Morrison, Air Ontario's vice-president of flight operations.

The original MEL was submitted to Transport Canada in February 1988. More than ten months later, after at least seven individuals within Transport Canada had an opportunity to review and comment on the document, Air Ontario had "verbal interim approval" to use the MEL and, in June 1989, one-and-a-half years after the process started, Transport Canada issued formal approval for the document.

In the same month that the MEL was formally approved, Air Ontario discontinued its F-28 program. Air Ontario F-28 pilots had been deferring the maintenance of essential aircraft equipment in the absence of an approved MEL since June 1988, in apparent contravention of ANO Series II, No. 20.

I calculate approximately seven months of the delay – from February to September 1988 – to be primarily attributable to Air Ontario; and nine months of the delay – from September to the December "interim

approval" and from December 1988 to the June 1989 formal approval – to be primarily attributable to Transport Canada. I wish first to discuss the delay I assign to Transport Canada – particularly the period from September to December 1988, and then go on to look at Air Ontario's role in the preparation and approval of the MEL.

Mr Brayman provided the following explanation for the delay in the approval process:

> Q. Now, can you tell us why it would have taken so long, 10 months, to have an MEL approved for the F-28?
>
> A. There were two reasons. One, the original copies of the MEL as submitted by the company were unacceptable, and I can't speak for airworthiness, but I remember at the time speaking to Mr Nielsen about it several times. He had returned his copy of the MEL to the company with a specific request to change the format, and I gather the revised copy was a long time in coming back.
>
> I also believe that at that time, the responsibility for monitoring the company had been transferred from the Ontario regional office of airworthiness to the London office, and I think that the inspector down there, his name was Alex Brytak, I think he took over responsibility for ensuring the company produced a working MEL.
>
> We also had a major problem in headquarters ... I believe they had two different inspectors working on the MEL program. One was a gentleman called McInnis, and I do believe that he was so overloaded that at one time, he probably had 20 such documents sitting on his desk.
>
> An MEL is a very technical document and requires a great deal of checking. You have to go through it word for word, clause by clause, and I don't believe that there were sufficient bodies available to do the job that was needed.
>
> Q. Was there any pressure at your level from region to expedite the approval process of the MELs?
>
> A. Well, there was a considerable pressure from operations at Air Ontario. This is an ongoing process. And I'm sure Mr Nyman was on the phone numerous times asking me, you know, what was happening with the MEL.
>
> But we could only refer him to his own maintenance department, who were partly responsible, and basically tell him we would follow up and see what we could get for him. We weren't very successful a lot of times.
>
> Q. In attempting to assist Mr Nyman?
>
> A. In attempting to get these documents pushed through so they were approved.
>
> (Transcript, vol. 131, pp. 131–32)

With great respect to Mr Brayman, whom I found to be a forthright and credible witness, I am not at all persuaded by the reasons offered for the delay. It seems to me that the problem was not simply one of "overloading" any one individual, but was also one of an unnecessarily complicated and bureaucratic approval process.[28] Mr Brayman described some seven individuals in three Transport Canada offices who were involved, communicating with each other and the carrier via written memoranda and correspondence.

I have reviewed the F-28 MEL, the MMEL, and the Aircraft Minimum Equipment List Order, and I do not believe I am being overly simplistic in saying that the entire approval process could have been finalized in the course of a single constructive meeting among an airworthiness and air carrier representative from Transport Canada and a flight operations and maintenance representative from Air Ontario. I heard the evidence of Messrs Brayman, Nielsen, Nyman, and Kenneth Bittle and I feel confident in saying that, if Air Ontario had put forth an honest effort in producing a reasonable first draft of the document, these four gentlemen could have effected its approval to everyone's satisfaction in a much shorter period of time.

The process simply should not be so complicated. Transport Canada correctly devotes much time and effort to the approval of the MMEL. Once this MMEL standard is accepted by the regulator, then the process of MEL preparation and review should be straightforward.

The MEL should be "tailored to the carrier's specific operating environment," but how idiosyncratic can such operating environments be? Air Ontario's proposed deployment of the F-28 was modest, operating initially from Toronto to Sault Ste Marie, Thunder Bay, Dryden, and Winnipeg, with Toronto representing the main maintenance base and Winnipeg providing routine line maintenance. Any peculiar accommodations for such line operations should have been narrow and easily identified.

What is particularly galling is that, in spite of this protracted process of review and amendment, the approved MEL was significantly deficient. The APU deferral sections 49-01 and 49-04 were inconsistent with each other and they contained no restriction on line operations into stations without ground-start facilities using an aircraft with an unserviceable APU.

---

[28] Transport Canada MMEL/MEL Policy and Procedures Manual, Exhibit 962

Transport Canada's MEL Approval Policy: Recent Developments

Since Commission investigators made their first inquiries about the deficiencies in the approval and use of the Air Ontario F-28 MEL, Transport Canada has published its MMEL/MEL Policy and Procedures Manual. I would like to express my support for three significant initiatives in this new policy document, which, I believe, will improve MEL approval and use.

First, a time limitation has been placed on deferrals through a program of amending approved MMELs such that maintenance deferrals are categorized according to set schedules of required defect rectification. Air carriers have 120 days to amend their own MELs to conform with the MMEL containing the new categorized repair limits. This program would eliminate the practice of indefinitely deferring the maintenance of certain items, which was discouraged but not prohibited by the former policy. I commend this initiative, and I hope that the program proceeds to a prompt conclusion.

Further, I note that the new Transport Canada MEL policy manual specifically prohibits "interim approvals" while the MEL is undergoing the review process. The confusion surrounding the verbal interim approval of the Air Ontario F-28 MEL supports the idea that an "interim approval" is really no approval at all. The regulator must satisfy itself that the MEL is acceptable, and then promptly issue a formal approval and authorization of use. This view was supported by Mr William Slaughter, director of flight standards at Transport Canada headquarters, who agreed that the verbal approval of MELs is unacceptable and has now been discontinued.

Another commendable aspect of the initiative is the delegation to regional managers of the responsibility and authority to approve MELs within their jurisdiction. In so doing, Transport Canada headquarters is removed from the decision-making process. In the case of Air Ontario's F-28, the additional step of sending the MEL to Mr Umbach would have been avoided under the new policy.

While this streamlining of the approval process is certainly a positive step, I am perplexed that Transport Canada still insists upon a review process involving so many people. Under the new policy, when the MEL is received from the air carrier, the regional manager of air carrier operations forms an MEL Review Group to assess the proposed MEL and work with the carrier until the group is able to recommend to the regional manager that the MEL be approved. The MEL Review Group is to consist of:

- a chairman who is the principal air carrier inspector for the carrier;

- the lead air carrier inspector on type;
- the principal airworthiness inspector for the carrier;
- the lead airworthiness inspector on type (if required);
- a passenger safety inspector (if required);
- a regional MEL coordinator (if required); and
- a regional airworthiness avionics inspector operators [sic].

(Based on Exhibit 962, app. E)

There are therefore anywhere from four to seven people involved at the regional level in the review of the MEL. By way of explanation the policy states that "[t]he purpose of forming such a group is two-fold. Firstly, authority; secondly, proper coordination between Airworthiness and Operations is formalized to ensure approvals can be achieved in a timely manner" (Exhibit 962, app. E).

To reiterate my earlier comment, it seems to me that the process should be fairly straightforward. The carefully approved MMEL should be the starting point, against which the carrier MEL deviates only to the extent that the carrier and the regulator seek to make operational and maintenance limitations more restrictive to reflect idiosyncrasies in the carrier's operation. On the regulatory side, I do not believe that MEL approval requires the involvement of more than one individual each from air carrier and airworthiness who are familiar with the particular aircraft type.

Throughout these hearings I heard much disturbing evidence regarding the lack of resources available within Transport Canada during a period of economic deregulation of the airline industry. For the reasons elaborated upon below, there were undoubtedly resourcing problems within some areas of Transport Canada. In the present case, however, I am firmly of the view that staffing problems were not the root cause of delays in the MEL approval process; rather, the delays were attributable to an unnecessary duplication of effort. Why have eight people reviewing each other's work when two competent individuals can do the job?

Air Ontario's Role in the Preparation and Approval of the MEL

I will now deal with Air Ontario's involvement in the MEL preparation and approval. More specifically, I am concerned with the actions of Air Ontario management prior to the February 1988 submission of the first-draft MEL to Transport Canada and during the months from February to September 1988 when the rejected first draft was back in its hands.

Air Ontario management recognized that it would require an MEL for the F-28 in order to operate its aircraft efficiently and effectively. Accordingly, the initial plan was to have a Transport Canada–approved

MEL in place before the F-28 aircraft was put into service. This was documented by the Air Ontario Inc. F-28 Project Plan 1987, which stated:

> The Vice President of Maintenance and the Director of Flight Operations would develop workable MEL for our environment and obtain MOT approval. Fokker's, Piedmont's Norcan Air's and Quebecair's MELs will be used as reference.
>
> (Exhibit 799, p. 3)

According to the original October 1987 Project Plan, the MEL was to be developed and approved by the final week of March 1988. In the Revised Project Plan of December 28, 1987, the projected completion of the development and approval of the MEL was advanced four weeks to February 29, 1988.[29]

Captain Robert Nyman was director of flight operations during this period and, as such, had co-responsibility with the vice-president of maintenance, Mr Kenneth Bittle, for production and approval of an MEL. By correspondence dated February 3, 1988, Captain Nyman submitted the first draft MEL for approval to Transport Canada. Mr Brayman testified that this first document was immediately sent back to Air Ontario for rewriting because it was unacceptable (Transcript, vol. 131, p. 131).

Captain Nyman, while acknowledging responsibility for production of the F-28 MEL, stated that he delegated the task to Captain Joseph Deluce. Captain Nyman provided no clear reason why there was such a delay in the production of the second draft of the MEL (Transcript, vol. 107, p. 199). He testified that, having delegated the task of producing the MEL to Captain Deluce, he did not monitor the progress regularly. His recollection of the events surrounding the MEL approval was vague:

> Q. So you knew that ... operating the aircraft without an MEL would be a problem, and it was a full year from the striking of the implementation plan to the approval of the MEL –
>
> A.. Yeah.
>
> Q. – and, yet, you recall no specific steps taken to monitor the progress of the MEL ... [I]s there an explanation for that?
>
> A. ... I do not recall personally taking specific steps. There was during that time, of course, the pilot strike, during which – I think it was for a couple of months. That certainly would have occupied much of my time and much of Joe Deluce's time also.

[29] Exhibit 802, Air Ontario Inc. Revised F-28 Project Plan, p. 104 (December 28, 1987)

> I'm not sure what progress maintenance may have been making on the MEL during that period. I really can't say.
> (Transcript, vol. 107, p. 200)

Captain Nyman acknowledged that, although the plan was to have an MEL in place prior to commencing F-28 service, Air Ontario was "a little bit optimistic" in its projections (Transcript, vol. 107, p. 201).

Captain Deluce's evidence on his involvement with the production of the MEL was equally unclear and seemingly not forthright. He acknowledged that, as F-28 chief pilot, he was concerned with the timely production of F-28 standard operating procedures and the F-28 MEL (see chapter 19, F-28 Program: Flight Operations Manuals). He provided the following explanation: "I pursued the MEL and the standard operating procedure in the best manner that I could" (Transcript, vol. 111, p. 183). Captain Deluce also pointed out that he officially became the F-28 chief pilot in December 1988, the same month that the MEL was verbally approved on an interim basis. He seemed to be suggesting that he believed he had no responsibility over the MEL until he officially became F-28 chief pilot. This would contradict the evidence of Captain Nyman that the matter had been delegated to Captain Deluce; and it would also contradict Captain Deluce's own correspondence as the "F-28 Project Manager" to Mr Brayman dated September 15, 1988, wherein he enclosed the second draft MEL for approval (Exhibit 818). In any event, Captain Deluce did not provide any satisfactory explanation as to why the draft MEL remained at Air Ontario from February until September 1988.

Mr James Morrison took over as vice-president of flight operations in July 1988. He testified that, within weeks of his arrival at Air Ontario, Captain Nyman advised him that the F-28 had no approved MEL and that a revised draft was in the hands of Transport Canada. Mr Morrison stated that he did nothing to follow up on the status of the F-28 MEL, though he was aware that Air Ontario's two F-28 aircraft were operating without an MEL until the verbal interim approval came in December 1988 (Transcript, vol. 115, pp. 110–11).

Mr Bittle testified that, in early March 1988, he delegated to Mr Teoman Ozdener, the Air Ontario F-28 maintenance manager, the responsibility of working with flight operations to produce an MEL (Transcript, vol. 103, pp. 134–41). Mr Ozdener testified that he attended at Norcan Air/TimeAir on March 29–30, 1988, to observe their facilities. He was advised by personnel at that airline that their MEL was being approved by Transport Canada and that, when approval was obtained, they would forward a copy of the MEL to Air Ontario for reference. Mr Ozdener advised Mr Bittle that they would be in receipt of the Norcan

Air MEL by the end of April 1988.[30] Mr Ozdener testified that as of June 1988, Captain Robert Murray of Air Ontario asked him for assistance in the "finalization" of the MEL. Mr Ozdener stated that Captain Murray had rewritten the February 1, 1988, version of the MEL, which was "no good," to produce a second draft dated May 14, 1988. Mr Ozdener, with the assistance of Mr Murray Keith of Transport Aérien Transrégional (who was in London, Ontario, to assist with the importation of C-FONF), prepared their maintenance-related restrictions on the MEL. Mr Ozdener had no further evidence on the status of the MEL other than his best recollection that, based on "second-hand information," he understood that verbal approval of the MEL was achieved in late October or early November 1988 (Transcript, vol. 101, pp. 86–87).

These five individuals within the Air Ontario flight operations and maintenance departments – Messrs Nyman, Deluce, Morrison, Bittle, and Ozdener – had varying degrees of responsibility for the timely completion of the MEL. Their evidence on the subject was vague and somewhat contradictory.

Findings

After considering all the evidence on the subject, I make the following findings:

- The F-28 project plans of October and December 1987 identified the director of flight operations, Captain Robert Nyman, and the vice-president of maintenance, Mr Kenneth Bittle, as being responsible for the production of the F-28 MEL.

- Captain Nyman delegated the flight operations component of the MEL to Captain Joseph Deluce. Mr Bittle, as of March 1988, delegated the maintenance component of the MEL to Mr Teoman Ozdener.

- A first draft MEL was submitted by Captain Nyman to Transport Canada in February 1988 and was found to be unacceptable.

- In June 1988, on the eve of the introduction of the F-28 into commercial service, Captain Robert Murray, with the assistance of Mr Ozdener and Mr Murray Keith of TAT, rewrote the February MEL to produce a second draft of the document.

- Mr Morrison became the vice-president of flight operations in July 1988 and was advised by Captain Nyman that the second draft of the

[30] Transcript, vol. 101, p. 68. See also Exhibit 817, Report of Mr Teoman Ozdener re: trip to Norcan Air/TimeAir March 29–30, 1988.

MEL was in the hands of Transport Canada. In fact it was not until September 15, 1988, that Captain Joseph Deluce, as the F-28 project manager, submitted the second draft of the document to Transport Canada.

- Witnesses Nyman, Deluce, Morrison, Bittle, and Ozdener were questioned at length on the subject, yet no one could offer an explanation for the delay between the rejection of the first-draft MEL in February 1988 and the increased activity of Captain Murray and Mr Ozdener in June 1988. Similarly, no explanation was offered for the delay following the rewrite by Captain Murray and Mr Ozdener and the submission of the second-draft MEL to Transport Canada in September 1988.

- I am left with the conclusion that the timely production of the F-28 MEL was simply one of many items that were neglected in the F-28 implementation plan. In spite of Captain Deluce's claim that he pursued the MEL in the "best manner" he was able, I am of the view that, as F-28 project manager, he bears a large measure of responsibility for the delay.

- Further, as Captain Nyman and Messrs Morrison and Bittle were the senior managers in the flight operations and maintenance departments, they knew or ought to have known that maintenance deferrals on their F-28 aircraft were occurring between June and December 1988 in apparent violation of ANO Series II, No. 20. Each of these individuals should have independently taken whatever steps were necessary to ensure that
  - the MEL was prepared in a timely manner; and
  - there were no deferrals of the maintenance of essential aircraft equipment in the absence of an approved MEL.

An Alternative Approach: Air Canada Procedures

Among all the evidence I heard regarding the operational procedures of the parent company, Air Canada, there were two practices that are particularly germane to this discussion on the APU and the MEL:

Air Canada Practice: Operating with an Unserviceable APU

Captain Charles Simpson, Air Canada vice-president of flight operations, testified that it is the policy of his company that an aircraft with an inoperative APU will not be dispatched to a station where ground-start equipment is not available. This restriction is clearly described in the sections dealing with APU unserviceability in each individual aircraft MEL.

Air Canada Practice: Operating without an Approved MEL

Captain Simpson testified further that Air Canada would never operate a transport jet aircraft in commercial service without an approved MEL. The MEL is submitted by Air Canada to Transport Canada for approval at the same time that Air Canada applies for approval of a new aircraft type within its operations. Captain Simpson provided the following evidence on the importance of the MEL to Air Canada's operations:

> Q. Sir, why is it important for an airline to have an MEL at the time an aircraft is put into operation? Why is that important?
> A. Well, in order to be able to operate the airplane, you from time to time will have some minor deviations on it where you may want to move the airplane back to a main station to get it fixed. It may be something of an insignificant nature, but without any document that allows you to do it, you're not allowed to operate the airplane.
>
> So it's a straight case of – and, as far as the pilot is concerned, both pilots and maintenance personnel need some guidance, so this is the document by which they can look at their airplane and decide if it can be dispatched in that condition.
>
> For example, you might ... have a problem with the reverse mechanism on an engine. It's not required, it's not part of the certification, but to operate the airplane, there are certain things that have to be checked.
>
> So you go to the MEL list. It says what maintenance have to do. It says what operations have to do. And then the airplane may be moved.
> Q. To the best of your knowledge, sir, has Air Canada ever operated an aircraft in revenue service without an approved MEL?
> A. Not to the best of my knowledge.
> ...
> Q. Captain, with your background and knowledge and experience, how would you view the operation of a new aircraft for six months with no MEL?
> A. Well –
> Q. When I say the operation, I'm talking revenue operation.
> A. Yeah. Well, I would be surprised that Transport Canada would allow that to go on, as the regulatory authority.
> Q. Would you permit that as a senior officer ... of your airline?
> A. No. We would not accept that, as an airline.
>
> (Transcript, vol. 118, pp. 112–13, 116–17)

The evidence is that Air Canada had no involvement with the production of the proposed F-28 MEL first submitted for approval by

Air Ontario. Given the experience that Air Canada has in the production of MELs for transport category jet aircraft, any assistance to its regional feeder would certainly have expedited the process. In particular, to the extent that the first draft was as deficient as was represented by Mr Brayman and Mr Ozdener, some Air Canada assistance would have helped enormously in producing a document that would have been acceptable to Transport Canada. Further, Air Canada assistance in the drafting of the MEL would, in all probability, have included the standard Air Canada operational restriction on deferred APU maintenance: that aircraft with unserviceable APUs are not to be operated into stations without ground-start facilities.

MEL Use and Approval: Governing Legislation

ANO Series II, No. 20, prohibits the operation of an aircraft if any "essential aircraft equipment" is inoperative unless such operation is in compliance with an approved MEL. In reviewing the deferral practices of Air Ontario, I was struck by the confusion and uncertainty among commercial pilots and Transport Canada air carrier inspectors regarding the interpretation of "essential equipment." Such confusion is not surprising when the regulatory definitions are considered.

Essential aircraft equipment is defined as:

> an item, component or system installed in an aircraft, that
> (a) has a primary role of providing information or performing a function required by regulation or order; or
> (b) is directly related to the airworthiness of the aircraft.
>
> (ANO Series II, No. 20, s.2)

Although "airworthiness" is not defined, "airworthy" is defined in the Air Regulations as "in a fit and safe state for flight and in conformity with the applicable standards of airworthiness" (Air Regulations, s.101(1)).

These are the only definitions found in the *Aeronautics Act*, the Air Regulations, or the Air Navigation Orders that have any bearing on the term "essential aircraft equipment." The evidence revealed that these definitions are of little practical assistance to pilots and aircraft maintenance engineers in their consideration of maintenance deferrals. In the absence of an approved MEL, which, in effect, describes what is essential aircraft equipment for the purposes of that aircraft type, most of the pilots who testified had difficulty describing what they considered essential equipment.

Mr Randy Pitcher, Transport Canada's air carrier inspector assigned to Air Ontario, provided the following evidence on "essential aircraft equipment":

A. As a matter of fact, Mr Commissioner, my interpretation is that any component that was required for certification in terms of interior, in the cockpit, be it an instrument, a light bulb, et cetera, must be serviceable at all times if the aircraft is to be operated, whether it's private or commercial.
Q. And where did you get this understanding of essential aircraft equipment?
A. I practised it, when I was an operating pilot.

(Transcript, vol. 127, p. 102)

Mr Ole Nielsen, Transport Canada's principal airworthiness inspector who assisted in the importation of Air Ontario's F-28 aircraft, explained the difficulty in working with the term "essential aircraft equipment":

Q. ... How does the guy on the shop floor know what is essential equipment in the absence of an MEL?
A. Very difficult. As a matter of fact, in certain cases, it's quite possibly impossible to tell for the AME on the floor.

If you look at the definition of "essential," depending on whose definition you use, our definition within airworthiness will be that it is that equipment called up by the type approval for the product as being essential for flight, and also, those regulatory statutes that require operation of certain equipment, such as a third horizon in turbo jet aircraft and the installation of lavatory smoke detectors and that sort of thing. Those are all essential for flight.

But the primary one that is hard to assess for the AME is the certification basis of the airplane, because ... all the essential equipment is called up in the certification basis, either CAR 4(b) or FAR 25.[31]

(Transcript, vol. 129, pp. 194–95)

An example of the Air Ontario F-28 operating with unserviceable "essential aircraft equipment" concerned the master warning light. This component is located on the instrument panel within the pilot's area of primary scan. When illuminated, it alerts the pilot that a warning light on the enunciator has been activated. The pilot would then reset the master warning light and look to the enunciator panel located down and to the side for more specific information about the problem. It was universally agreed among the experienced pilots who appeared before me that the master warning light fell within the definition of "essential aircraft equipment." In other words, even with the approved Air Ontario

[31] Aircraft certification is discussed in chapter 22, F-28 Program: Flight Attendant Shoulder Harness.

F-28 MEL in place, an unserviceable master warning light requires the aircraft to be grounded. Nevertheless, it became clear from the evidence that on April 5, 1989, Captain Robert Perkins operated the F-28 on a revenue flight from Winnipeg to Toronto without a serviceable master warning light. When questioned about this, Captain Perkins gave the following evidence:

> Q. ... you have said that, but in fact, if there was a problem, you have also told us that the first thing that would alert you to the problem likely would be the master warning light, is that right? That is the first thing that would warn you?
> A. Under normal condition, yes.
> Q. Right. You have also testified that you would want to know as soon as possible that you had a problem, right?
> A. That's correct, yes.
> Q. Correct, and you have also told us that the enunciator panel does not fit within your normal scan when you are in clouds?
> A. That's correct.
> Q. So I don't understand how you can say that the absence of a functioning master warning light does not affect the airworthiness of the aircraft.
> A. I'm saying today that as far as I'm concerned, it does.
> Q. Fair enough.
> A. Yes.
> Q. How could you understand it otherwise a year ago?
> A. That is a very good question. I don't have an answer for it.
> Q. When were you made a line check pilot? When was that?
> A. February of '88.
> Q. So you would be operating as a line check pilot with this misapprehension about the importance of the master warning light, is that right?
> A. I guess that's correct, sir.
>
> (Transcript, vol. 44, pp. 105–106)

This improper deferral came to the attention of Mr Morrison. The ensuing investigation by Mr Morrison prompted Captain Joseph Deluce to write a memorandum of April 25, 1989, to Mr Morrison defending Captain Perkins's decision on the basis that Captain Perkins was "comfortable with the warnings that were available" and "comfortable with maintenance decision to defer this item as he did not consider it an airworthiness item" (Exhibit 337). Captain Deluce went on "with hindsight" to question whether the item should have been deferred. He further undertook "to get a better interpretation from Transport Canada on what and how items can be deferred and when they cannot."

In the face of testimony of numerous experienced pilots that the master warning light is clearly an airworthiness item, I find it particular-

ly disturbing that an F-28 line check pilot, the F-28 chief pilot, and maintenance personnel at Air Ontario were all confused about the fundamental issue of what unserviceabilities legally necessitate the cancellation of a flight.

In this context I was not surprised to learn that there may have been confusion in Captain Morwood's mind about what constituted a "no go item." Flight attendant Sonia Hartwick gave a sworn declaration to this Commission (Exhibit 742) in which she said that on the morning of March 10, 1989, she and her colleague, Mrs Katherine Say, conducted a preflight check of the cabin emergency equipment on board C-FONF. Among others, the following defect was found:

> Katherine Say then proceeded to switch on the switch of the emergency lights and then we proceeded to check the emergency exit lights over the main entry door of the aircraft and the cabin entry door (passenger side). The emergency exit lights over both these doors were not working.

In her sworn statement, Mrs Hartwick also attested:

> Katherine Say then switched the emergency light switch back to the normal position and proceed to the flight deck. I followed her.
>
> Katherine Say informed Captain Morwood of the emergency exit lights which were not working, that there were three missing altitude compensating oxygen masks, and that there was two-way tape on the handle of the main entry door. I overheard Katherine Say mention these matters to Captain Morwood.
>
> Captain Morwood was not visibly impressed, and said words to the following effect "Oh God more snags.". At this time, Captain Morwood reached for a book which I believe was the Minimum Equipment List for the aircraft.

Captain Perkins was questioned about the significance of such an unserviceability:

> Q. And I referred you to item number 33 in the MEL which is in front of you to see if we could both find emergency exit lights. Do you remember we went through that, Captain Perkins?
> A. Yes.
> Q. And when we had a look at item 33 in Exhibit 310, we couldn't find emergency exit lights, right?
> A. That's correct.
> Q. And I asked you what happens then, and you said that means it's a "no-go item"; that's the phrase you used?
> A. Yes.
> Q. Now, what does a "no-go item" mean? Could you tell the Commissioner that, please.

A. Well, that would mean that it would have to be rectified prior to the next flight.

(Transcript, vol. 43, pp. 116–17)

It is apparent from Captain Perkins's evidence that he considered the emergency exit lights to be essential aircraft equipment for which there were no alleviations in the MEL, yet the aircraft was flown on March 10 without repairs first being made to this essential equipment.

Captain Joseph Deluce testified that, in the absence of an approved MEL, pilots would rely on maintenance personnel to make the determination of what is and is not essential aircraft equipment for the purposes of maintenance deferrals (Transcript, vol. 113, p. 131).

These varying views on the interpretation of ANO Series II, No. 20, are significant in that, from June until December 1988, Air Ontario pilots accepted F-28 aircraft into service with inoperative components. Whether such deferrals were legal depended on an interpretation of the term "essential aircraft equipment." As it happened, many of the deferrals during this period appear to have violated ANO Series II, No. 20, and the pilots, their supervisors, and Transport Canada inspectors knew or ought to have known about it.

Operating without an Approved MEL

During the period from June until December 1988, when Air Ontario was operating its F-28 without an approved MEL, personnel in maintenance and flight operations devised their own methods of maintenance deferral – methods which appear to have been in clear violation of ANO Series II, No. 20.

Mr Ozdener testified that maintenance deferrals became a problem almost immediately following the introduction of C-FONF into commercial service in June 1988. He recalled that "on the 9th of June there was a panic in Toronto" because there was a pilot snag and the maintenance group did not know how to deal with it without an MEL (Transcript, vol. 101, p. 72). Mr Ozdener testified that maintenance personnel began a practice of using a section of the Fokker F-28 Flight Handbook[32] known as a list of "allowable deficiencies" to defer the maintenance of essential aircraft equipment (Exhibit 825). If the allowable deficiencies document did not provide a ready solution to the deferral problem, maintenance personnel would telephone Transport Canada airworthiness

[32] The Fokker F-28 Flight Handbook (Exhibit 314) is also referred to as the F-28 Aircraft Flight Manual, or AFM. See chapter 19, F-28 Program: Flight Operations Manuals.

personnel, on an ad hoc basis, for verbal approval.[33] Mr Ozdener testified that it was his understanding that these deferral practices were sanctioned by Transport Canada; however, he conceded that this was somewhat of a grey area (Transcript, vol. 102, p. 113), and I heard no other independent evidence that corroborated such a regulatory approval. In any event, Mr Ozdener testified that the allowable deficiencies document was used by Air Ontario maintenance as a resource document to assist in the deferral of maintenance in the absence of an approved MEL (Transcript, vol. 101, pp. 72–83).

The evidence revealed that the allowable deficiencies document was, in fact, section 10 of volume 1 of the Fokker F-28 Flight Handbook. This section was described as an embryonic MEL that was superseded in 1983 by the Fokker F-28 MMEL. By a manufacturer's amendment dated April 15, 1983, the allowable deficiencies section was deleted from the F-28 Flight Handbook. On August 1, 1983, the F-28 MMEL was issued by Fokker as a separate document approved by Dutch Aviation Authorities. The MMEL functionally replaced the allowable deficiencies section of the F-28 Flight Handbook. This allowable deficiencies section, which was circulating throughout the Air Ontario maintenance department, was four years out of date when the company took delivery of the C-FONF and should never have formed any part of the documentation governing the operation of the aircraft.

Mr Ozdener stated that he and other maintenance personnel photocopied the allowable deficiencies section from the aircraft flight manual that arrived with the aircraft C-FONF. Unfortunately, that original document was destroyed in the wreckage; however, if Mr Ozdener's recollection was accurate, the Fokker F-28 Handbook on board C-FONF was likely not amended since at least April 1983. This fact would call into question the thoroughness of Transport Canada's certification of C-FONF prior to its importation into Canada.

Mr Bittle gave evidence on maintenance deferrals that were ongoing in his department during the period from June until December 1988:

---

[33] It should be noted that Mr Ozdener originally testified that maintenance deferrals were conducted pursuant to a document entitled the "CDL" or Conformity Deviation List (Transcript, vol. 101, pp. 74–75). Later in his testimony he corrected himself, stating that the document which was used for maintenance deferrals during this period was a section from the Fokker F-28 Flight Handbook entitled "Allowable Deficiencies" and not the CDL (Transcript, vol. 102, pp. 119–24). Mr Ozdener was shown a copy of the "Allowable Deficiencies" section and I am satisfied from his evidence and the later evidence of Mr Bittle that, indeed, some maintenance personnel were using that document for the purposes of maintenance deferrals during the period prior to the approval of the MEL.

Q. Now, it was Mr Ozdener's evidence that Exhibit 825, which is in front of you, was indeed this Deficiencies List that was being referred to.

Now, Mr Ozdener did not make the entry, obviously, but that was his understanding –

A. Right.

Q. – of the volume that was being referred to.

A. Right.

Q. Now, do you remember this practice being done at Air Ontario, using this particular volume for deferrals?

A. I don't have a clear memory of that particular situation. This exact volume being used ... since briefing myself for this testimony, it became evident that people were using it. At the time, was I aware of it? I am sorry, I cannot recall.

Q. You don't recall whether or not there was an approved MEL?

A. I know there was no approved MEL.

Q. Okay. And you did not know what deferral practices were going on?

A. I – I knew what the rules said, yes.

Q. No, no, did you know what actual deferral practices were going on in your department?

A. Not every one of them, no.

Q. Okay, which ones did you know about?

A. Well, I didn't check every log book of every airplane, if that's what you mean. And we had a system in place whereby people were delegated to do that. And, if someone felt something was going on that shouldn't have been going on, they had the option to bring it to my attention.

Q. Did anybody ever bring to your attention the use of Exhibit 825 for deferrals?

A. No, not that exhibit.

Q. Did anybody bring to your attention this procedure of phoning Transport and getting approval?

A. No, no, at that time, no, I – no one ever said, that I can recall – now, someone may say, well, they told me or I knew about it, and if that's the case, I'm sorry, I've just forgotten that.

And it's quite possible that someone told me, it's quite likely someone told me, but I can't remember who or when.

(Transcript, vol. 103, pp. 155–57)

In spite of his uncertain recollection, I am of the view that Mr Bittle knew or ought to have known that such deferral practices were ongoing in his department. He, along with Captain Nyman, was charged with the responsibility of preparing an MEL for the F-28 program. He clearly knew that the aircraft was operated from June until December 1988 without an approved MEL; and he should have known that if the strict rules of ANO Series II, No. 20, were followed, it would have been

virtually impossible to maintain any regular operations of the aircraft without an MEL.

On the flight operations side of Air Ontario, there were similarly innovative solutions to the dilemma of jet aircraft operations with no MEL. I have already recounted the evidence of the F-28 project manager and chief pilot, Captain Joseph Deluce, who testified that his pilots relied on maintenance personnel to determine what items might properly be deferred (Transcript, vol. 113, p. 131); and it is clear from the evidence that the maintenance group was relying on an unapproved, out-of-date document to assist them in deferrals. The evidence also revealed that the F-28 pilots, when flying the line, took the initiative in deciding how to operate the aircraft with unserviceable essential equipment.

Some Air Ontario F-28 pilots testified that they relied on their common sense and experience in assessing whether the aircraft was safe to fly with certain items unserviceable. Captain William Wilcox of Air Ontario explained his recollection of the situation:

> Q. You were happy just to exercise your own judgement and determine whether or not, if you had a landing light out or an APU not working or anti-skid not working, you were happy just to exercise your own judgement and decide whether or not the aircraft could safely be flown with that item not working, correct?
> A. That's correct, yeah.
> Q. All right. And you thought that, even once the MEL came into being, it was just there for your guidance, you could still exercise –
> A. No.
> Q. – your own judgement?
> A. No.
> Q. All right. You now agree that, once the MEL was approved, you were bound to comply with the MEL, are you?
> A. Then it becomes your reference, source of reference.
> Q. Well, it becomes the law, doesn't it? You're bound –
> A. Yes, your source of reference, something to fly the airplane by.
>
> (Transcript, vol. 93, pp. 211–12)

I find that, during the six months between June and December 1988, there was an understanding among Air Ontario F-28 pilots that they required an MEL to operate with inoperative essential aircraft equipment; they understood that without some deferred maintenance their aircraft would frequently be grounded; and they made a conscious decision to rely on their experience and whatever tools were available to them to operate their aircraft safely with unserviceable components.

One "tool" that pilots used in assessing the efficacy of a maintenance deferral was the MEL that appeared in their Piedmont F-28 Operations

Manual (Exhibit 307). Pilots apparently used this Piedmont MEL as they would any approved MEL. When they were at a line station and an aircraft component became unserviceable, they consulted the Piedmont MEL to assess the seriousness of the snag and whether they could continue flying, subject to operational restrictions. If the Piedmont MEL operational restrictions were met, then they would not note the defect in the aircraft journey log and would continue flying the aircraft (see, for example, Captain Erik Hansen at Transcript, vol. 94, p. 166).

Apart from the apparent illegality of not formally recording the snags in the aircraft journey log[34] as soon as they were detected, another problem was presented – namely, how to inform subsequent flight crews of the state of serviceability of the aircraft. To overcome this difficulty, the pilots devised a system whereby one crew would record defects on loose notes that were passed on to following crews. In the course of a flying day, the crews would accumulate these loose notes containing information regarding the unserviceability of aircraft components. At the end of a flying day, or before the aircraft was due to spend the night at the Toronto maintenance base, these defects would be formally recorded in the aircraft journey log. In so doing, the flight crews avoided a written record of operating with inoperative essential aircraft equipment. While the aircraft was at the Toronto maintenance base, the maintenance crews endeavoured to rectify all of the defects. To the extent that some defects were not rectified, the maintenance crews consulted the allowable deficiencies list and formulated a deferral.

This situation was clearly described by Air Ontario pilot, Christian Maybury. Captain Maybury was questioned regarding a comment he

---

[34] The Air Regulations provide that:

s.826(1) Every owner of an aircraft, other than an ultra-light aeroplane, registered under these Regulations, shall maintain for the aircraft an aircraft journey log and an aircraft technical log.

(2) The Minister may, by order, prescribe the form of the aircraft journey log and the aircraft technical log to be maintained pursuant to subsection (1) and the particulars to be entered in such logs.

s.827 Every entry log maintained pursuant to section 826 shall be made accurately and in ink by a competent person and signed by that person as soon as possible after the events they record.

Air Navigation Order Series VIII, No. 2/CRCc.-24, the Aircraft Journey Log Order, provides that the particulars of any defect in any part of the aircraft or its equipment and the rectification of such defect must be recorded in the aircraft journey log:

"Forthwith upon the defect occurring and upon rectification having been made" (ANO Series VIII, No. 2, Schedule s.3).

made to Captain Ronald Stewart[35] that he felt he was "fighting hard to maintain ... standards." On this point I feel it worthwhile to quote Captain Maybury at length:

> A. Air Ontario Limited[36] had very high standards, and it seemed to me that we were having to maintain – when I say maintain standards, it was maintain the standards that were set by Air Ontario Limited, which I think were very good ones to be setting our eyes on.
>
> There were just some – just operating the airplane – we've already really discussed it, really – operating an airplane with a level of experience that we had in our supervisory and maintenance people and we just ran into a lot of stuff that just didn't go down right.
>
> Q. In the regard of fighting hard to maintain standards, would you tell us a bit about the practice of passing snags from pilot to pilot.
>
> A. Well, that was one thing that didn't go down well at all. We went through a period where we did not have an officially approved MEL on the airplane, and it makes it very, very difficult to operate an aircraft under these standards, because ... there is equipment on the aircraft that is not required for safe flight. It's good stuff to have, but you can still operate an airplane very safely without it, and that's what the MEL covers.
>
> And, according to air regulations, if you don't have an MEL, the aircraft is grounded, any snag, even a light bulb out. Like, if you wrote up the light's burned out ... down in the cabin, according to air regulations, you're grounded.
>
> Q. If you don't have an MEL?
>
> A. If you don't have an MEL ... So the practice started, and I don't know exactly where it – I wouldn't want to say where it started from, but some of these Mickey Mouse type snags started getting passed by little bits of paper instead of it being officially entered in the log book.
>
> Q. When you say being passed, sir, are you saying that, when one crew would get off and another crew got on, they would pass pieces of paper noting snags on these pieces of paper so they wouldn't have to be entered into the journey look; is that right?
>
> A. Yes, that did occur.
>
> Q. Okay, and you're aware of that practice?
>
> A. Yes, I –

---

[35] Exhibit 744, "F-28 Pilot Questionnaire – Summary." See chapters 15, F-28 Program: Planning; 24, Flight Safety; and 42, Incident and Accident Reporting and Pilot Confidentiality.

[36] Captain Maybury was a pilot from the Air Ontario Limited side of the merged Air Ontario Inc.

Q. And are you personally aware if this practice was adopted and followed by Captain Joe Deluce?
A. Yes, it – I – it occurred at least once with his coming off of a line indoc flight and we were taking over the flight.
Q. And who was the captain of the aircraft when this occurred?
A. I believe it was Bill Wilcox.
Q. Okay. In hindsight, sir, what's your view of that practice?
A. Well, it's very frustrating. Once again, never at any time ... did we ever operate the airplane with something not operating that would have been on the MEL. ... [A]s a guideline, actually, we did have the Piedmont MEL available to us, so –
Q. That's the one in the back of the Piedmont manual?
A. That's right, yeah. So we had that available to us. It certainly isn't the way I feel comfortable flying the airplane.

It's unfortunate that these things take so much time with Transport, and once again getting into the field of Transport Canada, but why did it take months to approve an MEL ... when Piedmont already ... if they had an MEL, then they could have – it – I don't understand these things ... but I just don't understand why it has to take so long so companies and personnel working for these companies are put into this uncomfortable situation for such a long period of time.

Q. As a pilot, sir, did that make your life a little more difficult?
A. Yeah, it added to the stress level.
Q. In relation to the MEL, you noted a moment ago that you did have the Piedmont MEL to fall back on.

Did anyone at Air Ontario ever instruct you or are you aware if anyone in Air Ontario ever instructed F-28 pilots to use the Piedmont MEL?

A. No, no, it –
Q. This simply grew up?
A. This is something that just kind of grew within the system.
Q. Okay. And just to come back one more time, the passing of snags on pieces of paper, then, would mean that these snags would not be noted in the journey log; is that right?
A. That is correct.
Q. And if they're not noted in the journey log, then there is no continuity of snag deferral and rectification?
A. Often, the last crew of the day would enter them. This was more or less done to keep the airplane flying that day, and then the last crew of the day would enter them.

(Transcript, vol. 92, pp. 35–39)

On further examination, Captain Maybury explained why the Air Ontario pilots engaged in these deferral practices:

Q. Captain, my friend Mr Jacobsen asked you about why you didn't report to anyone within the company that these notes,

these maintenance notes, were being passed, and I want to ask you:

Did the fact that Joe Deluce, a member of the management, the fact that he countenanced – or appeared to countenance this activity, did that influence your decision somewhat about whether or not you should complain about it and report it?

A. It influenced it somewhat, but I think the – to be quite frank, the main motivation was the fact that we as a pilot group wanted the operation to be a success.

(Transcript, vol. 92, pp. 206–207)

Captain Deluce provided a lengthy explanation as to the use of the "yellow sticky pads" in Air Ontario F-28 operations. I will refer to his testimony on the subject:

THE COMMISSIONER: Go ahead and explain.

THE WITNESS: We used, it was these yellow sticky pads, for a number of things in the aircraft. We used them for communicating information between the crews.

For example, they would write down clearances or weather or stuff like along those lines, and stick them on the console between the two pilots, and what that enabled crews to do was to, you know if while one person was flying, the other one was taking a clearance or weather, it would enable that information to be readily available to the other pilot. With time he could read it rather than – so we used it for those types of purposes.

We also used the note pads to note observations and at times, defects. It was a quick way en route to jog it down, and it was something that a person could use to write in the snags when they are on the ground in more detail with more explanation that would be of better assistance to maintenance in troubleshooting the particular snag.

So it was convenient that way to keep track, because you always – at times, you would write them right into the book, if it was that phase of flight where you could do that. At other times, you would just make note of it.

Now, the normal practice was to enter these defects, if they were defects, into the log book. At times, maintenance would meet the aircraft and you would review it with them there and they would in fact write it in the log book.

At times, you would write it into the log book and go in to see maintenance on your way home and you would ... bring this sticky pad in to review it with maintenance to make sure ... if there was any additional information they would need before you went home.

At times ... you would slip it in your pocket. You would also use it if you bumped into a crew to just review with them what kind of problems you were having. It might enable them to –

alert them to the fact that they may need a little more time to ensure that maintenance clears something off before ... they take the aircraft.

So there was a number of uses ... of these note pads.

At times, I passed on what I considered observations that were not necessarily – or that weren't what I considered a defect yet, and at times, I may have even passed on other information that I did not consider essential operating equipment, and I had a reason when I did that, because I recall one specifically.

But I think before we get into the questioning much further, I would also like to take a moment to describe, in my estimation, what a snag or a defect is, because I think it's a very complicated thing, and I think some people might feel that it's really something that's black and white, and I don't believe that it's that case.

So I have heard some testimony with regard to snags and defects, and I have done a lot of thinking about it to try and ... recall what we did and to help, but I think, if you don't mind, I will take a few minutes to describe what ... I believe a defect to be.

THE COMMISSIONER: All right. We will hear you.

THE WITNESS: The reason why a defect is a complicated thing, because you have to – it's just not black and white. It's ... actually a decision-making process.

And basically, you can have a continuum whereby the pilot is flying and he is observing things, he is making observations, and at times, the observations and the evidence that he has from that observation is very cut and dry ... there's no question about it, we've got a defect, and that may be at one end of the spectrum.

There's another part of the spectrum where pilots are observing things, but the fact that they are not really at the point of time where they would consider that observation an actual defect.

An example of that might be – you might be doing an approach ... or you might be flying along and one of your VORs,[37] for example, flags.

Now, at that moment in time, you know that you are not getting information from that unit, but you don't know whether it's a problem on the ground or a problem with the unit itself. And it comes back on.

Now, you ... still don't know whether it was a problem on the ground or whether it was an intermittent problem with your

[37] VOR: very high frequency omni-directional range, a navigational aid used in the cockpit of aircraft

unit, so there's some realm here of what I consider strictly observations.

At some point in time, you reach a line where the evidence is that you have a defect. For me, the evidence might be here. For another pilot, it might be there. (Indicating.)

I believe, and ... from going through the testimony and going through the log sheets, I believe that in fact, I did pass on some information that was what I considered observations.

And I believe that in one particular case, that I passed on something as information, but it wasn't essential operating equipment, and I did that because we were troubleshooting the particular unit, and I had just done one flight and maintenance had wanted some troubleshooting information on that unit, and I felt it would be more useful for – and I talked it over with the crew, and they could have considered it a defect at that point in time, but there was a purpose for it, so –

But there wasn't what I considered a practice where crews passed on essential operating equipment.

I have been through the testimony and some crews – some crews indicated that they might have carried some snags. I don't believe that it was a practice.

I know for certain, on occasion, I carried some things that were observations, and I do admit on – I believe that I have, on occasion, maybe even carried something that was in the realm of a defect, but in that realm, I believe that it was something that was deferable.

You know, I'm trying to ... I have gone through log sheets and tried to jog memories of what happened, and I listened to people say things, and that's the best way I can describe what we had done.

At the time, I understood that we could operate the aircraft ... without an MEL if we did not fly it with a defect that was ... essential operating equipment, and I had expected ... because of the nature of part of that which is the airworthiness items, that that was a decision that maintenance would make technically, that I would also satisfy myself that it was safe.

If in fact they deferred something that was – and I accepted it as being non-airworthiness, I would ... probably consult the – I know I would consult the Piedmont MEL to see if there were any procedures covering ... that particular deferral.

I don't believe that just because something is in the MEL, that it's necessarily airworthiness or essential operating equipment. Or I don't believe that it's essential operating equipment.

That's – I don't know if that helps, but I'm trying to tell you how it worked now.

The use of those notes was something that we observed, and it seemed quite handy, when we were at TimeAir. I think ...

– as far as conveying information ... it worked well. The paper – the information was handy.

Anyhow, I will leave it at that, if you want to ask me some questions about whatever ...

THE COMMISSIONER: All right. Thank you for giving us an overview –

(Transcript, vol. 113, pp. 135–41)

Captain Deluce's lengthy explanation of the deferral practices at Air Ontario is revealing. The following points are particularly significant to this analysis:

- He conceded that he may well have deferred something via the "yellow sticky paper" that was "in the realm of a defect," but he stated that at no time did he operate the aircraft with essential aircraft equipment that was inoperative.
- When he made such deferrals, he would consult the Piedmont MEL to see if there were any special operating procedures covering the particular problem.
- He expressed his view that equipment listed in the MEL is not necessarily essential aircraft equipment.
- When he testified he understood that some crews may have carried forward snags via the note passing, but he did not think it was a practice.

The law requires that all defects be noted in the journey log as soon as they are detected. If Captain Deluce was consulting the Piedmont MEL for instruction on accommodating an operational problem, then clearly this was something that was more than "in the realm of a defect." It was a defect, and the practice acknowledged by Captain Deluce appears to have been in violation of ANO Series VIII, No. 2.

Indeed, there is some scope to include items in an MEL that are not essential aircraft equipment. If such were the nature of Captain Deluce's note deferrals, there should have been no reason why they were not immediately recorded in the aircraft journey log. The explanations offered by Captain Maybury and others were more plausible. The note deferrals were made because the pilots wanted to keep the aircraft flying.

In chapter 10, Technical Investigation, there is a detailed review of the aircraft journey log of C-FONF. In that analysis, I concluded there were many maintenance deferrals involving essential aircraft equipment during the period when there was no approved MEL. This suggests that there may have been violations of ANO Series II, No. 20. On the basis of the evidence reviewed in this chapter, I find that there were instances when the F-28 was operated with essential aircraft equipment inoperat-

ive, and the description of such inoperative equipment was contained on the loose notes passed by Captain Deluce and others.

Captain Nyman testified that he was not aware that such note deferrals were going on. He stated that the practice was not a good one and, had he been informed of it, he would have ordered that it be discontinued (Transcript, vol. 107, pp. 191–94).

Mr Morrison stated that he knew the maintenance department was deferring snag rectification pursuant to "some sort of document," but he was not fully aware of the deferral procedure ongoing when the F-28 was operated without an MEL (Transcript, vol. 115, pp. 111–12). Mr Morrison testified that he was not aware of the practice of note passing, as described by Captain Maybury, and he acknowledged that such a practice would have jeopardized the operating certificate of Air Ontario. If he had known the practice was ongoing, he would have put a stop to it and Captain Deluce would have been severely disciplined for having participated in the practice (Transcript, vol. 116, pp. 158–60).

During the period from June to December 1988 there were three significant non-standard and apparently illegal practices ongoing at Air Ontario with respect to maintenance deferrals. These were:

- the practice by maintenance personnel of deferring the maintenance of aircraft unserviceabilities pursuant to the obsolete "allowable deficiencies" section of the Fokker F-28 Flight Handbook;
- the practice by some F-28 pilots of writing up aircraft defects on pieces of paper and passing them along from crew to crew instead of recording them in the aircraft journey log; and
- the practice by some F-28 pilots of relying upon the MEL appearing in their Piedmont F-28 Operations Manual in the operation of the aircraft with inoperative equipment.

These practices were not officially sanctioned by the company, but the F-28 chief pilot and project manager knew of and took part in at least two of them. While the pilots and maintenance personnel were relying on their experience as they improvised solutions to the problems of operating without an MEL, this situation was clearly unacceptable in a properly functioning commercial air transportation system.

I must presume that the procedures established by the Air Regulations and the Air Navigation Orders are founded upon sound operational experience. The regulator is attempting to ensure standardized practices of timely defect rectification and prudent maintenance deferrals.

What is most troubling is that Air Ontario put its operational personnel in a position where they felt obliged to improvise these solutions to the MEL problem. The evidence revealed that Air Ontario personnel, in particular the pilot group, were enthusiastic about their

first jet transport operation and they wanted to make it a success. In their enthusiasm, they carried out operational practices that were in apparent violation of ANO Series II, No. 20, and ANO Series VIII, No. 2. When faced with these practices, it was the responsibility of flight operations and maintenance management to step in and put an end to them. They did not.

Findings

- Problems with the APU of aircraft C-FONF were recurring throughout the week from March 5 to March 9, 1989, and maintenance control personnel in London and personnel at the Toronto maintenance base were aware of the situation.

- On March 5, 1989, Captain Bradley Somers made note of two problems connected with the APU:
  - he noted that the APU was not producing sufficient air pressure to start the aircraft main engines; and
  - he noted that an oily smell filled the cabin shortly after takeoff.

- Maintenance supervisor John Jerabek addressed the snags as follows:
  - he could not duplicate the air pressure problem, and made an appropriate notation in the journey log;
  - he suspected that the cause of the oily smell was residual oil in the duct work connecting the Air Cycle Machine with the cabin ventilation system; and
  - he did not attempt to rectify the problem because it would have taken several hours to do so, and the aircraft was scheduled for imminent departure.

- Mr Jerabek's suspicion may have been well founded; however, a review of the aircraft journey log would have revealed that a similar problem was noted on two previous occasions. On January 21, 1989, smoke in the cabin of C-FONF was attributed to the air-conditioning system (the maintenance of the noted defect was deferred); and on February 27, 1989, thick oily smoke filling the cabin was again reported (the defect was rectified by correcting an oil leak in the duct work). The recurrent nature of this alarming defect should have warranted the serious attention of Air Ontario's maintenance department.

- What is even more troubling was what occurred after Mr Jerabek released the aircraft into service. The next day, on March 6, Captain

Morwood noted in the aircraft journey log that the cabin became smoky, a passenger complained, and the smoke detector went off. Maintenance did respond to Captain Morwood's journey log entry, noting that the defect was rectified by removing oil from the APU outlet ducting.

- Flight attendant Sonia Hartwick testified that on the morning of March 8, 1989, shortly after takeoff from Winnipeg to Dryden, aircraft, C-FONF, piloted by Captain Robert Nyman and First Officer Keith Mills, again filled with an oily smoke which triggered the smoke detector. Captain Nyman testified that he attributed the cause of the oily smoke – which he described as an "oily haze" – to the APU, and stated that it was a fairly common problem with that aircraft. He adopted the evidence of Mrs Hartwick that a circuit breaker was pulled to deactivate the smoke detector and that it was inadvertently not reset until they reached Thunder Bay, two flight legs later. Flight attendant Hartwick testified that smoke filled the cabin and the alarm again sounded during the return flight from Thunder Bay to Winnipeg. Captain Nyman did not note the cabin smoke incidents in the aircraft journey log because, as he put it, it was a recurring, intermittent problem of which maintenance was aware.

- On five separate occasions – January 21, February 27, March 5, March 6, and twice on March 8, 1989 – an oily smoke, smell, or haze was reported in the passenger cabin of C-FONF. Maintenance attempts at curing the problem were obviously unsuccessful, and I am not at all confident that maintenance properly identified the cause of the problem.

- I am not satisfied with Captain Nyman's explanation for not reporting the March 8 cabin smoke problems in the aircraft journey log. His failure to report the defects appears to have breached ANO Series VIII, No. 2. The deactivation of the smoke detector on the morning of March 8 was a poor practice and the evidence of Captain Nyman, that he operated the aircraft with this essential aircraft equipment deactivated, suggests an apparent violation of ANO Series II, No. 20.

- I found Captain Nyman's characterization that the deactivation of the smoke detector was against "the legal letter of the law" to be flippant and at least ill-advised. While Captain Nyman was not the director of flight operations on March 8 when the incident occurred, he was recognized and respected among Air Ontario pilots as among the most senior and experienced pilots in the company. All of the Austin Airways pilots would have worked for Captain Nyman at one time or

another and, indeed, pilot Keith Mills, who was his first officer on March 8, had worked in Captain Nyman's flight operations department for years prior to the incident. This mishandling of the cabin smoke incident reflects shoddy, lax flight operations practices and, coming from a pilot of Captain Nyman's stature, it most certainly would have sent the wrong signal to First Officer Mills, flight attendants Say and Hartwick, and anyone else in the organization who learned of it.

- At all material times, it was mandatory to report an in-flight incident involving smoke or fire to the Canadian Aviation Safety Board pursuant to sections 2 and 5 of the *Canadian Aviation Safety Board Act*. There is evidence that the described cabin smoke incidents were not reported to CASB (see chapter 10, Technical Investigation).

- The aircraft C-FONF arrived at the Toronto maintenance base on the evening of March 8, 1989, with APU air-pressure problems noted by Captain Nyman and Captain Reichenbacher. Captain Nyman contacted maintenance when the APU defect became known to him, and maintenance control assigned a maintenance control number to the defect. Captain Nyman recorded the maintenance control number in the aircraft journey log, which authorized the continued flight of the aircraft with an unserviceable APU until it reached the Toronto maintenance base. Once at the maintenance base, it was the responsibility of an aircraft maintenance engineer to rectify the defect, or, if conditions or circumstances made it impossible to rectify the defect, the supervising maintenance inspector could re-defer the maintenance of the defect.

- The evidence of the attempted repair of the APU air-pressure defect suggests that the maintenance personnel were not adequately familiar with the F-28 APU system. The evidence of Mr Athanasiou, in particular, suggests that he was never certain of the cause of the aberrant signal from the APU fire-detection light.

- Ultimately, the maintenance of the APU was deferred pursuant to the wrong MEL number.

- The handling of the two APU defects – the air-pressure problem and the cabin smoke – reflects poorly on the Air Ontario maintenance and flight operations departments:
  - The failure to rectify the snags after repeated attempts suggests a lack of expertise in the repair of the F-28.

- The willingness to defer repeatedly the maintenance of the defects for lengthy periods suggests that the maintenance group was under some pressure to keep the aircraft flying, was simply lax in its practices, or both.
- The handling of the cabin snag defect by Captain Nyman reflects poor judgement.
- The ultimate deferral of the APU fire-detection defect pursuant to MEL number 49-04 instead of 49-01 suggests a lack of familiarity with both the F-28 MEL and the APU system.

- On March 10, 1989, there was poor coordination between SOC, maintenance, maintenance control, and line pilots regarding the accommodation for the lack of ground-support facilities in Dryden:
  - Mr Steven Korotyszyn, the maintenance inspector ultimately charged with the responsibility of deferring the maintenance of the APU, was under the mistaken impression that there was a ground-start unit in Dryden.
  - Mr Danilo Koncan, SOC duty operations manager, the SOC supervisor involved in the APU deferral decision, was under the mistaken impression that the Winnipeg line maintenance facility had the ability to rectify the APU defect.
  - Mr Martin Kothbauer, the SOC duty operations manager who supervised the operational control of C-FONF on the morning of March 10, 1989, and Mr David Scully, the maintenance controller on duty on the morning of March 10, 1989, were also of the view that the Winnipeg facility was working to rectify the APU defect.

- Both Mr Kothbauer and Mr Koncan were aware of the company policy not to de-ice with main engines running; and both expressed a view that if weather threatened such that de-icing was a likelihood, they would direct the crew of an F-28 with an unserviceable APU to overfly Dryden, where there was no ground-start facility. Mr Kothbauer chose not to direct flight 1362/1363 to overfly Dryden because his assessment of the area weather was such that he did not view de-icing as a likelihood. He was aware of the possibility of freezing precipitation, but it was his opinion that the freezing drizzle would not occur until later in the day. I am of the view that Mr Kothbauer's retrospective meteorological assessment was simply too restrictive. Mr Kothbauer knew the limitations of operating an F-28 with an unserviceable APU into Dryden. He knew, from the early morning area and terminal forecasts, that there was unsettled weather moving into the Dryden area from the west. He should have directed the dispatchers responsible for flight 1362/1363 to monitor developments in the Dryden weather very closely. As it happened, an

amended terminal weather forecast for Dryden at 10:02 a.m. EST called for freezing drizzle. Mr Kothbauer stated that he should have been aware of this forecast and acknowledged a breakdown at Air Ontario SOC. When C-FONF was at the Thunder Bay terminal between 10:35 a.m. and 11:55 a.m., Mr Kothbauer should have directed flight 1363 to overfly Dryden on its return flight to Winnipeg.

- Complete line station ground support would have included an air-start facility in Dryden. As a regularly scheduled stop, it was less than satisfactory that there was insufficient equipment in Dryden to accommodate reasonably probable contingencies. Air Ontario may have made a reasonable commercial decision to delay the placement of ground-start equipment in Dryden. Having made such a decision, there should have been an operational accommodation for the deficient ground-start facility. Namely, it should have been operational policy at Air Ontario that an F-28 with an unserviceable APU was not to be dispatched into Dryden or any other station without ground-start facilities.

- An appropriate place for the promulgation of such a policy would have been in the APU deferral sections of the F-28 MEL. In those sections there should have been an operational limitation that aircraft with unserviceable APUs were only to be operated in stations with ground-start equipment.

- Non-standard and slipshod MEL practices were ongoing at Air Ontario almost from the inception of F-28 service.

- The F-28 C-FONF was repeatedly operated with inoperative essential aircraft equipment during the period from June until December 1988 when there was no approved MEL in place. This suggests an apparent violation of ANO Series II, No. 20.

- During this same period, there was a practice among Air Ontario F-28 pilots of recording defects on pieces of paper and handing them from crew to crew until, at the end of the day, the defects were entered in the aircraft journey log. This practice was apparently spawned by the pilots' desire to keep the F-28 aircraft flying and by a recognition by the pilots that, without an approved MEL, the proper recording of the defects in the aircraft journey log would have effectively grounded the aircraft. The failure to record defects in the journey log promptly appears to have been in violation of the provisions of ANO Series VIII, No. 2.

- These sorts of practices were or should have been known to Air Ontario maintenance and flight operations management and to Transport Canada air carrier and airworthiness inspectors.

- While there is no excuse for these operational practices, I am of the view that they were partially prompted by frustration on the part of line pilots and operational management with delays in the approval by Transport Canada of the Air Ontario F-28 MEL.

- I find that the MEL approval process is unnecessarily bureaucratic and complicated. This Transport Canada problem forms a partial explanation for the lengthy delay in the approval of the Air Ontario F-28 MEL.

- In addition, I find that Air Ontario operational management contributed to the delay in MEL approval. The need for an MEL was identified in the earliest stages of F-28 planning, yet the production of the document was disorganized and tardy.

- I find that had the parent carrier, Air Canada, taken more of an operational interest in its feed carrier, Air Ontario – and indeed its feed passengers – many of the problems associated with the MEL and the APU on March 10, 1989, could have been avoided.

RECOMMENDATIONS

It is recommended:

MCR 49 That Transport Canada proffer for enactment legislation which would require that approved minimum equipment lists be in place for all aircraft certified under United States Federal Aviation Regulation 25, predecessor regulations, or equivalent legislation, prior to the use of such aircraft in commercial service in Canada.

MCR 50 That Transport Canada not issue an operating certificate or amendment to an operating certificate to an air carrier operating aircraft certified under United States Federal Aviation Regulation 25, predecessor regulations, or equivalent

legislation until required and approved minimum equipment lists are in place.

MCR 51 That Transport Canada ensure that the repair of an unserviceable aircraft auxiliary power unit be deferred only with an operational restriction requiring approved engine ground-start facilities to be available at all airports into which that commercial aircraft is expected to operate. This operational restriction should be included in the aircraft minimum equipment list.

MCR 52 That Transport Canada issue to all pilots a warning pointing out the dangers inherent in pulling circuit-breakers on board an aircraft in order to silence an alarm that may in fact be giving a valid warning.

MCR 53 That Transport Canada require that air carriers have in place appropriate policies and directives to ensure that flight crews, at the time they receive an operational flight plan, are informed of any aircraft defects that have been deferred to a minimum equipment list.

MCR 54 That Transport Canada require all air carriers that operate aircraft having minimum equipment lists (MELs) to provide approved training to all pilots, maintenance personnel, and dispatchers on the proper use of an MEL.

17 THE F-28 PROGRAM: LACK OF GROUND-START FACILITIES AT DRYDEN

On March 10, 1989, Air Ontario's F-28 jet service, flight 1363, found itself in the operational predicament of flying with an unserviceable auxiliary power unit (APU), under weather conditions that could necessitate de-icing, into Dryden, a station without F-28 ground-start capability. The lack of an F-28 ground start in Dryden is an important link in the chain of events that ended in the crash of C-FONF. Indeed, had there been a ground start in Dryden on March 10, 1989, all other things being equal, the accident might have been averted.

In order to start the main engines of the F-28, a source of compressed air, normally supplied by the APU, is required. Should the APU be unserviceable, an external source of compressed air, referred to as a ground start or an air start,[1] is required to start jet engines.

There are no Canadian regulations requiring an air carrier to keep ground-start equipment at stations through which they operate. Instead, it is left to the individual carrier to decide, based on operational and commercial factors, whether its operation requires a ground-start facility at all of its scheduled station stops.

By way of a documentation package dated January 24, 1988, Air Ontario applied to Transport Canada to amend its operating certificate to reflect the addition to its fleet of the two F-28s. The application to amend the operating certificate included the following reference to ground support:

> 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, p. 33, para. N)

[1] The terms "ground start" and "air start" were used interchangeably in the hearings of this Commission. In actuality, a ground start can be either air powered or electrical, depending on the type of aircraft. The F-28 requires an air start. Alternative methods of air start are discussed in chapter 16, F-28 Program: APU, MEL, and Dilemma Facing the Crew.

It was not as a result of an oversight that there was no ground start at Dryden. Evidence presented before this Inquiry indicated that prior to making application to amend the operating certificate, Air Ontario had indeed considered, and decided against, acquiring ground-start equipment for Dryden. Chief operating officer Thomas Syme testified that in late 1987, which was prior to acceptance of the first F-28, Air Ontario's F-28 implementation team, including representatives from the airports, marketing, maintenance, and flight operations groups, considered the matter of a ground start at Dryden airport. The matter was also considered by Mr Syme in his capacity at that time as group vice-president, operations and marketing. Because of the high cost of a ground-start unit, approval by Mr Syme and the president, Mr William Deluce, would have been required. According to Mr Teoman Ozdener, former F-28 maintenance manager at Air Ontario, a ground-start unit would have cost approximately "$60–$70,000" (Transcript, vol. 102, p. 37).

In his testimony before the Commission, Mr Syme recalled that the cost of acquiring a ground-start unit for Dryden, along with the operational considerations discussed below, had been a factor in the decision not to furnish Dryden with ground-start equipment:

> Q. Do you recall specifically why it was decided not to put a ground start unit in Dryden?
>
> A. The rationale was that the aircraft had an APU ...
>
> Dryden was a through stop which meant the aircraft was on the ground for a very short period of time. And that with a serviceable APU, there wasn't a requirement for a ground start unit.
>
> ...
>
> A. ... I was made aware that without an air-start unit, if the APU was unserviceable and in circumstances if weather forecasts were extreme, that the aircraft would not operate into Dryden.
>
> (Transcript, vol. 98, pp. 82, 83–84)

It is indisputable that the safer practice would have ground-starting facilities at all scheduled station stops for all aircraft that might require them. (In the case of a turbojet such as the F-28, a ground air-start unit would be required.) With such facilities, a flight crew would have the option of shutting down the aircraft for any reason – including de-icing – without fear of stranding its passengers. However, commercial realities being what they are, it is understandable that, for a number of reasons, a carrier may not want to invest in ground-power units for all of its scheduled stations. Having stated this, I would hasten to add that, if a carrier makes such a commercial decision, there clearly must be an

operational accommodation for the lack of ground-start facilities at the individual stations.

According to Mr Syme, Air Ontario's operational accommodation for not providing a ground start in Dryden was to overfly that station in "extreme" weather (Transcript, vol. 98, p. 84). If indeed this was the policy at Air Ontario, its failure was in not committing this "operational accommodation" to a standardized, unambiguous directive contained in all appropriate manuals and communicated to all flight crews and dispatchers. In testimony, Mr Syme, Captain Robert Nyman, and Captain Joseph Deluce each conceded that there was no written policy directing pilots to overfly Dryden in circumstances where their APU was unserviceable.

Although there was no written policy, Captain Deluce was of the view that Air Ontario pilots were well enough equipped to respond to operational situations of this sort:

> Q. ... Now, as chief pilot, would you not agree with me that, if it was your view that, in a given situation, pilots could overfly Dryden, that that situation should be brought to the attention of the pilots?
>
> A. ... I think that there's no question about it, that I did not provide them with specific direction on that specific issue. But ... [by] the same token, I don't think it would be reasonable for me to document every possible scenario that – and make every possible decision that a pilot would ever be expected to make. To me, that is a reasonable decision for a pilot to make
>
> ...
>
> A. I believe that all pilots would know that they could do whatever they had to do to operate in a safe manner.
>
> (Transcript, vol. 111, pp. 204–205)

Captain Deluce's statement ignores the very real, and usually competing, choices with which an airline pilot is often confronted. On the one hand there is the corporate goal of getting passengers to their destinations on time and, especially, avoiding groundings. On the other hand, there is the imperative to operate as safely as possible. Recognizing this basic conflict, it is the air carrier's responsibility, within the air transportation system, to provide clear advice to its pilots for all reasonably foreseeable operational contingencies. The Dryden scenario, in my view, was reasonably foreseeable.

Captain Nyman, Air Ontario's director of flight operations and an F-28 company check pilot, was not aware of any company policy, written or otherwise, in this regard, and his view, in contrast to that expressed by Captain Deluce, was that company guidance was required. Moreover,

Captain Nyman admitted that at Air Ontario the pilots were alone when it came to these crucial, stressful decisions:

> Q. ... So just as a circumspective line pilot, if you had been faced with a decision of either, A, overflying Dryden, or B, possibly getting stuck in Dryden because you don't have an APU and it's snowing and so on, that's something that you just simply would have considered on your own, is that right, without any guidance from the company?
> A. I think that there should have been guidance from the company. That's not what I'm saying.
> Q. No, I understand that.
> A. I – yes, I would have considered that on my own, and I have often wondered, in fact, what I would have done.
>
> (Transcript, vol. 109, p. 236)

It is of utmost importance, as illustrated by the events of the Dryden accident, that maximum support be afforded flight crews in making difficult operational decisions. Clear policies must be put in place by air carriers to ensure that flight crews are not left to decide, in stressful, Dryden-type situations, whether to overfly a scheduled stop or ground an aircraft and strand a planeload of passengers, or to attempt a potentially hazardous takeoff. Having well-developed and understood company policy on which to base their decisions, pilots would be more easily able to make correct choices.

The preferred policy in my view, and the one employed by Air Canada, is simply not to dispatch a turbojet aircraft with an unserviceable APU into an airport lacking appropriate ground-start capability. Captain Charles Simpson, Air Canada's vice-president of flight operations, testified that Air Canada did not operate aircraft with unserviceable APUs into Fredericton, New Brunswick, a station with no ground-start facilities. This policy is in place in order to avoid the possibility of being unable to restart the aircraft engines if for some reason they had to be shut down.

In keeping with my earlier comments regarding the APU and the minimum equipment list (MEL), it is my view that this policy could be clearly stated in individual aircraft MEL sections dealing with APU unserviceability. For example, where the MEL provides relief to operate with an inoperative APU, the MEL could include a precondition of operation that necessary ground-start facilities be available at destination airports.

Findings

- Air Ontario failed to ensure that an operational policy was in place and communicated to all operational personnel so as to prevent the dispatch of an F-28 with an unserviceable auxiliary power unit into a station without ground-start facilities.

- Given the Air Ontario F-28 support facilities that actually were in place at Dryden, Transport Canada failed to ensure that there was an operational accommodation in place at Air Ontario. Such an operational accommodation would have prevented the dispatch of an F-28 aircraft with an unserviceable APU into Dryden.

RECOMMENDATIONS

It is recommended:

MCR 55 That Transport Canada ensure that air carriers have operational policies that require the availability of appropriate ground-support facilities at individual airports where the air carrier intends to operate.

MCR 56 That Transport Canada ensure that the operational policies referred to in Recommendation MCR 55 above be contained in the air carrier's operations manuals, such as its flight operations manual and its route manual, and/or the individual aircraft minimum equipment list.

MCR 57 That Transport Canada ensure that, when it is reviewing an air carrier application for an operating certificate or an amendment to an operating certificate, there be a scrutiny of the air carrier's intended aircraft support facilities. Transport Canada then should satisfy itself that operational policies contained in the air carrier's operations manuals adequately accommodate the air carrier's identified and existing aircraft support facilities. No operating certificate or amendment to an operating certificate should be issued unless Transport Canada is so satisfied.