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# Increased Amount and Types of Carry-on Baggage Bring New Industry Responses

***The increased capacity of passenger-cabin overhead bins and changing passenger behavior have made carry-on baggage a source of in-flight injury and a threat to emergency evacuations. Airlines have programs for limiting and safely stowing carry-ons, but controversy continues about the standardization and enforcement of such programs.***

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*FSF Editorial Staff*

The U.S. Federal Aviation Administration (FAA) has released the draft of a revision to its 10-year-old advisory circular (AC) about air carrier-designed, FAA-approved carry-on baggage programs. The proposed update was issued in the midst of a widely publicized controversy among airlines, flight attendant organizations and the public concerning problems caused by changes in the amount and types of baggage that passengers are bringing aboard airliners.

AC 121-29A, *Carry-on Baggage*, would replace AC 121-29, dated Nov. 2, 1987. "FAA personnel, certificated air carriers, airline personnel and the public have asked the FAA to clarify existing policy ... ," the draft AC said. "The FAA agrees that additional policy guidance is needed because of changes in the airline industry, such as reduction in personnel in the gate area. In fact, the reductions of personnel at the gate area may be the basis for withdrawing approval from a previously approved program."

The draft AC, like its predecessor, offers guidance to airlines for establishing and enforcing a carry-on baggage program that is required by the U.S. Federal Aviation Regulations (FARs). FARs Part 121.589 ("The Current U.S. Federal Aviation Regulation Addressing Carry-on Baggage," page 2) says, "No certificate holder [FAA-approved airline] may allow the boarding of carry-on baggage on an airplane unless each passenger's baggage has been scanned to control the size and amount carried on board in accordance with an approved carry-on baggage program in its operations specifications. In addition, no passenger may board an airplane if his/her carry-on baggage exceeds the baggage allowance prescribed in the carry-on baggage program in the certificate holder's operations specifications."

The draft AC includes a number of new provisions:

- "Definition of carry-on baggage. The operator's program should include a definition of carry-on baggage, which provides information about the types of items that are considered carry-on baggage. For example, carry-on baggage can include, but is not limited to: appropriate suitcases, food and beverages brought on the airplane by passengers, 'presents' or items in shopping bags, or duty-free items."
- "Definition of properly stowed. ... For example, an acceptable definition could be that carry-on baggage that is underneath a seat should be stowed in such a manner

## The Current U.S. Federal Aviation Regulation (FAR) Addressing Carry-on Baggage

**§121.589 Carry-on baggage.**

(a) No certificate holder may allow the boarding of carry-on baggage on an airplane unless each passenger's baggage has been scanned to control the size and amount carried on board in accordance with an approved carry-on baggage program in its operations specifications. In addition, no passenger may board an airplane if his/her carry-on baggage exceeds the baggage allowance prescribed in the carry-on baggage program in the certificate holder's operations specifications.

(b) No certificate holder may allow all passenger entry doors of an airplane to be closed in preparation for taxi or pushback unless at least one required crew member has verified that each article of baggage is stowed in accordance with this section and §121.285(c) and (d).*

(c) No certificate holder may allow an airplane to take off or land unless each article of baggage is stowed:

(1) In a suitable closet or baggage or cargo stowage compartment placarded for its maximum weight and providing proper restraint for all baggage or cargo stowed within, and in a manner that does not hinder the possible use of any emergency equipment; or

(2) As provided in §121.285(c) and (d); or

(3) Under a passenger seat.

(d) Baggage, other than articles of loose clothing, may not be placed in an overhead rack unless that rack is equipped with approved restraining devices or doors.

(e) Each passenger must comply with instructions given by crew members regarding compliance with paragraphs (a), (b), (c), (d) and (g) of this section.

(f) Each passenger seat under which baggage is allowed to be stowed shall be fitted with a means to prevent articles of baggage stowed under it from sliding forward. In addition, each aisle seat shall be fitted with a means to prevent articles of baggage stowed under it from sliding sideward into the aisle under crash impacts severe enough to induce the ultimate inertia forces specified in the emergency landing condition regulations under which the airplane was type certificated.

(g) In addition to the methods of stowage in paragraph (c) of this section, flexible travel canes carried by blind individuals may be stowed —

(1) Under any series of connected passenger seats in the same row, if the cane does not protrude into an aisle and if the cane is flat on the floor; or

(2) Between a nonemergency exit window seat and the fuselage, if the cane is flat on the floor; or

(3) Beneath any two nonemergency exit window seats, if the cane is flat on the floor; or

(4) In accordance with any other method approved by the Administrator.♦

*§121.285(c) and (d) refer to restraints on cargo carried aft of a bulkhead or divider, or in a non-transport-category airplane type, respectively.

that if a line were drawn from the back of the seat pan to the floor it would not intersect the article. In addition, that carry-on baggage placed in the overhead bin must be stowed in such a way that it will not fall out when the overhead bin or any other restraining device is opened. This means that carry-on baggage cannot be stacked, with the exception that lighter items such as coats, hats, pillows, etc., may be stowed on top of heavier items such as suitcases."

- "Personnel responsible for the scanning. The duties of personnel who are responsible for scanning should be clearly defined and manageable. For example, the operator should not assign a person 'scanning responsibilities' for more than one gate at one time. In addition, those persons responsible for scanning should be easily identified."

- "[A carry-on baggage program should include] procedures to prevent boarding of carry-on baggage that will exceed the placarded weight, size or shape limitations of the approved stowage areas, cargo bins and 'tie-down' areas."

- "[A carry-on baggage program should include] procedures to prevent the boarding of carry-on baggage that will exceed the total space of the stowage areas available on an aircraft for a particular flight. The space of the overhead bins is exceeded if baggage falls out when the bins are opened or the secondary restraint is removed. Operators that have experience with or wish to prevent carry-on bags from falling out of overhead bins should adjust their carry-on baggage programs.

  "These procedures might include revisions to the number and size of carry-on bags or the method of stowing them in the overhead bins (i.e., no stacking). Some airlines might want to restrict passengers to one bag per passenger with an additional small item such as a purse or briefcase. If a child is a passenger, the operator's program should anticipate that each child will probably bring on the same amount of carry-on baggage as any

other passenger plus a child-restraint system, if applicable.

"It is advisable to use a 'sizer' as a guideline. The 'sizer' can provide useful information to the passengers about the probability of their bags and additional items fitting into the available space."

- " ... The operator is responsible for ensuring that carry-on baggage that is carried to the airplane (by the passenger or others) but is then placed in an approved cargo compartment other than one located in the cabin, is assigned the proper weight in accordance with its approved weight-and-balance program."

[The proposed AC was published in the *Federal Register*, Dec. 2, 1997, p. 63742. Comments are invited on all aspects of the proposed AC, and should be addressed to the FAA, AFS-203, 800 Independence Avenue SW, Washington, DC 20591. Comments must be received on or before March 2, 1998.]

From the beginning of commercial aviation through the era of early-generation jet transports, carry-on baggage was rarely an issue because there was no place for anything larger than a passenger's coat, hat and "flight" bag in the cabin. Overhead storage space usually consisted of open shelves, similar to those found in trains and buses, that were clearly unsuitable for heavy, bulky objects.

But airlines began to outfit cabins with larger, enclosed carry-on baggage compartments as a convenience. Especially after the Airline Deregulation Act of 1978, airlines allowed increasing amounts of baggage to be brought into the passenger cabin in lieu of being checked to be placed in the cargo compartment.[1]

Safety specialists began to express concern about the possible consequences of carrying bulky and high-mass objects in the same general area as passengers.

In September 1981, the U.S. National Transportation Safety Board (NTSB) issued a study of 77 survivable or partially survivable aircraft accidents and incidents.[2] The study found that 78 percent of those accidents and incidents involved failure of cabin overhead furnishings. The report said, "The basic designs or failures of overhead racks or bins allowed items stored there to become missiles during the crash sequence; these items inflict injuries, in some cases incapacitating ones....

"If cabin furnishings fail in a crash, the furnishings or items released from them can become missiles in the cabin. They can cause injury directly by striking occupants, or they can block egress paths. They can also strike seats, imposing even greater loads on them and thereby induce failures in the occupant-restraint systems."

Except that overhead racks have largely been replaced by bins, the NTSB's language in 1981 was similar to warnings that are being issued today, more than 15 years later.

At the Flight Safety Foundation (FSF) 39th annual International Air Safety Seminar in 1986, Capt. Roger Brooks said, "We must realize that the development of large-capacity overhead bins has, in effect, created a new cargo compartment. A cargo compartment located in the worst possible place, directly over the heads of the passengers. Literally tons of mass are suspended in this potentially deadly position with required bin strength, as defined in the [FARs] Part 25 and the Joint Airworthiness Requirements [JARs] for Large Aeroplanes–25, sufficient to protect each occupant in only a 'minor crash landing.'"[3]

[FARs Part 25.561 and JARs Part 25.561 specify that an airplane's supporting structure, which includes overhead bins, must be designed to withstand forces in a "minor crash landing" of 3 Gs upward, 9 Gs forward, 3 Gs sideward, 6 Gs downward and 1.5 Gs rearward.]

Capt. L. Homer Mouden, then FSF vice president, technical affairs, wrote in the July–August 1987 *Cabin Crew Safety*: "Providing adequate restraint to ensure that the passengers remain in their seats with the minimum risk of injury from their own deceleration forces [in an accident] will not prevent injury if they are not also protected from dislodged items in the overhead bins and from improperly stowed floor-level items. The size of the overhead bins has increased with each new generation of airplanes until, by now, these bins in the wide bodies have become storage compartments for thousands of kilograms of articles. ... Even without being involved in a crash or a hard landing, passenger abuse of the overhead bins for storage has resulted in many passenger injuries. Bins are overloaded by being jammed full of things that should have been checked. Latches have been overstressed and come open, [and] passengers [have been] injured by falling cases and heavy objects."[4]

On July 25, 1990, the Canadian Transportation Accident Investigation and Safety Board (CTAISB) said, "Security personnel report that when they attempt to intercept oversized or excess baggage, they frequently encounter opposition from passengers and from management. If a traveler complains to an airline supervisor, these bags are often allowed through the security check point. Probably as a result of this lack of managerial support, [individuals] have witnessed security personnel regularly lifting oversized bags over or around the steel frames which are used to outline the average underseat storage area.

"Security company management in one case even advised an employee that his consistent refusal to allow oversized items through could adversely affect the employee's job security. The pressure exerted on employees by management may be understandable in the light of another report received by CASRP [Confidential Aviation Safety Reporting Program]

which alleged that the security companies have been advised by the air carriers who hired them that continual rejection of passengers' baggage could jeopardize contract renewals. ...

"Reporters [to CASRP] feel that since one cannot always anticipate stowage problems, there should be a means to off-load baggage as soon as an excess becomes evident. [Flight attendants] have noted instances where they had identified excesses in cabin baggage when the doors were still open. The excess baggage was collected, but baggage handlers were not available for off-loading it. In another report, [a flight attendant] advised the captain about excess baggage, but the baggage was not off-loaded because the captain was concerned about delaying the flight, thereby degrading their 'on-time performance' record.

"According to a number of [flight attendants], the lack of efficient off-loading systems and the 'on-time performance' requirements, in combination with apparent system breakdowns, have resulted in numerous instances where aircraft doors are closed and the aircraft have started to taxi while the [flight attendants] were still struggling to secure carry-on baggage that far exceeded the aircraft cabin's approved stowage space. The extra time required to deal with excess baggage problems has often left flight attendants with little time to complete other mandatory safety checks prior to takeoff, which they feel aggravates the safety problem even further."[5]

In August 1984, the Association of Flight Attendants (AFA) requested that the FAA set specific limits on carry-on baggage. The FAA held hearings on the AFA proposal in July 1985 and formally proposed a new carry-on baggage rule in May 1986. Following further hearings, at one of which the AFA presented 1,172 examples of carry-on baggage problems in a one-month period that were reported by member flight attendants, the FAA issued, in November 1987, AC 121-29.

The AC said, "Prevention of the boarding of unauthorized carry-on baggage should be an integral part of an air carrier's approved carry-on baggage program. The program should clearly describe the procedure and personnel the carrier will use to prevent the boarding of baggage which, for any reason, cannot properly be stowed. The program should also describe the facilities and location of the scanning point or points." The AC said that the program should address:

- "Area of operation, including terminal and scanning point facilities ... ;
- "Scanning point facilities and locations ... ;
- "Personnel who will actually do the scanning and personnel responsible for the scanning;
- "Description of the use of anticipated passenger load factor information in order to prevent the boarding of carry-on baggage which cannot be properly stowed;
- "Information regarding the prevention of the boarding of carry-on baggage which will exceed the weight, size or shape limitations of the approved stowage areas, cargo bins and 'tie-down' areas;
- "Information regarding the prevention of the boarding of carry-on baggage which will exceed the total volume of the stowage areas available on an aircraft to be used on a particular flight; [and,]
- "Information provided to passengers at scanning points or in other material such as ticket envelopes which includes the approved carry-on baggage size, stowage procedures and the responsibility of each passenger to comply with that air carrier's approved carry-on baggage restrictions and procedures, including following crew members' instructions."

The AC also said that an airline's carry-on baggage program should include "procedures which will assign a required crew member the responsibility for verifying that each article of baggage is properly stowed before all the passenger entry doors are closed. The air carrier's approved program should give this assignment to a specific crew member position. For example, an air carrier could assign this responsibility to the 'lead' flight attendant or to the pilot-in-command. It would not be advisable for an air carrier to have a procedure where any unspecified flight attendant or flight crew member could verify that each bag was properly stowed."

Those provisions, with occasional minor changes in wording, were carried forward into the draft AC on which revisions will be based.

The September–October 1987 *Cabin Crew Safety* said, "The new [1987] regulation could lead to some confusion, compounded by the fact that a passenger may connect with several carriers during the course of a single day or trip and find a wide variance with respect to 'approved' carry-on baggage. As a consequence, flight attendants may be faced, once again, with finding a suitable response to the passenger retort that 'the other airline let me bring it on.'" That apprehension turned out to be correct, with the same issue being raised by flight attendants 10 years later.

Nevertheless, the article concluded on an optimistic note: "Despite the potential differences in carry-on policies developed by the individual airlines, safety professionals and crew members alike hope that the ruling will send a strong message to air travelers that they can no longer carry just about anything they want on board a commercial transport aircraft."[6]

That message was not received, or was ignored, by many passengers in the ensuing decade, according to speakers at "Carry-On Bags: An Everyday Risk," a conference sponsored by the AFA in Washington, D.C., U.S., Nov. 13, 1997.

Margaret Gilligan, FAA deputy associate administrator for regulation and certification, said, "Somehow it appears that all that good work of a decade ago [the original rule about carry-on baggage programs] has gotten lost in the crush of higher-than-ever load factors. We've all heard the anecdotes — and will likely hear more. Most of us have probably experienced it. ... I've been behind the traveler with the rolling suitcase, the laptop computer, the 'purse' in which you could carry a full set of the *Encyclopedia Britannica* — after all, a reasonable amount of reading material is permissible — and the gifts for the kids, which were purchased at the new airport shopping center.

"I've been under the overhead compartment that can barely be jammed shut — and which pops [open] on landing, causing the poor guy in the aisle seat to reach up just in time to catch the basketball that the 19-year-old in the row behind us was sure he had wedged in nice and tight. We're carrying more stuff, and different stuff. Stuff — like the computer — we plan to use during the flight. Stuff — like the ball — that isn't easily checked in the cargo compartment."[7]

Patricia A. Friend, AFA international president, said, "The guidelines we are using today were established more than a decade ago when the industry and the typical passenger were very different. Current programs to control weight, size, number and contents of carry-on bags are inconsistent and inadequate, confusing and out of date. Passengers must navigate a maze of confusing carry-on baggage programs that differ on each airline and even on each flight. Carriers may even view the enforcement — or lack of enforcement — as a competitive issue. ...

"Any new rule must not repeat the mistakes of failed policies which did not take into account human behavior: In a competitive environment, during a period of robust growth, shrinking seat pitch [the distance between one seat and the corresponding location on a seat in the row forward or aft] and under-seat storage space, and increasing load factors, passengers have learned airlines will *try* to accommodate more carry-on bags, not require them to do with less."[8]

Shane Enright, a senior staff member with the London, England–based International Transport Workers' Federation (ITF)–Civil Aviation Section, said, "If one airline announces unlimited carry-on baggage on its aircraft, then other carriers feel pressure to follow suit or lose customers. If one carrier increases its business-class baggage allowance, others are soon to follow in the chase for premium-paying passengers. And this is an international problem. Increasingly, individual airlines within the newly emerging global [code-sharing] alliances are under pressure to offer uniform standards of service to passengers across all the alliance members. ... And always, in this madcap spiral, there is pressure for more bags, for heavier bags, for larger bags to be allowed onboard."[9]

The CTAISB said in 1990, "Increasingly, tourists are traveling with abundant items purchased abroad, including unpacked duty-free items; this is most noticeable on charter flights, where the seating density is highest. Aircraft manufacturers have responded to these changes in market demands by providing significantly more spacious overhead bins for carry-on baggage. In turn, marketers have promoted the use of this increased capability, and this encourages even more carry-on baggage. A vicious circle has been created. The problem is exacerbated by the wide variety of aircraft currently in service; many of the older and smaller aircraft are not capable of accommodating the amount of carry-on baggage possible in the new widebodied jets."[5]

There is a general agreement on the reasons why many passengers bring baggage into the passenger cabin:

- "Separation anxiety," with passengers fearing that baggage, if checked, will be misplaced, especially when it must be transferred to connecting flights. Although the public perhaps exaggerates the likelihood of such an event — an average of 4.34 passengers per 1,000 passengers in the U.S. domestic system reported mishandled baggage in one recent month, including reports that did not result in claims for compensation[10] — no one wants to be among the victims, even if they are a small minority;
- A desire to save time by not having to wait at the baggage carousel on arrival;
- The availability of wheel-fitted small suitcases, which require little effort to transport to the boarding gate; and,
- The duty-free and gift items purchased at airports, many of which are turning to on-site retail licensing as a way of increasing profits.

The items that are now most commonly brought into passenger cabins, and that have caused injuries, are briefcases, laptop computers, luggage carts with attached wheels and garment bags. But injuries have been caused by a remarkable variety of on-board objects — camcorders, tennis rackets, framed artwork, beverage coolers, wine and liquor bottles, pineapples, bird cages, vacuum cleaners, sets of china, potted plants, skateboards, fax machines and bowling balls. Occupants of aisle seats, in the path of objects that fall from overhead bins, receive the highest percentage of injuries (Figure 1, page 6). About 15 percent of all injuries from carry-on baggage are suffered by flight attendants.[11]

The process by which many injuries take place was described in a paper by Michael J. Polay and William D. Waldock of Embry-Riddle Aeronautical University, presented by Polay at the AFA conference. "As a cabin fills up with passengers, the bins usually are full before everyone is aboard. Passengers begin to fill up space in the overheads well in front of where they are seated. As the bins reach capacity, the last folks aboard (and a flight attendant or two) frantically search for places to

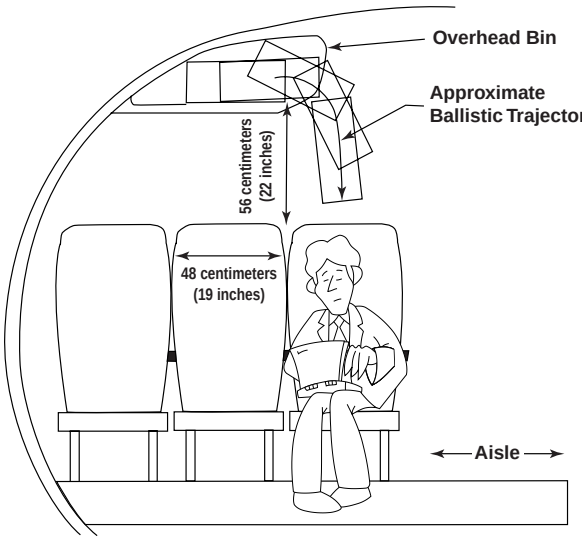


**Figure 1**

cram everything they brought with them. Items already stowed are moved around and compressed. Then the bins doors are forced shut and the flight is finally ready to go.

"Sometimes, while in flight, a passenger decides to retrieve something in the overhead and opens the door. The items inside may be [force]-loaded against the door and out they come onto the unwary person in the seat below with the potential to cause injury. At the arrival gate, the process is amplified as many folks are trying to open the bins all at once. Items that have shifted may be leaning against the door, waiting to slide out.

"Sometimes, the bin design itself seems tailor-made to drop stuff out. In some widebody aircraft, the 'clamshell' bins actually drop down, changing the bin-floor angle as much as 15 [degrees]–20 degrees downward. Any object inside will come out if the person who opened the bin is not ready to catch it."[1]

According to research by *Air Safety Week*, the largest percentage of injuries caused by objects falling from overhead bins occurred during cruise, rather than during the boarding and disembarking process (Figure 2).[11]

Statistics about injuries from luggage in the cabin are difficult to obtain, because passengers often do not immediately recognize the extent of their injuries until they have left the airplane and the airport, and because airlines are not required to report claims. One estimate is that about 1,200 people were injured by "overhead bin displacement" in 1996.[11] Other estimates say that about 4,500 travelers annually are injured on U.S. airlines by falling baggage.[12, 13]

Randolph W. Evans, M.D., described at the AFA conference three examples of head injuries caused by objects falling out of overhead baggage compartments (see "Three Casualties Caused by Falling Baggage," page 7). Many such injuries are categorized as mild head injury, but "mild" is a relative term. Dr. Evans said that the consequences of mild head injury can include headaches, dizziness, tinnitus (ringing in the ears), hearing loss, blurred vision, light and noise sensitivity, diminished senses of taste and smell, irritability, anxiety, depression, personality change, fatigue, sleep disturbance, decreased libido, decreased appetite, memory dysfunction, impaired concentration and attention, slowing of reaction time and slowing of information processing.

At the AFA conference, Lea H. Ray, a passenger, described her experience as she and her companion were preparing to disembark from an airliner cabin following a flight from New Orleans, Louisiana, U.S., to Atlanta, Georgia, U.S., in August 1996:

"As I moved toward the aisle, a passenger from the seat in front of me opened the overhead. A laptop computer fell directly on top of my head and I went to my knees. I was not knocked out completely, but was put into a semiconscious state. Four or five passengers helped me to my feet and I thought I would be okay. Therefore, I didn't make a report to the flight attendant. After getting off the plane, we went straight to baggage claim and with every step my head hurt more and my back began to throb down my spine. As we got on the shuttle to the carport, I realized I was hurt and would have to get

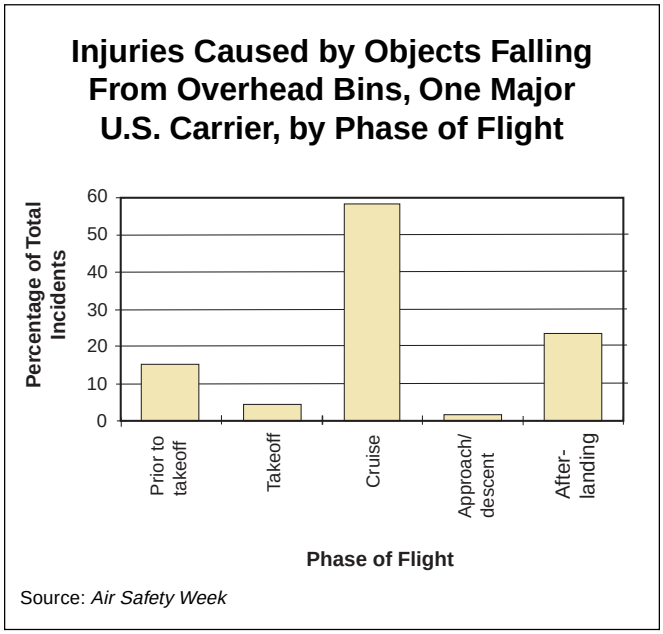


**Figure 2**

## Three Casualties Caused by Falling Baggage

Randolph W. Evans, M.D., a Houston, Texas, U.S., neurologist, described three head injuries caused by objects falling from overhead baggage compartments:

- A 38-year-old woman was sitting in an aisle seat after the airplane had landed and was at the gate. Another passenger, removing a case of wine from an overhead compartment, lost her grip on the case, which struck the patient over the left posterior side of the head. A magnetic resonance imaging (MRI) scan of the patient's brain showed no abnormality, but after eight months, the patient is still having post-traumatic headaches.

- A 67-year-old woman was seated in an aisle seat, reading, while the plane was in flight. A flight attendant opened the overhead compartment to retrieve a pillow when an attaché case fell, striking the passenger on top of her head. She had an occipital [on the posterior part of the skull] scalp laceration that bled profusely. The pilot was considering an emergency landing, but a fellow passenger was able to control the bleeding with compression. An MRI scan of the brain showed no abnormality, but the patient has had post-traumatic headaches for a few weeks.

- A 44-year-old woman was sitting in an aisle seat during flight. When another passenger opened the overhead compartment, a laptop computer and books fell out, striking the patient on top of the head. She was dazed. An MRI scan of the brain showed no abnormality, but more than one-and-a-half years later, she complains of daily neck pain and weekly post-traumatic headaches.♦

some help. I made an appointment with my chiropractor ... and saw him that day. My spine had been compressed from the accident."

The possibility of injury caused by carry-on baggage is not limited to objects falling out of bins and striking passengers or flight attendants. Safety authorities have expressed concern about the role of spilled carry-on baggage in emergencies requiring aircraft evacuation.

"Airline crews and passengers continue to observe in-flight situations where cabin baggage would create a severe impediment to efficient evacuation in the event of a crash and/or fire — an impediment which could cheat a potential survivor of the extra seconds needed to reach safety," said the CTAISB.[5]

The 1981 NTSB study of 77 accidents said, "Emergency evacuation was also hampered when items stored in overhead compartments were released. Even items such as blankets, pillows and coats, which are unlikely to cause injury when they become loose, were thrown into the aisles and against bulkheads adjacent to the exits, creating barriers to exits. Failed overhead racks or bins also blocked movement in the cabin by cutting off access to and from aisles and overwing exits."[2]

"Debris was a significant obstruction to the evacuation process in four of the occurrences reviewed," said a 1995 Transportation Safety Board of Canada (TSB) study of 21 evacuations of large passenger aircraft. "As a result of debris, escape paths and access to exits were blocked, passenger movement was hindered and the evacuation process was prolonged."[14] Although the debris probably included objects other than baggage from overhead bins, two descriptions of the evacuations included in the study specifically mentioned spilled contents of overhead bins or carry-on baggage.

Baggage ejected from overhead bins became a factor in a number of accidents, and either hindered the evacuation or could have hindered an evacuation had there been one, as documented in official studies or accident reports:

- On June 23, 1976, an Allegheny Airlines Douglas DC-9 struck terrain while attempting a go-around at Philadelphia (Pennsylvania, U.S.) International Airport, sliding about 610 meters (2,000 feet) before stopping after the tail section separated from the fuselage. Thirty-six of the 107 occupants were seriously injured. The NTSB said, " ... Overhead storage racks spilled their contents into the aisles. Some passengers encountered baggage and garments in the aisle during evacuation, and some stopped to retrieve possessions before leaving the aircraft."[2]

- A United Airlines Boeing 737 en route from Washington (D.C., U.S.) National Airport to Chicago (Illinois, U.S.) Midway Airport struck terrain while attempting to execute a localizer-only approach to the runway at Midway Airport on Dec. 8, 1972. Of the 61 persons aboard, 43 were killed, with 27 of the fatalities from fire-related causes. The NTSB said, "Survivors reported that debris cluttered the aisle and exit routes, making movement within the cabin [during the evacuation] difficult. Included in the debris were overhead bins, ceiling panels, luggage, seats from the left side of the coach cabin, and liquor compartment and oven units from the aft galley."[2]

- On Dec. 27, 1991, a Scandinavian Airlines System McDonnell Douglas MD-80 experienced the failure of both engines at an altitude of 610 meters while climbing after takeoff from Arlanda International Airport, Stockholm, Sweden. During an emergency landing, the aircraft broke into three sections, resulting in eight serious injuries and 39 minor injuries to the 129 occupants. The NTSB, which was a party to the accident investigation, reported: "About 70 percent of the

[overhead] bin doors had damaged lock plates (striker plates) or plates that were missing from their attachment points on the bin doors. Passengers stated that the carry-on luggage in the overhead bins was thrown throughout the cabin during the impact sequence."[15]

- A Tower Air Boeing 747-136 departed the runway during a rejected takeoff at John F. Kennedy International Airport, New York, New York, U.S. on Dec. 20, 1995. One cabin crew member was seriously injured and 24 passengers received minor injuries in the accident. The NTSB said in its accident investigation report, "The R4 flight attendant [on the aircraft's right side near the fourth exit aft] ... recalled that while the airplane was still moving, many overhead bins opened and spilled their contents. The larger side bins in the cabin nearby also opened and spilled even more debris. …

  "The L4 flight attendant [on the aircraft's left side near the fourth exit aft] stated that when the aircraft stopped abruptly, the overhead bins in Zone E opened, and luggage spilled 'all over the place.' … The UD [upper-deck] flight attendant reported that the doors to several bins opened during the accident sequence. She recalled that various items of personal equipment she had stowed came out of the bins."[16]

- On June 26, 1978, an Air Canada DC-9-32 overran the runway following a rejected takeoff at Toronto (Canada) International Airport, coming to rest in a ravine past the overrun area. There were two fatalities and 47 serious injuries among the 107 occupants. The TSB said, "Debris severely restricted egress, hindered passenger movement and prolonged the evacuation process. Three of seven exits, two of which were primary door exits, were completely blocked by debris. Overhead bins collapsed on top of people, injuring and trapping many of them. The spilled contents in the aisle obstructed passenger flow and blocked the right forward overwing exit."[14]

Under FARs Part 25.561, overhead bins in older aircraft are certified to withstand downward forces of 4.5 Gs, and in newer aircraft are certified to withstand downward forces of 6 Gs — provided that the bin contains no more than its specified, placarded weight. Polay and Waldock suggested in their AFA conference presentation that the theoretical tolerances are being reduced by overweight carry-on baggage.

"While it is true that a bin will often fill up before it reaches [the specified] maximum weight, many people in the industry suspect that individual baggage weights have been increasing," said Polay and Waldock. "… If, for example, a bin is certified at [45 kilograms (100 pounds)] maximum weight, it is supposed to withstand at least [272 kilograms (600 pounds)] of downward force in a 6-G vertical impact. What happens if the baggage in that bin actually weighs [91 kilograms (200 pounds)]? The bin will fail well below its certified design tolerance; it will fail at negative 3 Gs. When is the last time you saw any airline personnel weighing carry-on baggage? How do we really know how much weight is in the bins on any given aircraft?"[1]

Nor is blocking aisles or exits the only hazard that can be created by carry-on baggage in an emergency. As in the Allegheny Airlines DC-9 accident, passengers often try to take carry-on baggage when evacuating an aircraft, thereby losing time that is usually at a premium in an evacuation. The TSB study of 21 evacuations said, "There were nine occurrences in which passengers stopped to retrieve carry-on baggage and attempted to take it with them as they exited the aircraft. This was despite having been specifically told not to [retrieve their carry-on baggage] by the cabin attendants."[14]

For example, a Nationair B-747 experienced compressor stalls and tailpipe fires on three engines during the rollout after landing at Gatwick Airport, London, England, on Aug. 7, 1990. The aircraft was stopped and an emergency evacuation was ordered. There were no injuries among the 17 crew members and 439 passengers. The TSB report said, "Despite being advised to leave everything behind, many passengers insisted on retrieving their carry-on luggage. When confronted at the exits by the cabin attendants, some passengers tried to return to their seats to stow their baggage in the overhead bins."[14]

Less than a week before the AFA conference, the landing gear of a US Airways flight collapsed at Charlotte (North Carolina, U.S.)/Douglas International Airport. An evacuation was ordered. It was reported that "almost half the passengers reacted by grabbing for their carry-on luggage. According to safety investigators and some of those aboard the aircraft, flight attendants were hard pressed to usher everyone off without injury. One man grabbed two bags. Another struggled with a large bag. A woman blocked the aisle struggling to get a garment bag out of an overhead bin, arguing with a flight attendant who prodded her toward an exit."[17]

Because carry-on baggage is rarely if ever weighed, it adds an element of uncertainty to pilots' weight-and-balance calculations. Anecdotal evidence suggests that the total weight of carry-on baggage per flight has increased in recent years. Ronda Ruderman, a flight attendant and chair of the Aircraft Technical Committee, AFA, said at the AFA conference, "The [air] carriers ... display widely varying estimates of just how much weight is being brought on board in carry-ons. One carrier, for example, has declared that the average carry-on bag brought onboard its aircraft is [3.2 kilograms (seven pounds)] fully loaded. However, we have identified several empty carry-on bags that fit within the limits of that carrier's program that all weigh more than seven pounds when empty, including one bag that weighed [5.4 kilograms (12 pounds)] empty."

Bob Frantz, a Boeing 777 first officer and member of the Air Line Pilots Association, International (ALPA) Accident

Survival Committee, said at the AFA conference, "The weight question about carry-on baggage makes weight-and-balance calculations difficult, and that makes go/no-go decisions riskier."

The duty-free liquor purchased at airports and carried in the cabins of international flights represents a potential danger beyond its weight and mass. Alcohol becomes, as Capt. Mouden wrote, "a fast-burning fuel in the event of fire."[4] If half of 400 passengers in a B-747 bring into the cabin the liter of alcoholic beverages that each is permitted to import duty-free by the U.S. Customs Department, that represents 200 liters, or 53 U.S. gallons, of "fast-burning fuel" distributed throughout the cabin in close proximity to passengers.

Carry-on baggage could have security implications, too. At the AFA conference, Billie H. Vincent, president and CEO of Aerospace Services International and former director of the FAA Office of Civil Aviation Security, said, "From a security-screening standpoint, reducing the number and size of carry-on articles could result in a substantial improvement in the effectiveness and efficiency of the passenger screening process. As an example, restricting carry-on articles to one item per passenger would reduce the number of articles that would have to be screened by approximately one-half."[18]

Capt. Robert J. Cox, a U.S. Airways pilot and an associate member of the ALPA National Security Committee, has conducted a thorough study of the conditions under which airport screeners work. He noted that "the average screener will scan close to 300,000 bags and 100,000 passengers in a year ... ," and that "at a Category X airport [such as John F. Kennedy International, New York, New York, U.S., or Los Angeles (California, U.S.) International], where some screening points run continuously and at the industry standard of moving a bag through an X-ray machine every five seconds (it's more like three), the screeners on a shift will screen 720 bags per hour, 17,280 bags in a 24-hour period, or 6.2 million bags per year."[19]

Significantly reducing the number of carry-on bags that must be screened could — provided the security management did not just reduce the number of screeners — allow more careful scrutiny of baggage and relieve the productivity pressure on screeners. That pressure, combined with low pay and status and the tedium of the job, results in a national annual turnover rate of more than 500 percent for screeners. The corollary of such high turnover, Capt. Cox said, is that "screening points are understaffed, which leaves us with fewer experienced personnel on the screening point than we should have; ... the time of the experienced screeners or supervisors is spent instructing and watching over trainees instead of using their valuable experience controlling or supervising the screening point; and trainees and inexperienced screeners slow things down ... ."

No one at the AFA conference dissented from the view that the types, sizes and weight of carry-on baggage have become excessive, but there was some divergence of opinion about the cure.

Gilligan expressed the FAA's view: "In our opinion, this is not a regulatory issue — the rules are clear. All carry-on baggage must be safely stowed. ... We do see this as a behavior issue. We need to teach today's travelers what the rule is, and what behavior we expect. ...

"We agree with AFA there needs to be a clear, consistent policy. We need to clearly define what fits — and what doesn't. Maybe we need to count as carry-on baggage most of those personal items — like a woman's purse — that we didn't use to count.

" ... Maybe we need to be religious in our use of a sizer to limit what comes in. A passenger could carry on several things — as long as they all fit in the sizer. ... And airlines need to support the crew members who are responsible for implementing the approved carry-on baggage programs. And then the crew must play its part. The programs place the ultimate responsibility on the crew to ensure that everything brought on board is safely stowed. You need to make sure that happens."

But flight attendants argue that placing "ultimate responsibility" onto the cabin crew is part of the problem, shifting the task of enforcing carry-on baggage policies to those who are in the worst position to do so.

"Flight attendants are expected to enforce the FARs, but the company may get complaints from irate passengers if flight attendants make them check one or more of their carry-on bags," said AFA's Ronda Ruderman. "These complaint letters can be placed in the flight attendant's employee file and lead to disciplinary action. Because of the carriers' concern about pleasing passengers, they often do not back up flight attendants who are trying to enforce the airlines' own carry-on baggage programs, even though this is a regulatory requirement. This is a disincentive for the flight attendant to enforce the rules and demonstrates the carriers' lack of respect for the rule."

The FAA tries to warn passengers of danger from baggage in overhead compartments. For example, it has published a pamphlet with the message: "Caution: 'Terror' May Lurk in the Overhead Bin." The text reads, in part:

"In the interest of time, you stowed your new 'carry-on' in the overhead compartment. The thought against stowing it with so much junk in that small compartment came to mind before departure. But now, it's too late to check it. Besides, airlines have carry-on restrictions based on airplane size, and available storage. Even though you had to jam it in, yours fit.

"The bumpy flight has made you wonder what your priceless, new bag is going through. That thought is still in progress on the ground, after landing, when a fellow passenger opens the bin allowing your brown leather [bag] to fly over the middle row for an unsuspecting passenger's head. Ouchhhh!!!

"The poor fellow, disoriented, negotiates his way between your apologies and your monster still resting on his lap. He must have been impressed with the quality of the bag because he studied it a lot. He even took copious notes and measured it several times. He seemed extremely polite until he handed you his card. An attorney???!!!"[20]

Safety authorities have tended to legislate the desired result — carry-on baggage safely stowed — while leaving the exact means of achieving that result to the airlines, and offering guidance about how to meet the goal.

The ICAO International Standards and Recommended Practices says, "The operator shall ensure that all baggage carried onto an airplane and taken into the passenger cabin is adequately and securely stowed."[21] In October 1992, the ICAO Air Navigation Commission issued a letter to member states advising them about implementing the standard. It said, in part:

"It is recognized that the extent of the problem ... can be related to the size of the airplane and that the question of interlining and changing from one type of airplane to another during a journey is [a] problem. This does not, however, detract from the fact that cabin safety must be preserved and the carry-on baggage adequately and securely stowed. This is the responsibility of the operator under the overall supervision of the state civil aviation authority. The program to control carry-on baggage, instituted by the operator, should ensure that in cases of doubt the baggage in question is checked and carried in the baggage hold.

"The principles to be applied should be at least the following:

- "Only loose clothing may be placed in an open overhead rack, unless that rack is equipped with doors or suitable restraining devices;

- "Overhead racks should not be loaded to an extent greater than the permitted loading;

- "Individual heavy items of baggage, particularly those appropriate for stowage beneath the seats, should not be stowed in overhead racks;

- "Each passenger seat, under which baggage is intended to be stowed, should be fitted with means to prevent baggage from sliding forward and, if an aisle seat, with means to prevent baggage sliding sideward into the aisle;

- "Each passenger seat in which baggage may be stowed, where this practice is permitted, should be fitted with a suitable restraining harness appropriate to the baggage to be restrained;

- "Facilities should be provided, where traffic dictates, for the stowage of overnight or garment bags in a suitable closet or compartment approved for that purpose and providing proper restraint;

- "Training should be provided to ground personnel involved and to cabin attendants to cover the subject of carry-on baggage and the procedures to be used and action to be taken when excess carry-on baggage is apparent at the point of check-in or is carried onto the aircraft; and,

- "Passengers should be made aware of the necessary restrictions to carry-on baggage and the reasons for the restrictions."[22]

Various parties to the debate about carry-on luggage have called for an end to the system in which each airline determines how, when or — it is charged — whether to enforce restrictions.

AFA President Patricia Friend said, "AFA believes the solution is a simple two-part program: One, industrywide, all items must fit within a sizer box of uniform dimensions, basing the carry-in limits on volume per passenger; and two, the carry-on baggage policy must be enforced well before passengers arrive at the gate for boarding.

"The FAA has the power to invoke this solution quickly. The FAA can level the playing field for all carriers by creating a uniform, enforceable rule which eliminates the ambiguities. The commercial aviation industry can change its way of doing business and it can affect passengers' behavior with decisive action. We did it with smoking on aircraft, we can do it with carry-ons!"[8]

ITF's Enright said, "It is clear that in a free market in which competing carriers are essentially selling the same product — a flight from A to B — service and branding issues will continue to be at the front line of a company's attempts to improve market share. In these circumstances, airlines simply cannot be left to their own devices to decide on their own carry-on baggage policies. As soon as one carrier breaks rank to make carry-on baggage concessions to its passengers, the pressure on the others to follow is immense. We need new regulations which limit the number, size and weight of carry-on baggage. Only by creating a level playing field for all air operators will we be able to put a brake on this growing risk."[9]

On Nov. 13, 1997, American Airlines, along with the Allied Pilots Association (APA), which represents the company's pilots, and the Association of Professional Flight Attendants (APFA), which represents the company's flight attendants, requested the FAA to issue and uniformly enforce rules that would place a two-bag carry-on baggage limit for all U.S. airlines. The request, made in a letter to FAA Administrator Jane Garvey, said, "American, APFA and APA do not believe that individual air carrier policies regarding carry-on baggage should be a factor in airline competition either domestically or internationally. We believe such policies

should be determined by the FAA pursuant to its rulemaking authority."

Polay and Waldock suggested that the best solution to the enforcement issue might be to have the airport or airport security staff accomplish the task.[1]

ICAO has drawn the attention of its member states to the need to limit the carriage of duty-free liquor in the passenger cabin. In the letter outlining the principles for carry-on baggage programs, ICAO said, "These bottles constitute a heavy and frangible hazard. The program to control carry-on baggage instituted by the operator should take into account the need to control and to provide proper stowage for these bottles if they are to be carried. A means to stow such items in bulk in a baggage hold for distribution at the destination would be one appropriate solution."[22]

Capt. Mouden wrote, "Millions of gallons of fuel would be saved through reduced actual gross weight, and the margins of safety and passenger protection would be increased, if the airlines and governments of the world could agree to accepting the delivery of duty-free goods, sold before departure or in flight, at the passengers' disembarkation terminal. The same economic benefits could accrue to the sellers as now; sales could be made from illustrated catalogues or a single display and the customer given a sales order; passengers would be spared going through customs with additional goods, and they could pick them up after they had cleared [customs]. Cooperative and innovative planning could eliminate the carrying of duty-free items as passenger luggage on airline flights."[4]

British Airways has fitted netted safety visors inside the overhead bin openings in its B-747s, Boeing 757s and B-737s. The safety visor provides a secondary restraint, and its see-through design offers a forewarning of baggage that has shifted and might be prone to falling. British Airways reported a "dramatic reduction" in injuries because of the visors. Outfitting the 30 152-centimeter (60-inch) bins on a B-757 costs about US$30,000 and adds about 45 kilograms (100 pounds) of installed weight.[12]

Some airlines are beginning to adopt more stringent carry-on rules for themselves. In November 1997, Northwest Airlines began limiting all domestic passengers other than its highest-level frequent-flier-plan members to one carry-on bag plus a laptop computer, purse or briefcase. In December 1997, United Airlines began a much-publicized test of a one-bag restriction for low-fare passengers embarking at Des Moines (Iowa, U.S.) International Airport. In addition, United was testing a new device that uses laser beams to determine whether carry-on bags fit within prescribed maximum dimensions (23 centimeters by 36 centimeters by 56 centimeters [nine inches by 14 inches by 22 inches]). Beginning in February 1998, Southwest Airlines will restrict passengers to a single carry-on bag on busy flights, and briefcases and laptop computers will be considered carry-ons. Cathay Pacific Airways allows economy-class passengers departing from Kai Tak Airport, Hong Kong, one bag.

The Kai Tak Airport authority recently began limiting passengers to one carry-on bag with maximum dimensions of 23 centimeters by 36 centimeters by 56 centimeters.

In December 1997, the trade group Luggage & Leather Goods Manufacturers of America (LLGMA) issued a statement supporting: development of a definition of a carry-on item; FAA regulations about the number of carry-on items that a passenger may bring on board; and "guidelines" that define the maximum size of luggage suitable for carry-on use, subject to an agreement that the guidelines will not be implemented until luggage manufacturers have had time to modify their production to conform to the guidelines.

"The [LLGMA] believes the adoption of FAA-imposed carry-on regulations is a necessary interim action," said the statement. "Such regulations, however, do not address the underlying cause of the carry-on baggage problem, which is the traveling public's perception that airline baggage-handling systems are inconvenient. LLGMA recommends [that] airlines actively and aggressively address [concerns about] luggage security, lost or damaged luggage, time required for baggage checking and the timeliness of luggage delivery to baggage claims areas."

Unless civil aviation authorities worldwide choose to adopt regulation uniform industrywide specifications for carry-on baggage, the individual airlines and their flight attendants will continue to bear the responsibility for various programs to enforce reasonable limits. The success of such programs will depend to a large extent on the attitude of the flying public. That attitude, in turn, can perhaps be best influenced by faster and more reliable baggage handling and better educational outreach by the airlines to explain the hazards and problems caused by abuse of carry-on baggage allowances. Even assuming that both of those conditions can be fulfilled, only time will tell whether they will be sufficient, or whether regulatory authorities will finally have to intervene.♦

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