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INJURIES IN AIR TRANSPORT EMERGENCY EVACUATIONS

Donell W. Pollard
Civil Aeromedical Institute
Federal Aviation Administration
Oklahoma City, Oklahoma

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16. Abstract

Twelve air transport evacuations are reviewed. Injuries are discussed with emphasis on configurational and procedural contributing factors. Recommendations and information about possible methods of reducing injuries are provided.

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INJURIES IN AIR TRANSPORT EMERGENCY EVACUATIONS

I. Introduction.

The aviation industry, the Federal Aviation Administration (FAA) Office of Aviation Medicine, and other interested people have expressed concern about the severity of injuries occurring in relatively minor evacuation accidents. To assess the significance of these injuries, it is necessary to develop a background based on descriptive statistics and actual accident histories. Evacuations are often investigated by FAA field personnel who may have limited training in human factors; therefore, the data are not always reported in a consistent manner. It is difficult to establish exit usage patterns and injury causation since the uninjured people involved in an evacuation are not always available for interview. These and other inconsistencies in the fact-collecting process make it impossible to accomplish a statistically valid analysis of this problem. However, an examination of typical evacuations with reported injuries can provide useful insight into the nature and severity of the problem.

According to the Air Line Pilots Association's Fire and Rescue Committee (1), in 1974 the crews of 628 airline flights carrying an estimated 50,000* people received fire and rescue equipment assistance. All 628 flights were potential evacuations; however, the Civil Aeromedical Institute (CAMI) accident/incident data bank, which is based on data obtained from FAA and National Transportation Safety Board (NTSB) files, lists only 24 evacuations in 1974. Fourteen of these caused 4 serious and 61 minor injuries, and there were no injuries reported in the 10 remaining incidents. Appendix A provides data summary tables and accident history summations for the years 1970-1974 (inclusive) and will provide additional detailed information about the nature and cause of evacuation-related injuries. A better evaluation of the number of injuries may be obtained by surveying the 5-year period of 1970-1974. For these years, the CAMI accident/incident bank lists 112 evacuations involving 8,886 people, with 57 of these evacuations producing 157 serious and 485 minor injuries. Snow et al. (7) developed the method of classifying factors or problems influencing passenger egress used in this report. This method classifies these elements into the four factors/problems outlined in Table 1.

These factors, present in all accidents, may overlap in many cases. However, the configurational and procedural factors are stressed in this discussion. The environmental factor is significant in high-impact accidents, especially those producing thermal toxic atmosphere; however, it is a rather complex subject which is being researched elsewhere. The biobehavioral factors cannot be controlled and are therefore not emphasized in this paper.

*Estimated because number of passengers not always given in report.

Eleven accident histories were selected for this report because they are representative of types of evacuations. A 12th history was selected because the passenger load consisted of trained personnel and thus is unique.

II. The Accidents.

Configurational Factors. The two primary injury-producing configurational factors are escape slides and wings.

Escape slide angle contribution to injury is illustrated by the following two accidents.

During the Trans Caribbean Airways accident at St. Thomas, Virgin Islands, December 28, 1970, a Boeing (B)-727 bounced several times on landing, yawed to the right, slid part of the way up a hill, broke in two places, and came to rest partially on its left side. The angle of the fuselage caused the slide at the right front door to fall 1.8 m (6 ft) short of the ground. During the evacuation, 7 of the 46 passengers used this exit. Six of these sustained multiple contusions and bruises. The seventh passenger, the only female to use the exit, suffered a fractured vertebra.

On July 30, 1971, after sustaining structural damage during takeoff, a Pan American World Airways (PAA) B-747 circled, landed at San Francisco International Airport and, after stopping, came to rest on its nose gear. It then gradually rotated and after 70 s rested in a nose-high attitude that caused the forward emergency slides to assume an angle of 68^{o} as opposed to a normal angle of 37^{o} to 40^{o}. The crewmembers were confused about the responsibility and signal for evacuation initiation, and the evacuation did not start until 30 s after the airplane came to a stop. At this time the forward doors were opened by members of the flight deck crew. The other doors were then activated front to rear as cabin crewmembers observed the evacuation activity at the doors in front of their assigned positions. The aft doors were opened 70 s after the airplane stopped. "There is no record of the elapsed time to complete evacuation (3)." Motion picture film shows that at least four passengers used the right front door after the airplane rotated, and it is known that several other passengers also used the right front door at this time. However, the portion of the 199 total passengers who used the forward escape slides is not clear. Eight of those who did sustained serious back injuries and reported that the slide was quite steep.

Tears in slides are also an element in the configurational factor but are seldom documented unless injury results. In the Braniff International Airways McDonnell Douglas (DC)-8 landing accident at Panama City, Panama, on May 19, 1974, only a few of the 148 passengers were able to use the left main door because the slide was ripped by a female passenger's high-heeled

shoes. The FAA has no official position on removal of shoes before entering the slide. However, most airlines' procedures emphasize speed in unforewarned emergencies; therefore, shoes are not normally removed in this type of accident. In forewarned accidents, most airlines advise crewmembers to ask those passengers wearing shoes that might damage a slide to remove them.

Tears in slides may be caused by other factors. An example of this is furnished by the United Air Lines (UAL) DC-10 accident on October 16, 1975, at the Seattle-Tacoma International Airport, Seattle, Washington. The flight with 118 passengers was taxiing for takeoff when the flight deck crewmembers, after being advised by the control tower that the auxiliary power unit (APU) was on fire, initiated an emergency evacuation. During the evacuation two overwing ramp/slide combinations ripped. (The ramp is that portion of the ramp/slide combination that comes out over the wing and provides a way for the evacuees to go out over the wing and then down the slide portion of the combination to the ground.) These failures caused injuries to 21 occupants, 14 of whom required only onsite first aid treatment. Five were taken to the hospital, treated, and released. One of the two held in the hospital was seriously injured when she fell the 3.9 m (13 ft) from the leading edge of the wing through a hole in the ramp/slide and sustained lacerations, a concussion of the brain, and fractures at the elbow in two places. The other person, a 2-yr-old child who had a scraped nose and forehead contusion, was transferred to another hospital and released the next day.

Frequently the reason for an injury occurring on a slide is unknown. This is the case in the UAL B-737 accident, July 19, 1970, in which the aircraft crashed during takeoff from Philadelphia International Airport with such severity that the cabin crew knew an emergency existed, gave instructions to assume the brace position, and initiated the evacuation. The second officer stated that "the first lady down the right front slide jammed her right foot and apparently broke her ankle at this time (2)." This 55-yr-old female passenger was treated in a local hospital for a compound fracture at the right ankle. There were 55 passengers on board and, according to crewmembers' statements, most of the passengers evacuating from the front of the aircraft used the left main cabin door; this woman was one of the few passengers to use the right front door. The aircraft came to rest at a 5^{o} right-roll attitude; thus the slide used by the injured person was not as steep as the normal 37^{o} to 40^{o} angle. It is not clear whether the slide angle contributed to her injury. Another facet of slide usage which may contribute to injuries is the failure of the slide or the door to operate. Quantitative information about this factor is not readily available.

Examples of evacuations in which both slides and wings contributed to injuries are provided by the following two accidents.

On June 20, 1973, an Overseas National Airways (ONA) DC-8 with 251 passengers was taking off from the Bangor, Maine, airport when, because of a muffled noise and jarring sensation, the captain rejected the takeoff and stopped the airplane. A fire broke out in the right wheel well, and an evacuation was initiated by the senior flight attendant. "During the emergency evacuation 34 passengers were injured when they fell from the escape slides. Slower moving passengers were struck from behind by others who were jumping down the door slides. Still other passengers were injured as they jumped or fell from the edge of the left wing, or as they ran and stumbled away from the aircraft (5)." One passenger sustained a fracture at the right ankle; a second fractured a lower right leg; and a third sustained fractures of the left clavicle, right humerus, and left hip.

On January 16, 1974, the nose gear of a Trans World Airlines (TWA) B-707 collapsed during landing at Los Angeles International Airport. The aircraft traveled 1,859.28 m (6,100 ft) down the runway and came to rest at a 5^{o} nosedown attitude and remained in this position throughout the evacuation. The flight attendants reported the evacuation alarm was not activated and the captain initiated the evacuation by saying, "Let's evacuate," over the public address system. Sixty-five persons were on board the aircraft, including four flight attendants, three flight deck crewmembers in the cockpit, and two flight deck crewmembers classifed as additional crewmembers (ACMs) seated in the cabin. Eight passengers were injured (three seriously) during the evacuation. A 48-yr-old female sustained a fracture of the third lumbar vertebra when she apparently fell or was pushed from the forward edge of the left wing. A 60-yr-old male passenger broke his left leg when he fell from the left side of an aft slide, and a 62-yr-old male suffered fractures at both wrists and of his left arm when he fell from the top right edge of an aft slide, a distance of about 3 m (10 ft). Whether the nosedown attitude of the aircraft contributed to injury causation is uncertain. It is known that one of the ACMs was the first person down the right forward slide which he straightened and held for about 13 other evacuees. No one was hurt using this door.

Wings were also a configurational problem in the American Airlines evacuation at the Chicago, Illinois, O'Hare International Airport, on July 10, 1974. The flight deck crew received a fire warning while the B-727 was climbing, elected to return to the airport, and notified the flight attendants of a pending evacuation. After the airplane came to a complete stop, the captain initiated an emergency evacuation. This flight had 3 flight deck crewmembers, 5 flight attendants, and 57 passengers. Of the 40 males and 4 females who replied to the NTSB questionnaire, 2 sustained serious injuries. A female passenger fractured her right heel and lacerated her nose and left knee, and a male passenger suffered a fracture at the right ankle and a sprained left ankle when they slid from the wing to the ground on properly positioned flaps. (When an evacuation is anticipated, approved procedure calls for the flaps to be lowered to enable passengers to slide down them to the ground. This procedure is believed to reduce the possibility of injury.)

Procedural and Configurational. Frequently the procedural and configurational factors combine in one accident to contribute to the causes of injuries. Such was the case in the TWA B-727 evacuation on April 1, 1971, at Chicago, Illinois, O'Hare International Airport, and the UAL DC-8 accident at Hilo, Hawaii, on March 3, 1971. In each of these evacuations a trained flight attendant initiated the evacuation based on an assessment that an emergency did exist (torching of the No. 1 engine in the UAL accident and torching of the APU in the TWA accident).

Following a routine flight, the TWA B-727, carrying 53 passengers and 7 crewmembers, landed at O'Hare airport. While taxiing to its assigned gate, the aircraft stopped momentarily because of conflicting ground traffic. When the flight engineer tried unsuccessfully to start the APU, flames erupted from the exhaust at the right wing root. A supervisory flight attendant, dressed in civilian clothes and seated in midcabin, noticed the flames and yelled for the passengers to evacuate. Passengers and crewmembers estimated that 40 percent of the evacuees used the overwing exits and jumped 3 m (10 ft) from the wings to the ground. (During this unanticipated evacuation the B-727 flaps were up in the approved taxi configuration.) Four passengers sustained injuries when they jumped from the wings. Of these, one male passenger sustained a fracture at the ankle, another fractured a left heel, and a third fractured both legs. The only seriously injured female sustained a fracture at the left ankle. The door-open warning lights alerted the flight deck crew to the evacuation in progress. When they opened the cockpit door, a couple of passengers informed the captain that a bomb had been thrown into the back of the airplane. He activated the evacuation alarm and announced over the public address system that the passengers should leave via the rear door stairs. Those passengers still on board when the announcement was made followed his directions.

The UAL DC-8 was parked at a gate at the Hilo, Hawaii, airport loaded with 119 passengers and 10 crewmembers. During emergency equipment demonstrations, and while the engines were being started, a flight attendant saw a bright flash on the left side of the aircraft. This flash was actually the torching of the No. 1 engine; however, the flight attendant initiated an emergency evacuation. Before the flight deck crewmembers were able to stop the evacuation, 29 passengers had evacuated. During the evacuation, seven people sustained injuries. The only serious injuries, a break at the wrist and a broken pelvis, were suffered by a female passenger who used the jet escape door that was opened by her husband. She fell out of the slide as it twisted "because of a gust of wind," possibly associated with the DC-8's engines that the flight deck crewmembers had not stopped because for some time they were unaware of the evacuation.

Procedural. Other illustrations of evacuations involving procedural factors are provided by the TWA and ONA accidents at John F. Kennedy International Airport, Jamaica, New York.

On September 1, 1972, a TWA B-747 was being taxiied in preparation for takeoff when a tire in the left body gear blew out and a fire was started. Three flight deck crewmembers, 15 flight attendants, and 335 passengers were on board. The evacuation was initiated by the first officer; however, the captain later announced the evacuation over the public address system and the evacuation alarm (reported as being "not very loud") was activated. "According to passengers, flight attendants, fire personnel and security personnel, the aircraft engines were running during the initial stages of the evacuation and most of the injuries were reportedly caused by people being blown down or around by this jet blast (4)." The 15 flight attendants reported a second contributing procedural factor in this accident--trouble separating the evacuees from their carry-on items (coats, luggage, and duty-free purchases). These problems slowed the evacuation. One of the injuries occurred when a passenger slid down the slide carrying duty-free liquor bottles that broke at the bottom of the slide. Another passenger slid into this broken glass and severely cut her hand.

On November 12, 1975, an ONA DC-10 encountered a flock of birds during the takeoff roll and sustained a fire in the No. 3 engine. The flight deck crew executed a high-speed aborted takeoff procedure and the aircraft was evacuated. This evacuation was unique since the 139 people on board were all company employees and only one had not received emergency procedures and/or aircraft familiarization training. Twenty were flight deck crewmembers, 93 were flight attendants, 10 were maintenance personnel, 3 were passenger service representatives, and 2 were scheduling personnel. The airplane was evacuated in less than 60 s. Two of the acting flight deck crewmembers sustained severe rope burns when they slid down the cockpit emergency escape ropes. One of these also sustained a sprained ankle. Thirty other occupants received minor injuries consisting of lacerations, muscle strains, contusions, sprains, and abrasions. They attributed their injuries to slide usage and contact with seats, seat armrests, carry-on baggage, and exterior items such as asphalt, concrete, gravel, etc.

During the deceleration, the fire became so intense in the right overwing and aft right cabin areas that windows melted and people moved away from these areas. Ceiling panels were dislodged and one panel partially blocked the left rear aisle and access to the left rear exit. Fire and smoke entered the cabin when the two middle doors on the left side were opened. The passengers were redirected to other exits; however, only three of the eight exits could be used because of fire and smoke on the outside of the aircraft. The failure of the slides to fully inflate at the usable exits may have contributed to some of the minor injuries. The NTSB, while classifying this as a survivable accident, also stated, "Serious evacuation problems could have been experienced had this been a routine passenger flight with untrained airline passengers (6)."

III. Discussion.

Cost effectiveness is always important to an industry that depends on making a profit and, while the aviation industry is concerned about the safety, well-being, and comfort of its passengers, it must consider the financial aspect of any modifications. However, our investigation of injuries occurring during the emergency evacuations indicates that the number of injuries will probably increase because, if for no other reason, the number of passengers carried on civil air transports increases each year. Therefore, it might be worthwhile to consider the following suggested changes or modifications to procedural and configurational factors.

Designers and engineers might consider directing attention toward the design of slides to compensate for unusual aircraft angles and effects of wind and to offer protection for passengers landing forcefully at the bottom of slides. Slides such as slide/rafts (slides that may also be used as liferafts) which have high sides, that mitigate falls over the sides as happened in the ONA (Bangor, ME) and the TWA (Los Angeles, CA) accidents, might be considered for use whenever possible. Where tearing of slides is a factor, such as in the Braniff (Panama City) and the UAL (Seattle, WA) accidents, the use of stronger slide material, coupled with more frequent and required tests to ensure permeability and tensile and bonding strength of slide material, might reduce injuries.

One way to reduce injury-producing falls from wings is to provide a ramp/slide similar to the one used by McDonnell Douglas on the DC-10 and by Boeing on the B-747. Another method is to provide access to the ground from the cabin wing area without using the wings. Lockheed does this in the L-1011 by having large emergency-slide-equipped, floor-level exits on both sides of the cabin both fore and aft of the wings.

Airline training departments recognize the difficulty in training flight attendants to react quickly, evacuate the airplane rapidly, exhibit leadership skills in emergency situations, and at the same time teach them to take time to assess a situation but also check with the flight deck before acting. There is some doubt that any emergency procedure that slows the evacuation time is desirable, so there may always be a certain number of unwarranted evacuations such as the UAL (Hawaii) and TWA (O'Hare) accidents. However, training departments might reduce the number of these accidents by putting additional emphasis on crew coordination and communication. The use on all airline aircraft of evacuation alarms to notify all crewmembers when an evacuation is in progress might also be considered. One type of alarm system is already in use by some of the airlines. An easily perceived signal to alert crewmembers to discontinue an evacuation might prove helpful in having passengers deplane in a normal fashion when an evacuation is no longer warranted.

There are several instances such as the TWA (John F. Kennedy Airport) accident where carry-on items contributed to an injury. Training crews and airline ground personnel to recognize the potential danger of carry-on items, strictly adhere to regulations concerning these items, and caution passengers to leave the items at their seats in the event of an emergency evacuation might reduce injury potential.

The FAA Flight Standards Service has pointed out that the following action has been taken which pertains to some of the recommendations contained in this paper: Airworthiness Review Notice 75-26 is being considered and it includes much of what is recommended regarding slides. The following quote is from a letter signed by Mr. J. A. Ferrarese, Acting Director, Flight Standards Service: "A 25 knot wind criteria for chutes, for instance, is proposed. Also, TSO revisions are under consideration to require higher chute side walls, greater tear and fire-resistant chute material, etc." In addition (again quoting from the same letter): "Additional emphasis on crew coordination and communication was instituted by a notice issued August 2, 1977. Also, an NPRM* is being prepared which would require evacuation alarms."

TABLE 1. Factors Influencing Passenger Egress

Factor	Description
CONFIGURATION	The standard features of the occupant environment that control access to exits and evacuation flow rates. These include seating density; aisle width; size, number, and location of emergency exits; slides; physical exit cues, etc.
PROCEDURE	The regulatory and training practices of crew and other nonpassenger rescue personnel that influence evacuation procedures.
ENVIRONMENT	This refers to such features as the occupant space and factors outside the aircraft that control survivability and evacuation time. Examples would be the heat and toxic byproducts of combustion, secondary explosion, outside light, and weather.
BIOBEHAVIORAL	Those characteristics individuals bring with them to the flight; for example, sex, physical condition, and experience.

*Notice of Proposed Rulemaking.

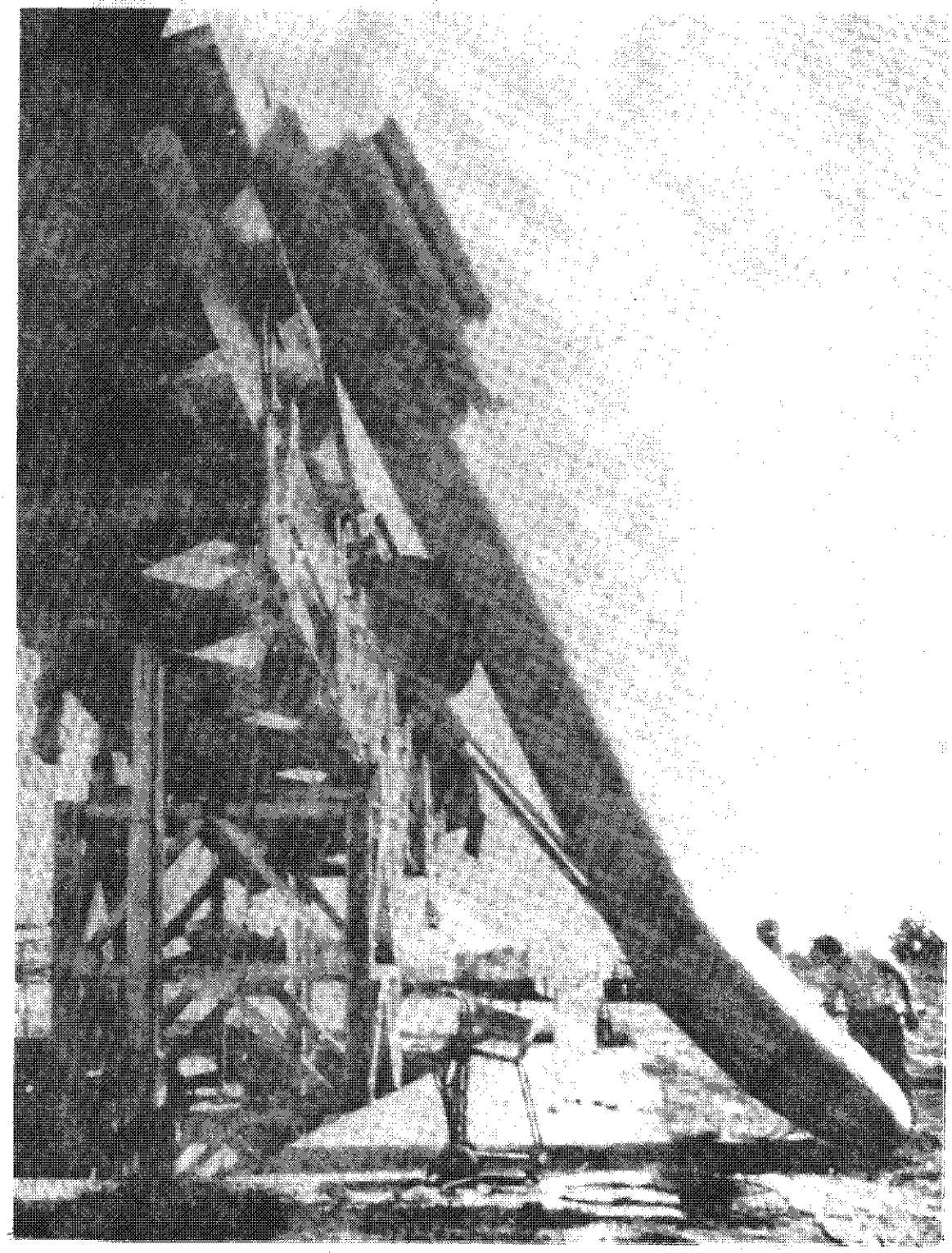

FIGURE 1. CAMI evacuation simulator showing slide deployed at a 68^{o} angle.

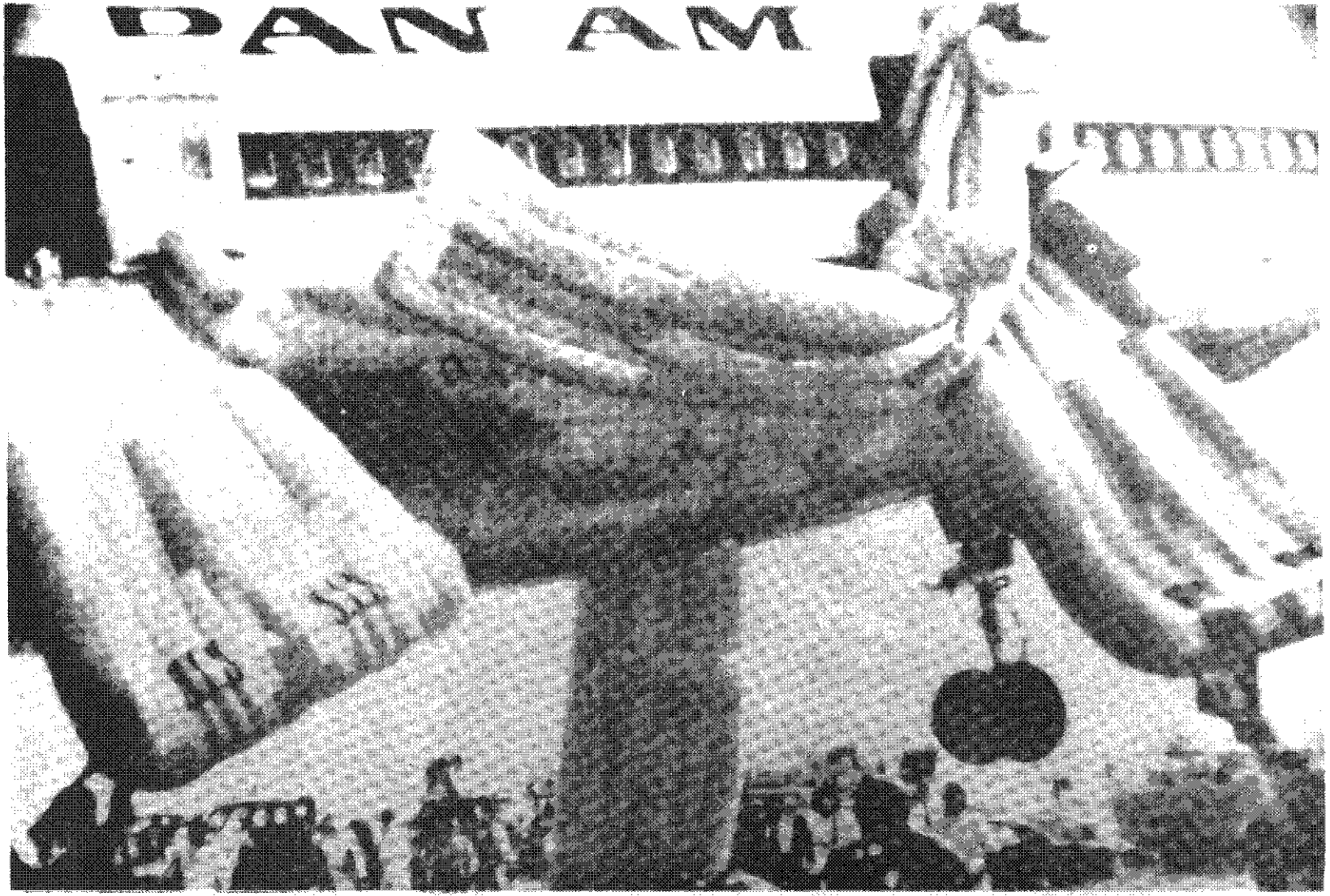

FIGURE 2. PAA B-747 after rotation of aircraft and following evacuation. Slides at the right and left front doors, number 2 exit slide, and slide at lounge area exit are shown.

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5. National Transportation Safety Board: Aircraft Accident Report, Trans World Airlines, Inc., Boeing 707-131B, N757TW, Los Angeles International Airport, Los Angeles, California, January 16, 1974. Report No. NTSB-AAR-74-10, 1974.

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APPENDIX A

SURVEY OF INJURIES IN AIR TRANSPORT EMERGENCY EVACUATIONS

LIST OF ABBREVIATIONS

pax	passenger
CAMI	Civil Aeromedical Institute
ALS	Approach Light System
PIT	Pittsburgh, Pennsylvania, airport
F/A	flight attendant
SFO	San Francisco International Airport
DCA	Washington National Airport
S	serious injury
M	minor injury
F	fatal injury
PA	public address system

NOTE: Numbers in this report beginning with 1- (e.g., 1-0032) or N are NTSB numbers; numbers beginning with 7- are FAA (CAMI) numbers.

TABLE 1. Emergency Evacuation Reports in the CAMI Biomedical Data Bank

Type Report	No. Reports	Crewmember Injured in Evacuation*	Pax Injured in Evacuation*	Total No. Reports Citing Injuries in Evacuation
Forewarned Evac.				
NTSB	12	1	8S 7M	8
FAA	16	0	2M	2
Unforewarned Evac.				
NTSB	36	4	6 pax M 14S 22M	23
FAA	44	2	2S 15M	17 17
TOTALS	108	7	pax 6 24S 46M	60

*No. of reports

TABLE 2. Injuries Occurring in Emergency Evacuations*

Type Emergency	No. on Board Pax	Crew	Total	Pax Injuries M	S	Total	Crew Injuries M	S	Total	Total Injuries
Forewarned										
NTSB	957	102	1,059	64	15	79	4	0	4	83
FAA	611	60	671	2	0	2	0	0	0	2
TOTAL	1,568	162	1,730	66	15	81	4	0	4	85
Unforewarned										
NTSB	3,378	294	3,672	331	73	404	6	5	11	415
FAA	3,169	315	3,484	78	2	80	2	0	2	82
TOTAL	6,547	609	7,156	409	75	484	8	5	13	497
TOTAL Fore-Warned and Unforewarned	8,115	771	8,886	475	90	565	12	5	17	582

*Data include 1-0007 (7/30/71), 1-0004 (6/12/72), 1-0029 (11/27/73), 1-0028 (11/27/73) that list some injuries which are not technically evacuation injuries but must be listed to correspond with NTSB data.

INJURY CAUSE SUMMATION*

Date	Report	Description
		Wing
**05/18/70	1-0036	Pax jumped from wing. Nature of injury unknown.
**02/19/72	1-0008	Pax injured when slid off trailing edge of wing.
**07/10/74	1-0028	Pax stated something should be done to break fall from wing.
03/02/70	1-0024	Pax fractured ankle when he dropped off the wing.
04/01/70	1-0010	Pax sustained fracture when jumping from leading edge of wing.
05/07/71	1-0030	Pax injured when jumping from wing to ground.
05/15/71	1-0011	Six persons were hurt when they jumped from the wing to the ground.
06/20/73	1-0015	Some pax injured when jumped or fell from the wing.
01/04/74	1-0002	Broken leg when jumped or fell from wing.
		Slides
05/18/70	1-0036	Elderly woman fell off slide, landed on bad leg.
**07/30/71	1-0007	Eight serious back injuries, angle of slide became steep.
**06/29/71	1-0048	One serious when pax fell out of slide.
06/09/70	1-0029	People were injured going down slide with tear.
07/19/70	1-0012P	Pax broke ankle when foot "jammed" at bottom of slide.
12/28/70	1-0026	One serious injury when pax fell 6 feet from end of slide to ground.

*This section comprises selected cases for which information in the files was more complete.
**Forewarned evacuation (from NTSB files).

07/23/71	1-0017	Pax sustained serious injury when fell off slide at bottom.
03/03/72	1-0024	Pax fell from slide which was twisted.
06/20/73	1-0015	Some pax injured when fell from slides.
03/27/74	1-0019	Pax injured when fell from slide because pushed from behind.
09/01/72	1-0013	Pax injured coming down slides.

Carry-On Items

09/01/72	1-0013	Pax severed tendon when struck broken bottle of duty-free liquor.
11/01/72	1-0038	One man was injured when struck by suitcase.
06/20/73	1-0015	Two of pax who carried totebags through overwing exits were injured.

Top of Fuselage

12/17/73	1-0004	Injuries sustained when jumping from top of fuselage.

FOREWARNED EVACUATIONS*

Date	NTSB No.	Place	Aircraft	Injuries	Description
05/18/70	1-0036	Chicago, IL	B-727	Pax 1S 2M	Smoke in cabin. Orderly evacuation. Minor injuries include one elderly. One serious injury when "Pax jumped from trailing edge of wing to concrete." Nature of injury not in CAMI file.

*Where there is no entry under Description, there is no information in the CAMI files.

09/29/70	1-0053	Dallas, TX	B-720	No Injuries	
07/30/71	1-0007	San Francisco, CA	B-747	Pax 10S 19M	Struck ALS on take-off. Two pax hurt seriously during flight. Eight serious back injuries resulted when angle of slide became steep because of aircraft settling back and pax continued to use these slides. The nature and cause of the minor injuries were not determined.
08/20/71	1-0018	PIT	CV-580	No Injuries	
12/04/71	1-0021	Raleigh, NC	DC-9	No Injuries	
06/29/71	1-0048	France	B-747	F/A 4M Pax 25M 1S	Bomb threat evacuation. The slide at the second right-hand emergency door deployed at an angle. One pax was seriously injured as a result of falling out of this slide. The cause and nature of minor injuries were not determined.
01/10/72	1-0044	SFO	B-727	Pax 9M	No information about nature or cause of injuries.
02/19/72	1-0008	DCA	B-727	Pax 1S	Pax who was seriously injured exited over right wing and was holding his granddaughter in his arms when he slid off trailing edge of wing. No information in CAMI file about nature of injury.

06/12/72	1-0004	Detroit, MI	DC-10	Pax 9M F/A 2M*	Rapid decompression because of loss of cargo door. F/A injuries occurred when they were thrown to the floor during decompression, seated 4R and 4L. Not clear from Human Factors Group Chairman (HFGC) report nature or cause of pax injuries.
12/22/73	1-0036	Detroit, MI	B-727	Pax 4M 1S	Emergency landing due to bomb threat. CAMI files do not contain information about the nature or cause of these injuries.
02/10/74	1-0028	Chicago, IL	B-727	Pax 4M 1S	"One pax stated that some provision should be made to break a fall from wing" (sustained injuries). No further information on nature or cause of injuries. However, files do indicate problem with emergency slide--unclear whether or not this contributed to injuries.
11/06/74	4-0028	Boston, MA	DC-9	No Injuries	

Date	CAMI No.	Place	FAA Aircraft	Injuries	Description
01/04/71	7-0023	Indianapolis, IN	CV-580	No Injuries	"Pax interview indicate problem with understanding instructions over PA."

*F/A injuries not technically evacuation injuries; however, they must be included in these numbers in order to correspond to NTSB printout.

01/18/71	7-0239	Detroit, MI	BAC-1-11	No Injuries	No indication of problems.
04/05/71	7-0024	Winston, NC	YS-11	No Injuries	No indication of problems.
04/14/71	7-0240	NY	B-727	No Lnjuries	No indication of problems.
04/19/71	7-0241	Houston, TX	DC-9	No Injuries	No indication of problems.
08/09/71	7-0245		B-707	Pax 1M	Due to friction burns and sprained ankle.
08/18/71	7-0246	Fayetteville, NC	YS-11A	No Injuries	
11/04/71	7-0247	San Francisco, CA	B-707	Pax 1M	Tire blew; therefore, evacuation from left slide only. One female slightly injured. No further information about nature or cause of injury.
08/19/72	7-0025	NY	B-727	No Injuries	
10/07/72	7-0026	Durango, CO	CV-580	No Injuries	
11/01/72	7-0027	Atlanta, GA	DC-8	No Injuries	
05/31/73	7-0028	Minneapolis, MN	CV-580	No Injuries	No problems reported.
04/09/74	7-0500	Washington, DC	B-727		Right forward slide could not be used.
10/12/74	7-0504	Chicago, IL	B-737	No Injuries	Bomb threat by pax on board the aircraft.
12/19/74	7-0529	Minneapolis, MN	DC-9	No Injuries	

UNFOREWARNED EVACUATIONS

NTSB

Date	NTSB No.	Place	Aircraft	Injuries	Description
01/17/70	1-0017	Aspen, CO	CV-240	No Injuries	"All emergency exits opened; however, majority of pax evacuated through right cabin door. Crew stated evacuation orderly and completed within 60 to 90 seconds."
02/01/70	1-0006	Romulus, MI	CV-580	Pax 1	Nature and cause of injury not clear. Partially blind 88-yr-old woman with cardiac condition complained of ½-mile walk across airfield in the dark.
03/02/70	1-0024	Chicago, IL	B-720	Pax 9	Pax fractured ankle when he dropped off wing. No information about nature or cause of other injuries. Right forward slide did not deploy and left rear slide failed to inflate properly.
03/04/70	1-0021	NY	Helicopter	No Injuries	
06/03/70	1-0015	Newark, NJ	B-727	No Injuries	
06/09/70	1-0029	Bangor, ME	DC-8	Pax 14	Slide at Exit 7 did not inflate. Long tear near reinforcing patch. People went down this slide and were injured. No information about extent or nature of injuries.

07/19/70	1-0012	Philadelphia, PA	B-737	Pax 1S 16M	The Second Officer stated "the first lady down the right front slide jammed her right foot and apparently broke her ankle." No information about nature or cause of minor injuries.
09/18/70	1-0016	Louisville, KY	DC-9	F/A 1M Pax 14M	Ceiling panel in way during evacuation. Carry-on baggage was a problem. Buffet area had to be cleared of buffet ice drawer before evacuation could start at that door. No information in CAMI files about nature or cause of injuries.
11/04/70	1-0040	Savannah, GA	B-727	No Injuries	
12/10/70	1-0050	St. Thomas, VI	CV-640	No Injuries	
12/16/70	1-0047	Burbank, CA	B-727	No Injuries	"The galley door slide automatically deployed, but because of angle of floor, package deployed on cabin floor instead of outside airplane. Two pax required assistance--one 82-yr-old lady and gentleman with crutches."
12/23/70	1-0044	Kansas City, MO	CV-580	Pax 1M	"One woman cut finger as she deplaned."

12/28/70	1-0026	St. Thomas, VI	B-727	Crew 2S Pax 10S 2F	One serious injury occurred when pax fell 6 ft to the ground due to aircraft attitude when it came to rest. CAMI files do not contain additional information as to the nature or causes of other injuries.
01/11/71	1-0004	Jackson, MS	DC-9	No Injuries	"Forward slide fell out when door was opened but did not inflate until F/A pulled handle.
02/26/71	1-0031	St. Louis, MO	B-727	No Injuries	Slide at galley did not inflate properly and was not used. Elderly man helped by ground personnel.
04/01/71	1-0010	Chicago, IL	B-727	Pax 5S 7M	Many of the pax who evacuated via the window exits jumped from the leading edge and tip of the left wing, a distance of 10 ft. One pax fractured both legs, two sustained left ankle fractures, a man fractured his left heel, and the only woman injured sustained an ankle fracture.
05/07/71	1-0030	Charlotte, NC	B-737	Pax 1S	Pax injured when jumping from wing to ground. No information in CAMI files about nature of injury.
05/15/71	1-0011	San Francisco, CA	DC-8	F/A 2M Pax 5S 1M	"Six persons were hurt when they jumped from wing to ground."
07/19/71	1-0015	Denver, CO	B-727	Pax 8	No information about nature or cause of injuries.

07/23/71	1-0017	Chicago, IL	B-747	Pax 1S Several M	"Pax panicked pushed from behind and tumbled down slide 3R, lack of support on right side at bottom caused pax to fall off onto runway."
03/03/72	1-0024	Hilo, HI	DC-8	Pax 1S 6M	The serious injury was suffered by a female pax who fell from the slide as the slide twisted, possibly as a result of the jet exhaust blast from the engines that had not been shut off.
05/18/72	1-0002	Ft. Lauderdale, FL	DC-9	F/A 1S Crew 1S Pax 1S 5M	Injuries apparently sustained during impact. Seat, panel and galley failures.
09/01/72	1-0013	NY	B-747	Pax 6S 74M	Four seriously injured sent to hospital (one woman had severed tendon and artery, one had skull fracture, one had a concussion, and one had a broken knee cap). No description of nature of other two serious injuries. Minor injuries were mainly "abrasions and contusions with some sprains and fractures." Severed tendon caused by landing on duty-free liquor bottle that another pax carried down slide and broke. Cause of other injuries not clear.

09/26/72	1-0043	Amchitka Island, NY	L-188	No Injuries	Malfunction of slide.
11/01/72	1-0038	St. Louis, MO	B-707	Pax 9	Only comment in CAMI files about injuries was, "One man was injured when a suitcase was dropped on him from wing."
12/15/72	1-0037	Miami, FL	B-747	Pax 4M	Slide at 2L deployed but did not inflate. No indication of nature or cause of injuries.
03/03/73	1-0005	Wichita, KS	B-727	Pax 3M	"Pax injuries occurred during evacuation." No indication of specific cause or nature of injuries.
06/12/73	1-0014	Pittsburgh, PA	CV-340/540	Pax 1M	"One pax sustained injuries using slide." No indication of nature of injuries.
06/20/73	1-0015	Bangor, ME	DC-8-63	Pax 3S 31M	"Despite shouted warnings not to use the overwing exits, at least eight used the two exits over the left wing." "Two pax who carried totebags as they exited through a left overwing window, were among those injured." "Some pax were injured when they fell from the escape slides. Slower moving pax were struck from behind by others who were jumping down the door slides. Still other passengers were injured as they jumped or fell from the edge of the left wing." Nature of injuries not in CAMI files.

10/28/73	1-0019	Greensboro, NC	B-737	No Injuries	
11/27/73	1-0029	OH	DC-9	Crew 1M 1 F/A 1M 1 Pax 13*	Injuries appear to have occurred during impact.
11/27/73	1-0028	Chattanooga, TN	DC-9	Crew 2S F/A 2M Pax 1S 5M*	Injuries appear to have occurred during impact.
12/17/73	1-0004	Boston, MA	DC-10	F/A 1S Pax 2S 13M	A female F/A and two pax sustained serious injuries when they jumped from the top of the fuselage. The F/A had pelvic fractures. One pax fractured her right ankle and the other pax fractured her left ankle and suffered a compression fracture of the second lumbar vertebra.
12/17/73	1-0035	Greensboro, NC	DC-9	Minor Injuries	CAMI files do not contain information about nature or cause of injuries.
01/04/74	1-0002	Tampa, FL	B-727	Pax 1M 1S	Pax sustained broken leg. Cause of injury could not be determined from CAMI files; however, verbal communication with F/A indicates leg was broken when pax jumped or fell from the wing.
03/27/74	1-0019	Anchorage, AK	DC-8	Pax 11M 1S	"Passenger said he started down slide and someone pushed him from behind and he fell off the slide."

*Injuries not technically evacuation injuries; however, they must be included in these numbers in order to correspond to NTSB printout.

FAA

Date	CAMI No.	Place	Aircraft	Injuries	Description
01/07/71	7-0001	Los Angeles, CA	DC-8	No Injuries	Door not locked open before slide inflated--when slide inflated, door blew back causing slide not to go on out door.
01/24/71	7-0002	Winston-Salem, NC	YS-11A	No Injuries	
01/27/71	7-0003	Miami, FL	B-727	No Injuries	
05/08/71	7-0242	Kansas City, MO	CV-880	1M	"One female passenger received minor injuries when sliding off aft slide onto ramp surface." Nature of injury not in CAMI file.
06/02/71	7-0243	Cincinnati, OH	B-727	F/A 1M Pax 6M	"Injuries while evacuating forward slide." Nature of injury not in CAMI files."
07/25/71	7-0244	Milwaukee, WI	B-707	No Injuries	
03/23/72	7-0248	San Juan, PR	CV-640	No Injuries	
05/01/72	7-0249	Sioux Falls, SD	CV-580	No Injuries	
06/09/72	7-0004	Pittsburgh, PA	B-737	Pax 3M	Pax injured on slide. Crewmember report: "Probable cause of injuries--they were pushed from behind."

07/30/72	7-0005	Chantilly, VA	B-707/138	No Injuries	
08/03/72	7-0006	Denver, CO	CV-580	No Injuries	
10/11/72	7-0007	Chantilly, VA	B-727	No Injuries	
10/12/72	7-0008	Pittsburgh, PA	B-727	No Injuries	
11/10/72	7-0009	Rapid City, IA	B-737	Pax 4M	"Injuries were slide burns and one tail-bone injury."
11/17/72	7-0010	Las Vegas, NV	B-737	Pax 4M	CAMI files do not contain any information about nature or cause of injury.
11/26/72	7-0011	Los Angeles, CA	B-727	Pax 1M	CAMI files do not contain any information about nature or cause of injury.
01/08/73	7-0012	Baltimore, MD	DC-9	No Injuries	
01/19/73	7-0013	NY	B-727	No Injuries	
02/19/73	7-0014	Washington, DC	B-727	Pax 5M 1S	"Emergency slides worked properly." "Six passengers sent to the hospital for observation. One passenger required extended observation for cracked vertebra."
02/22/73	7-0015	Cleveland, OH	DC-9	No Injuries	
02/29/73	7-0016	Atlanta, GA	DC-7	No Injuries	
04/01/73	7-0017	Battle Creek, MI	B-707	No Injuries	

04/18/73	7-0018	Newark, NJ	DC-8	No Injuries	
04/28/73	7-0019	Columbus, OH	DC-9	No Injuries	
07/31/73	7-0020	Chattanooga, TN	DC-9	Pax 1M	"One pax bruised in evacuation." No information about cause of bruise.
08/10/73	7-0021	Yohota, Japan	DC-8	Pax 11M	"Eleven passengers injured. Slide burns, skin abrasions."
09/15/73	7-0022	Albuquerque, NM	B-727	No Injuries	
11/21/73	7-0251	Tampa, FL	DC-9	Pax 4M	"All four passengers refused treatment. Injuries from sliding down chutes."
03/01/74	7-0501	Yohota, Japan	DC-8	No Injuries	
03/26/74	7-0502	New Orleans, LA	DC-10	No Injuries	
05/05/74	7-0308	Birmingham, AL	B-737	Pax 1M	"One pax sustained slight injury during evacuation."
05/19/74	7-0309	Panama City, Panama	DC-8	No Injuries	
05/31/74	7-0310	Chantilly, VA	DC-10	Pax 1M	"One pax received a minor abrasion during evacuation."
06/22/74	7-0311	Cedar Rapids, IA	B-727	No Injuries	
07/21/74	7-0530	Los Angeles, CA	B-747	30M	"Thirty pax's received minor slide burns. None required hospitalization."

07/27/74	7-0312	San Diego, CA	B-707	No Injuries	
07/27/74	7-0313	West Palm Beach, FL	DC-9	No Injuries	
07/31/74	7-0314	Flint, MI	B-737	Pax 3M	"Three pax's said they received injuries to knee, wrist, and ankle/ back during evacuation."
08/03/74	7-0316	Chicago, IL	B-727	Pax 1M	"One pax injured during evacuation. He received minor skin abrasions on his arm."
08/21/74	7-0317	Jackson, MI	CV-580	No Injuries	
08/31/74	7-0315	Seoul, Korea	B-747	No Injuries	
09/12/74	7-0318	Pittsburgh, PA	B-707	No Injuries	
12/22/74	7-0505	NY	B-707	Pax 5M	"Five pax's received minor injuries while evacuating aircraft."
12/25/74	7-0506	Seattle, WA	L-1011	F/A 4M Pax 1S	"Four F/A received minor injuries and bruises: Two with ankle and two with hip injuries. One pax received a back injury and had broken foot." Cause, except for occurring during evacuation, not clear.

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