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Canadian Report of Airliner Evacuations Cites Six Safety Recommendations

The report identified safety deficiencies associated with communication during evacuation, exit operation, passenger preparedness and the presence of fire, smoke and toxic fumes.

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When a Boeing 737 flight crew rejected takeoff after an uncontained engine failure at Calgary Airport, Alberta, Canada, a locked door and an unanswered interphone signal kept the flight crew from finding out immediately about a serious engine fire.

That lapse in communication between the cabin and the flight deck was a factor in delaying the start of the evacuation, which did not begin until nearly two minutes after the rejected takeoff. Four persons were injured seriously during the evacuation resulting from the engine fire in March 1984.

In a recent report, the Transportation Safety Board of Canada (TSB) concluded that "ineffective crew communication" had jeopardized the likelihood of successful evacuations in at least three events involving large Canadian-registered passenger aircraft over a 13-year period. "Poor crew communication may result in unnecessary injuries or fatalities and unnecessary exposure of risk for passengers and aircrew alike," the report said.

Faulty crew communication was just one of numerous problems that the TSB cited in its report of 18 evacuations of Canadian aircraft and three evacuations of non-Canadian aircraft in Canada from 1978 to 1991 (Table 1, page 2).

Of those 21 evacuations, 14 took longer than 90 seconds (the standard goal for evacuation time); five took 90 seconds or less; and the exact timing of two evacuations was not recorded.

Aside from poor crew communication, other important factors that delayed or complicated evacuations included smoke or toxic fumes from aircraft fires; problems with overwing exits and with opening emergency exit doors; difficulties with using evacuation slides; debris blocking movement out of the aircraft; and obstructive behavior by some passengers.

After analyzing the problems with and the injuries attributed to evacuations, the TSB recommended six changes in regulations and procedures to make evacuations safer.

The 21 evacuations studied for the TSB report ranged from a 1978 B-737 runway crash in Cranbrook, British Columbia, that killed 42 of the 49 persons aboard, to a relatively simple rejected takeoff at Riviere-Aux-Saumons, Quebec, in 1991, in which no one was seriously injured.

In all, 91 persons died as a result of those airline acccidents, which involved a total of 2,305 passengers and 139 crew members (Table 2, page 2). Of those 91 deaths, researchers found that 36 deaths occurred during evacuation. Another 13 of the deaths occurred at impact. The cause of death was not documented for the remaining 42 passengers.

Of the 78 serious injuries resulting from those accidents, at least eight injuries resulted from the evacuation. But the cause of injury was undocumented for 52 of the serious injuries.

Table 1
Factors in 21 Canadian Aircraft Evacuations, 1978–1991

Lead Event	
Fire	8
Engine failure	5
Runway excursion	3
Component/system failure	2
Miscellaneous	3
Phase of Flight	
Ground	1
Takeoff	6
En route	5
Landing	9
Planned/Unplanned	
Planned	8
Unplanned	13
Land/Water	
Land	21
Water	0
Time to Evacuate	
More than 90 seconds	14
90 seconds or less	5
Unknown	2

Source: Transportation Safety Board of Canada

When researchers examined the injury reports, they discovered that six passengers were injured when they escaped from aircraft through overwing exits.

- In the 1984 Calgary accident, three passengers fractured bones when they jumped to the ground from the wings' leading edges. A fourth passenger fractured his pelvis and some ribs when he fell from the wing after slipping on foam.

- In a 1986 incident in Kelowna, British Columbia, one passenger chipped an ankle bone when he escaped from a crippled B-737 through an overwing exit.

- At the Regina, Saskatchewan, airport in 1983, a passenger injured his back when he escaped from a McDonnell Douglas DC-9 through an overwing exit.

The researchers also found that there had been minor injuries to passengers who used the aircraft evacuation slides. For example, a passenger bruised his tailbone when he was not caught at the end of a slide; several passengers suffered cuts and bruises when they fell off slides and onto the tarmac; and passengers who "piled up" at the bottoms of the inflatable slides suffered various injuries from other sliding passengers.

The TSB report's main purpose was to study and to analyze problems with aircraft evacuations, defined as "the disembarkation (planned or otherwise) of passengers because of an existing or perceived emergency." That includes precautionary evacuations, abnormal deplanings and emergency egress situations.

In a planned evacuation, some time is available for the previously advised cabin crew to prepare the cabin and the passengers before the evacuation command is given. In an unplanned evacuation, the evacuation begins as soon as possible after the decision is made to evacuate.

In testing an aircraft's evacuation capability, airlines are required to show that all passengers and crew can be evacuated from the aircraft to the ground within 90 seconds. That is the typical amount of time that passengers can survive in an aircraft fire.

The TSB researchers found wide variations in the emergencies that led to the studied evacuations, but they also found some problems that complicated many evacuations.

Communications failures. Just before the B-737 flight crew aborted the Calgary landing in 1984, the chief cabin attendant saw fire break out and tried to notify the flight crew. But a locked flight-deck door delayed the attendant for about 45 crucial seconds.

Meanwhile, the aft-cabin attendant tried to use the aircraft's interphone system to notify the flight deck about the engine fire. But the first officer did not answer because he mistook the signal tone for a flight attendant call-button bell.

Failing to get a response from the flight deck, the aft-cabin attendant then used the interphone to call the chief cabin attendant, who was at the front of the aircraft, to let him know about the fire, and ask him to tell the flight crew to stop the aircraft immediately. But the chief attendant did not confirm

Table 2
Injuries in 21 Canadian Aircraft Evacuations, 1978–1991

	Fatal	Serious	Minor/None	Total
Crew	7	6	126	139
Passengers	84	72	2,149	2,305
Total	91*	78**	2,275	2,444

*Of these deaths, 36 occurred during the evacuation, 13 resulted from impact and for 42 the cause was not documented.

**Of these injuries, eight occurred during evacuation, 18 occurred at impact and for 52 the cause was not documented.

Source: Transportation Safety Board of Canada

that he had received and understood the message, so the aft-cabin attendant "did not know if he had been successful in transmitting this vital message."

The report concluded: "Inadequate communication between the cabin and the flight deck resulted in a significant delay before the flight crew was aware of the existence and seriousness of the fire, and contributed to the fact that the evacuation was not initiated until one minute, 55 seconds following the rejected takeoff."

As the engine/wing fire melted windows along the aircraft's left side, smoke and heat rushed into the cabin. But the crew gave no specific command to passengers to evacuate the aircraft. Also, the report said, it does not appear that the crew gave additional instructions that are typical during an evacuation, such as, "Come this way," and "Leave everything behind."

"In a situation such as this, where the cabin was filled with smoke and visibility was obscured, a loud voice can act as a beacon guiding passengers to the nearest exit," the report said.

Despite the problems, the report found that the rushed Calgary evacuation had been generally successful, with only four of the 119 passengers sustaining serious injuries. But the report noted that the evacuation's success was mainly attributable to "the fact that almost all the passengers were frequent air travellers familiar with the Boeing 737, and that there were no children, elderly or disabled passengers on the flight."

The Calgary accident was one of three evacuations studied for the TSB report during which "ineffective crew communication jeopardized or potentially jeopardized the likelihood of a successful evacuation." The other two evacuations:

- After a double-engine flameout of a Boeing 767 in 1983, the use of "improper terminology" by the chief cabin attendant gave at least two other cabin attendants the false impression that the aircraft was about to crash.

  The chief attendant said they were "going in" when he should have used the term "forced landing," meaning that the flight crew had some element of control. "In this case," the report said, "inappropriate communication may have contributed to the stress and anxiety felt by the cabin crew, and could have adversely affected their judgment and decision-making ability."

- A miscommunication between the captain and the chief cabin attendant delayed the evacuation of a B-737 in Vancouver, British Columbia, in 1989. The captain contended that he ordered evacuation via the "front exits," while the chief attendant thought the captain said, "front airstairs," and some of the passengers said they heard, "front doors."

  As a result of this misunderstanding — as well as that she was not told exactly why the aircraft was to be evacuated — the chief attendant tried to lower the forward airstairs, even though no power source was available. Had the captain told the chief attendant the reason for the evacuation — that the aircraft's engines had been shut down because of a fire in the auxiliary power unit (APU) — she would not have wasted time trying to lower the airstairs.

"Effective crew coordination is crucial to a successful evacuation, but ineffective crew communication leads to ineffective crew coordination," the report said. "As evidenced by the occurrence data, poor crew communication may result in unnecessary injuries or fatalities and unnecessary exposure to risk for passengers and aircrew alike."

"Improper terminology" by the chief cabin attendant gave at least two other cabin attendants the false impression that the aircraft was about to crash.

In 1987, Canada's Aviation Safety Board (the predecessor to the TSB) made recommendations to improve crew communication. And the TSB is now investigating "at least four occurrences where the absence of effective crew communication may have placed both passengers and aircrew in positions of unnecessary risk."

Experts in the United States have reached similar conclusions. In 1988, the U.S. Federal Aviation Administration (FAA) published a report that said, "the key to improving cockpit and cabin-crew coordination lies in improving the communication between the two crews and in increasing each crew's awareness of the other crew's duties and concerns."[1] In 1992, the U.S. National Transportation Safety Board (NTSB) also found that ineffective crew communication remained a serious problem in emergencies.[2]

Some large airlines conduct joint [cabin and flight] crew training, and others say that they plan to do so. In an emergency, the crew usually communicates via the interphone or the public address system. Typically, the cabin crew calls the flight deck on the interphone, and a member of the flight crew answers.

One large air carrier has installed in many aircraft a "hot line," also called an "open interphone system," that provides an open communication line between the flight deck and specific cabin-attendant stations.

In 1993, the TSB was assured by Transport Canada that it encouraged commercial aircraft operators to review their

training procedures "to ensure that information critical to the safe operation of their aircraft can be communicated to the cockpit crew in a timely and effective manner."

The TSB report said that joint crew training is not yet mandatory. But air carriers are required to include a chapter on "Aeroplane Ground Emergency Procedures and Coordination" in their operations manuals and in training manuals. Also, Transport Canada requires that air carriers with cabin attendants use interphone systems, or similar direct modes of communication with the flight decks.

The board recommended that Canada's Department of Transport (DOT) "require that air carriers implement an approved joint crew emergency training program with emergency simulations for all air crew operating large passenger-carrying aircraft."

Another aspect of communication involved problems with aircraft public address systems. The report found that in eight of the evacuations studied, the cabin crew and/or passengers were unable to hear the first evacuation command, or, in some instances, later commands. During four of those evacuations, the public address systems were inoperable. Some examples:

- When a DC-9 rolled off the runway after a tire failure on takeoff at Toronto, Ontario, in 1978, a flawed public address system prevented passengers from hearing the chief cabin attendant's instructions to stay calm and remain seated until the exits were opened. The passengers sitting beside the overwing exits also did not hear the chief cabin attendant's directions to open those exits.

- In another DC-9 evacuation, in 1983, the chief cabin attendant found that the public address system was not functioning when she tried to give an emergency briefing prior to an evacuation because of a cabin fire.

  The attendants then gave the briefing by shouting instructions, but because of the commotion, thick black smoke and toxic fumes that filled the aircraft cabin, "many passengers were unable to hear the prelanding emergency briefing, the command to evacuate or the shouted verbal commands directing them to the exits."

- In 1989 at Saskatoon, Saskatchewan, the captain and chief flight attendant used the public address system to ask passengers to stay calm after a runway overrun. But the aft-cabin attendant could not hear the announcement, and had to walk to row 18 in the cabin before she could understand the captain's announcement.

  By the time the captain decided to evacuate via the forward airstairs, the engines were off and the public address system had no power. Because verbal commands could not be understood everywhere in the cabin, attendants were forced to walk from one end of the aircraft to the other to give evacuation instructions, causing a delay in the evacuation.

- On a Lockheed Martin L-1011 at Gander, Newfoundland, in 1986, the captain made the command to evacuate on the public address system, but the cabin attendant stationed in the rear of the aircraft could not hear the command. She started evacuating passengers from the rear cabin only after she saw other exit doors being opened.

- At Regina, Saskatchewan, in 1983, the flight crew allowed a DC-9's engines to continue operating during the evacuation. The captain's order to evacuate the aircraft was inaudible over the engines' roar.

  The chief cabin attendant, realizing that an evacuation was necessary, shouted the evacuation command but neither the command nor further instructions could be heard beyond the midcabin area. The chief cabin attendant had to walk through the cabin to alert passengers who were lining up to use the overwing exit that the front exit was available.

During four evacuations, the public address system was inoperable.

The TSB report expressed concerns about the eight incidents involving public-address problems. The board is now investigating a more recent case of a de Havilland DHC-8 in which neither the cabin attendant nor the passengers could hear the captain's announcements on the public address system.

The report recommended that Canada's DOT "review the adequacy of power supplies and standard operating procedures for [public address] systems in an emergency for all Canadian operators of large passenger aircraft."

Fire, smoke and toxic fumes. The report found that the presence of fire, smoke and/or toxic fumes "presented the greatest risk to a successful evacuation." Such hazards occurred in three of the four fatal aircraft accidents that the study examined, and seriously injured many of the survivors.

In the Calgary evacuation, the report said, smoke and heat pouring into the aircraft cabin from fire-melted windows and through cabin exits "obscured visibility almost totally during the last stages of the evacuation."

In the cabin's aft section, where smoke hazards were worst, passengers who left via the rear exit "reported that they were unable to see the exit, and were required to follow the person ahead to locate it. By the time most had reached this exit, the smoke had lowered to about knee height. The bottom portion of the door and the slide were all that was visible."

Other aircraft accidents involving fires showed similar patterns. After a cabin fire forced the landing of a Canadian DC-9 in Cincinnati, Ohio, U.S., in 1983, for example, "the location of two passengers' bodies indicated that, in their attempt to get out of the aircraft, they had unknowingly passed an available exit." Twenty-three persons died in that accident, and three were seriously injured. Another 20 passengers escaped with no injuries or minor injuries.

In nine of the evacuations studied, fire and smoke blocked egress from some of the normally available exits. And in three evacuations, smoke and toxic fumes inhaled by passengers limited their mental and physical stamina, "obstructing or prohibiting their attempts to reach, operate and negotiate emergency exits or egress through breaks in the fuselage."

Numerous Canadian regulations, as well as airline industry operating procedures, are designed to help protect passengers and crew from the dangers of such fires, smoke and toxic fumes. The safety board focused its examination on two areas of risk mitigation: protective breathing equipment (PBE) and aircraft interior flammability standards.

Transport Canada's regulations define PBE as "equipment to cover the eyes, nose and mouth, or the nose and mouth if acccessory equipment is provided to protect the eyes, that will protect the wearer from the effects of smoke, carbon dioxide or other harmful gases."

Opening a lavatory door during the 1983 DC-9 flight, a flight attendant "saw light grey smoke had filled the lavatory from the floor to the ceiling, but she saw no flames. The flight attendant closed the door — but not before she had become dizzy from inhaling the smoke." Smoke from the lavatory was so dense that the chief cabin attendant "was unable to locate the source and exact nature of the fire or to fight it effectively," the TSB reported.

That description of the hazards from an in-flight fire shows the need for PBE for cabin attendants, in addition to the PBE that is normally issued for flight crews, the report said. In its investigation of the fire, the NTSB reported later that "had an oxygen bottle with a full-face smoke mask been available and used, it might have encouraged and enabled [the chief cabin attendant] to take immediate and aggressive actions to fight the fire, as set forth in the company manual."

In its report on evacuations, the TSB noted that many flight attendants are not provided with PBE in the aircraft cabin, even though they are expected to help fight cabin fires. Some air carriers in Canada issue at least one portable PBE unit for cabin attendants who may, on occasion, be called on to help douse cabin fires.

Transport Canada regulations require PBE for each flight-crew member at his or her station, but "there is no regulatory requirement to provide cabin attendants, other than those working on 'combi' aircraft [carrying passengers and freight], with PBE."

Canadian officials have rejected proposals to provide "smoke hoods" for passengers, mainly because one study indicated that such hoods might delay evacuation time to the extent that more lives would be lost, in the end, than the lives saved in cabin fires.[3] Canadian rules bar passengers from carrying their own PBE units, which provide oxygen from a cylinder of compressed gas, because of the fire hazard from the oxygen supply. PBE units that use filters to provide breathable air (and do not provide oxygen from a compressed gas cylinder) are permitted.

In the United States, PBE for flight crews has been mandatory for more than 45 years. And in 1987 — in part, as a result of the DC-9 fire and evacuation in Cincinnati — the FAA amended U.S. Federal Aviation Regulations (FARs) Part 121.337 to require that air carriers operating transport aircraft must also provide PBE to both flight crews and to other crew members who are responsible for fighting fires that might occur aboard the aircraft. In the United Kingdom, readily accessible PBE units are also mandatory for both flight and cabin crew.

Neither country requires PBE for passengers. The TSB report found "no direct evidence that a lack of PBE for cabin crew resulted in fatalities or injuries during evacuations. Yet, there is a paradox that cabin attendants are expected to fight cabin fires, but, in many cases, they are not provided with PBE in the aircraft cabin." Contending that ready access to PBE "could improve [cabin attendants'] ability to fight fires," the TSB recommended that Canada's DOT require that "sufficient portable protective breathing equipment units with full-face masks be carried in the passenger cabins ... for cabin crew."

The TSB recommended that the transport department re-evaluate research on PBE for passengers, with a view to determining whether it would be feasible to allow passengers to carry their own oxygen-supplying PBE aboard aircraft.

Although Transport Canada is working to develop improved flammability standards for aircraft interiors, the TSB stressed the need for quick action. In its report, the board noted that, in cases where the cause of death was recorded, smoke inhalation or burns were the primary causes of fatal injuries to 36 of the 49 persons who died during the aircraft incidents studied. In addition, "it is suspected that a large number of [fatalities where cause was not documented] were also fire-related," the report said.

In the United States, an analysis by the FAA's Civil Aeromedical Institute found that smoke inhalation and/or burns were the primary causes of death in about 95 percent of the fatalities during evacuations. That report examined 58 "survivable or partly survivable" aircraft accidents between 1970 and 1993.[4]

In its examination of flammability standards for aircraft interiors, the TSB found that Canada's current standard, although consistent with the original standard set jointly with the United States and the United Kingdom, "does not meet the current improved flammability standards of either … ."

The U.K.'s new flammability requirements went into effect in 1987, and the FAA's latest U.S. standards apply to all commercial aircraft manufactured after August 1990. Even so, a January 1993 study by the U.S. General Accounting Office contended that "under the airlines' current practice of replacing, rather than modifying, aircraft, the entire [U.S.] fleet is not expected to comply with the stricter flammability standards until 2018 at the earliest."[5]

Meanwhile, Transport Canada has been working for several years on new flammability standards, which have not yet been completed. A commission of inquiry into a crash at Dryden, Ontario, in 1989 — in which smoke and burns injured numerous people in the aircraft — said that " ... Transport Canada has attempted to adopt the new FAA standards for cabin interiors" but said that, as of 1991, the new standards for Canada were not in effect.

Noting that those new standards had still not been issued by early 1995, the TSB report expressed concern "about the length of time required to put such new standards into effect ... ."

Slide and exit operations. Many of the Canadian evacuations were delayed or complicated by problems with operating emergency exits and deploying emergency slides.

During four evacuations, cabin attendants reported difficulties operating emergency exit doors. In another three cases, passengers had trouble using overwing exits. Of the 15 evacuations where the crews deployed emergency slides, they had problems in seven evacuations, including several instances of difficulty in positioning the slide at the correct angle.

Crews in four evacuations were unable to deploy their aircrafts' forward airstairs, despite the captains' orders to do so. Instead, after "significant delays," the crews were forced to set up evacuation slides. Three of the aircraft were B-737s; the other was a DC-9.

The difficulties encountered in nearly half of the evacuation-slide deployments prompted the TSB to remark in its report that "the intent of the current airworthiness standard is not being achieved." Among the slide problems:

- In two evacuations (in 1986 and 1989), the slides did not deploy automatically. The crew then set up the slides manually. But, in one case, the slide went straight down to the ground, and had to be repositioned from the outside before passengers could safely use the exit.

- During a 1986 evacuation at Wabush, Newfoundland, neither of the rear slides deployed properly: they were twisted, tangled, partially inflated and curled back toward the aircraft. Neither exit could be used until firefighters repositioned the slides.

- In one evacuation involving an L-1011 in 1986, the R-4 [at the fourth exit on the right side of the airplane] slide could not be deployed, either automatically or manually. In a 1990 evacuation of a Canadian aircraft at Gatwick Airport, London, England, one slide deployed at an awkward angle relative to the door sill.

- During two evacuations (in 1982 and 1983), wind blew the escape slides up against the sides of the airplanes, preventing the slides' use until someone who used another exit arrived to reposition the troublesome slides and hold them in place.

- In one evacuation, the escape slides did not reach all the way to the ground, mainly because the aircraft was resting at an unusual angle. In two evacuations, the crews of other aircraft decided not to use slides, because the slides' angles of decline were too steep. And, in another evacuation, some passengers suffered minor injuries because a slide was at too steep an angle.

"There does not appear to be a simple explanation why some slides did not deploy automatically or properly," the report said. "In one instance, the problem was traced to excessive clearance between the bar on the door and the aft latch on the floor, which allowed the bar to pull free. In other cases, the attitude of the aircraft at rest was unusually nose-high or -low."

Noting that the optimal angle for slides is about 36 degrees, the Canadian researchers found that, at angles of 48 degrees or higher, "the evacuees have a tendency to hesitate before entering the slide because of its steep appearance," and evacuations tend to progress more slowly.

Because escape slides can be critical to a successful evacuation, the board recommended that Canada's DOT, in concert with industry, "re-evaluate the performance of escape slides on all large passenger-carrying aircraft registered in Canada."

The four problems reported with emergency exit doors included the following:

- In 1982, high winds made it difficult to open the exit door of a B-737 during an evacuation after a hard landing at Sault Ste. Marie, Ontario.

- In 1986, it took a cabin attendant and two male passengers to force open an emergency exit door on a B-747 at Goose Bay, Labrador.

- In 1984, the purser of a B-737 at Calgary was able to unlatch and "crack the door open," but had trouble fully opening the door, mainly because of "drag" from the

evacuation slide. A similar problem occurred in 1978 on a DC-9 at Toronto.

In the four evacuations in which captains made the decisions to evacuate the passengers by way of the forward airstairs, the crews were unable to deploy those stairs and, following "significant delays," used slides instead.

Although expressing dissatisfaction with some of the evacuation problems involving aircraft egress, the TSB made no specific recommendations on emergency exit doors or overwing exits.

Nevertheless, the TSB report stated concern "that four evacuations were significantly delayed because crew could not deploy the airstairs, possibly due to their expectations that the airstairs could be deployed without power."

During three other evacuations, crews reported difficulties with overwing exits. Two of those cases involved "inappropriate passenger behavior" (detailed below). Overwing exits are often opened by passengers, because cabin attendants are not usually stationed at such exits.

Passenger problems. After a DC-9's landing gear collapsed on a snowy runway at Regina, Saskatchewan, in 1983, part of the evacuation was delayed when passengers in exit-row seats either refused or were unable to open the emergency doors.

"I asked one guy to open a door and he wouldn't, he just stood there," a passenger later told investigators. "I told another fellow, I got stern with him, 'Open that door!' ... Before he opened it, he said to me, 'How? How do you open it?' ... After the hatch was opened, he just set it down then, right in the doorway; he didn't bother getting out of the window ... . He just stood there with the door open and the wind and snow blowing in, and I said to myself, 'This is the last straw.'"

While the Canadian study found no direct evidence that the persons in exit-row seats were incapable of opening emergency doors, the researchers found ample evidence that some of those passengers "did not quickly or correctly open emergency exits, resulting in delays in evacuations." During an evacuation at Kelowna, British Columbia, in 1986, the passenger sitting next to the left overwing exit "made no attempt to open the exit, nor did she respond when directed to open the exit by a cabin attendant." After the uncontained engine failure on takeoff at Calgary, the passenger sitting next to the right overwing exit opened it only after the urging of several other passengers. But he then placed the hatch in the cabin, where it "obstructed passenger movement."

Although passengers cannot be expected to know how to open emergency exits, they are provided with safety information cards that give such instructions. But one survey of Canadian air travelers in 1989 found that only 29 percent of the passengers read those safety cards.[6]

The TSB report said that "it is common practice for Canadian air carriers to prohibit certain passengers from sitting in emergency exit rows." Those "restricted" passengers include pregnant women, unaccompanied children, disabled persons and families with infants or children.

But, while FAA regulations in the United States require that air carriers screen and brief passengers sitting in exit-row seats, Canada has no such requirement. In April 1994, a proposed Transport Canada regulation was published that would direct air carriers to "ensure that, prior to takeoff, every passenger seated next to a window emergency exit is informed by a crew member that the window is an emergency exit and how the exit operates."

The TSB report concluded that "passengers occupying exit-row seats have frequently demonstrated a lack of knowledge and determination to open the exits under emergency situations." But the TSB, knowing of the proposed exit-seat amendment, opted against recommending any further safety actions.

In 11 instances during the 21 evacuations studied, some passengers behaved inappropriately and complicated the evacuations. That obstructive behavior ranged from overt panic — characterized by screaming, hysteria or overaggressive action — to the "negative panic" of frozen inaction. For example, shortly after the B-747 turned off the runway at Gatwick in 1990, the captain ordered an immediate evacuation because of tail-pipe fires. Despite being told to leave all belongings behind and leave the aircraft immediately, "many passengers insisted on retrieving their carry-on baggage. When confronted by cabin attendants, some passengers tried to return to their seats to stow their baggage in the overhead bins."

During the Calgary evacuation, passengers in the first seven rows ignored the urging of a cabin attendant at the open, right-forward exit door, and instead tried to leave the plane via the opposite door.

"A cabin attendant had to stand in the middle of the passage between the two exits and aggressively direct passengers" to the right door. Passengers later said they had headed for the left door because they had entered the aircraft via that door.

The Canadian researchers found that passengers tend to be less prepared to evacuate aircraft when an emergency happens during the landing phase. Possibly they are fatigued and more relaxed after a long flight, or perhaps they have forgotten the evacuation information that was presented at the safety briefing before takeoff.

In April 1994, Transport Canada proposed that air carriers be required to give passengers on flights two hours or longer a prelanding safety briefing, including the locations of emergency exits and exit location signs.

But that proposal has since been abandoned, in favor of one that would require such briefing only on flights lasting four hours or longer.

The TSB report endorsed the need for a prelanding safety briefing, but expressed concern that such briefings are unlikely to review the detailed information on the safety-features cards about exit operations, recommended brace positions and use of escape slides and life jackets.

Because most evacuations occur during the landing phase, the board recommended that Canada's DOT "encourage carriers to include sufficient detail in their prelanding briefings to prepare passengers for an unplanned emergency evacuation."♦

Editorial note: This article is adapted from *A Safety Study of Evacuations of Large, Passenger-Carrying Aircraft,* Transportation Safety Board of Canada (TSB) Report No. SA9501. March 1995. The 39-page report is available from Transportation Safety Board of Canada, Place du Centre, 4th Floor, 200 Promenade du Portage, Hull, Quebec, K1A 1K8.

The original report cited 33 references, including two articles from Flight Safety Foundation publications about smoke hoods and evacuation slides.

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