SPECIAL STUDY

IN-FLIGHT SAFETY OF PASSENGERS AND FLIGHT ATTENDANTS ABOARD AIR CARRIER AIRCRAFT

ADOPTED: MARCH 14, 1973

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
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16. Abstract

This study examines nonfatal in-flight injuries of passengers and flight attendants in air carrier operations during the years 1968 through 1971. Injuries caused by turbulence, evasive maneuvers to avoid a collision, and self-initiated injuries are summarized. Conditions, circumstances, and pre-existing factors instrumental in creating a hazardous environment for persons aboard aircraft are examined, as well as types of injuries sustained and the treatment of such injuries. Also examined is the relationship of injuries to passenger seatbelt discipline, structure and design of cabin furnishings, flight attendants' duties, consumption of alcoholic beverages, and the location in the airplane of passengers and flight attendants. Six safety recommendations are presented.

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I. INTRODUCTION

A matter of increasing concern to the National Transportation Safety Board in recent years is the fact that a number of passengers and flight attendants have sustained injuries aboard air carrier aircraft which encountered turbulence. Also of concern to the Safety Board are allegations that the in-flight service of liquor, which was liberalized in 1969, has led to increased hazards to passengers and flight attendants.

In order to assess the magnitude and significance of the hazards associated with in-flight turbulence as well as the intemperate use of alcohol as related to air travel, the Safety Board has studied reports of injuries over a recent 4-year period. The areas studied were: aircraft operational factors, environmental conditions within the cabin, the causal relationship between passenger intoxication and injuries, the correlation between the severity of injury and the location of cabin occupants, and in-flight first-aid treatment of the injured.

Information was compiled from the Safety Board's air carrier accident reports from 1968 through 1971 for situations which resulted in nonfatal in-flight injuries. For the same 4-year period, Federal Aviation Administration files were examined for incidents, as distinguished from accidents, which recorded in-flight injuries. The files of associations representing pilots and flight attendants were reviewed for instances in which allegedly intoxicated passengers caused in-flight disturbances. Reports by flight attendants regarding injurious conditions within the cabin were similarly reviewed.

These data were then assessed to determine the frequency and the severity of injuries which resulted from abrupt changes in flightpath because of clear air turbulence, convective turbulence associated with thunderstorm activity, and maneuvers made to avoid midair collisions. Injuries to persons who tripped or fell in the cabin were also analyzed.

The data revealed that flight attendants were the only crewmembers who were injured in in-flight accidents or incidents.

To date, the types of injuries to which this study was addressed have been nonfatal in nature. However, the need for application of adequate safeguards and preventive measures is clearly seen, since there is a potential for fatalities to result from such in-flight injuries.

As a result of this study, the Safety Board directs four recommendations to the Federal Aviation Administration. Two additional recommendations are directed to the Air Transport Association and member air carriers.

II. INSUFFICIENCY OF AVAILABLE DATA

Attempts to identify all cases of nonfatal in-flight injuries which occurred from 1968

through 1971 proved to be difficult. We noted that reports of minor mishaps, classified as incidents, which resulted in in-flight passenger injury had been subjected to several preliminary screenings before they were filed with the Federal Aviation Administration (FAA) or with the Safety Board. Currently, there is no Federal Aviation Regulation which requires the reporting of minor in-flight injuries to the FAA; such data are now reported on a volunteer basis. The reporting of minor in-flight injuries has a potential value in that injury trends may be identified.

Typically, the flightcrew first determined whether a minor mishap merited a report to the company. Sometimes, when flight attendants sustained only minor injuries, no report was filed with the FAA. Also, there was a paucity of reports for cases of disruptive passengers who had been drinking prior to boarding the plane or who became intoxicated while in flight.

Apparently, crewmembers made individual decisions that a mishap merited a report, and prepared the necessary forms and statements. A comparison of FAA files and files of flightcrew associations indicated that many in-flight injuries reported to the associations were not reported to the FAA. This suggests that the reporting process was not complete, thus resulting in the loss of valuable data. Also, data could have been lost if an in-flight mishap was not first classified properly as an accident. In such cases, flight data recorder readouts and information regarding severity of injuries and location of the injured were lacking.

The absence of complete data on in-flight mishaps could lead to an overly optimistic estimate of the safety of occupants of air carrier aircraft. Since the true significance of such events can be determined only when all cases of injury are reported, compiled, and compared with other types of accident data, the importance of reporting incidents which result even in minor injury cannot be overemphasized. Adequate reporting may identify operational and design deficiencies which could result in serious injuries when more severe incidents or accidents occur.

III. IN-FLIGHT INJURIES: CAUSAL FACTORS

A review of the Safety Board's air carrier accident summaries for 1968 through 1971, as well as a review of the FAA incident files for the same period, disclosed two types of situations or causal factors which can predispose a person to in-flight injuries:

Environment-Initiated: Injuries can occur because of abrupt changes in flightpath, either as a result of clear air turbulence (CAT) or as a result of convective turbulence associated with thunderstorm activity. Also, injuries can be sustained when a sudden maneuver is performed to avoid a collision.

Self-Initiated: This factor is limited to those instances in which a passenger or a flight attendant is injured solely as a result of his or her own carelessness; e.g., a person trips or falls.

Accidents

Figure 1 summarizes in-flight accidents which have resulted in serious injury or substantial damage, as defined in section 430.2 of the Safety Board's procedural regulations [1].* A comparison of injury-producing situations – turbulence, evasive maneuver, or self-initiated action – indicates that turbulence accounted for most in-flight accidents during the 4-year period under study. The number of accidents which are attributed to evasive maneuver and to self-initiated action has remained relatively constant. Although a slight downward trend is noted in turbulence-related accidents, the decrease does not appear to be directly related to advances in turbulence forecasting, reporting procedures, or use of airborne radar [2].

Figure 2 depicts turbulence-related accidents which resulted in injuries. The number of accidents which resulted from encounters with CAT for each year was consistently less than the

*The numbers in brackets throughout this study identify references appearing on pages 46 and 47.

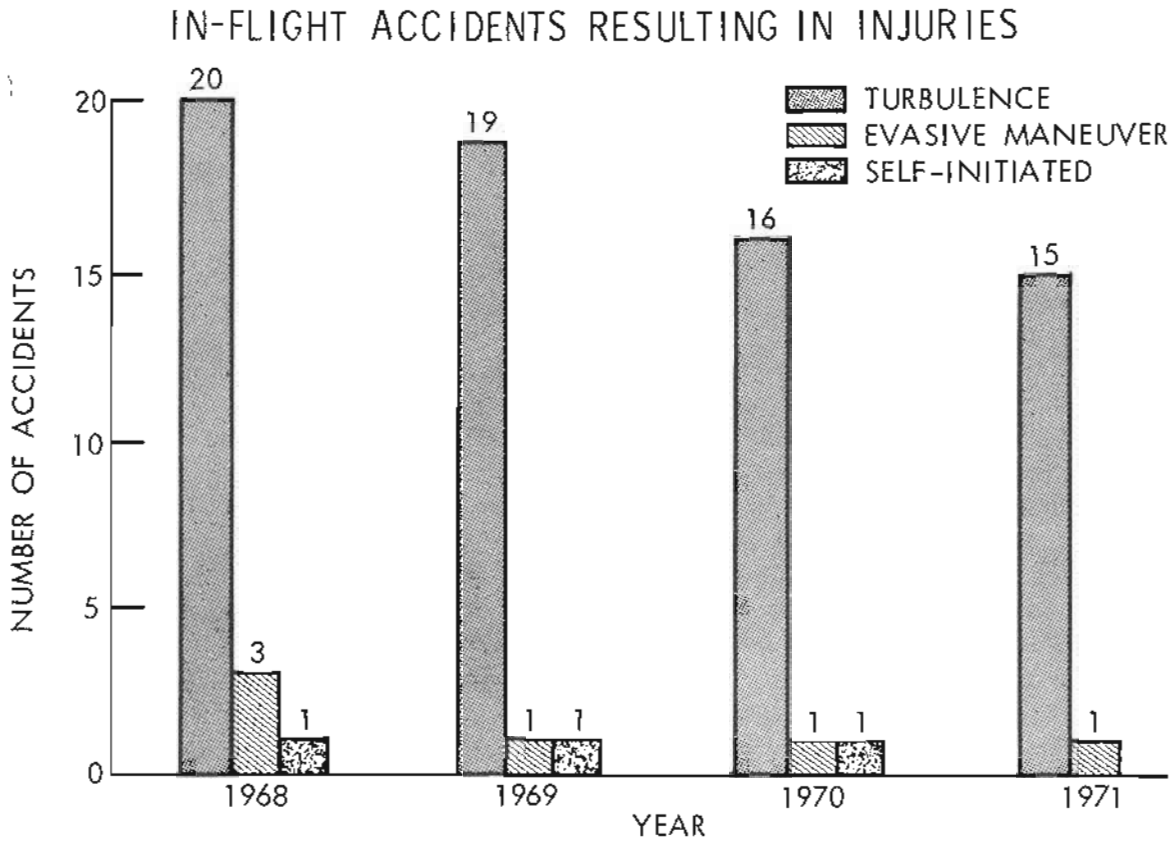


FIGURE 1

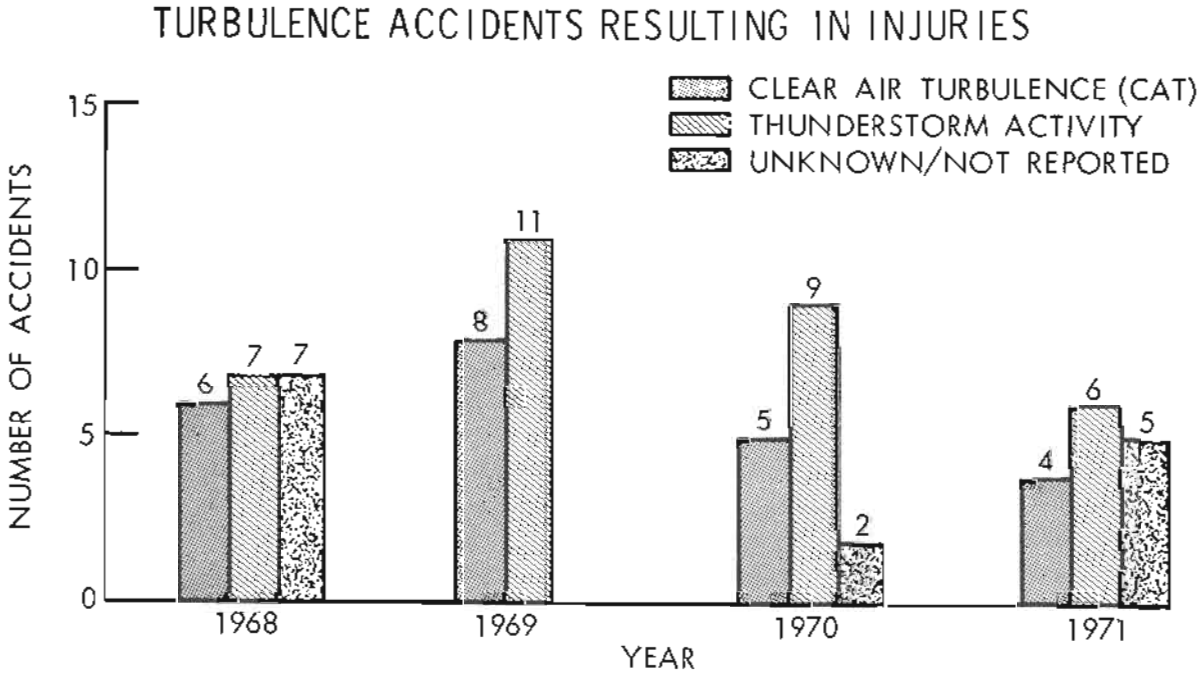


FIGURE 2

number of accidents in which thunderstorm turbulence was encountered. As indicated in a recent Safety Board study [2], aircrews are unable to locate CAT accurately and then avoid it. Moreover, it appears that turbulence encounters which are associated with thunderstorm activity continue to be a problem, even though air carrier aircraft are required to be equipped with operable weather radar and to have flightcrews trained in its use.

Figure 3 identifies the number and severity of turbulence-related injuries sustained by passengers and flight attendants. Minor injuries were sustained by passengers far more often than were serious injuries. Conversely, flight attendants incurred more serious injuries than minor injuries for all but 1 year of the 1968-1971 period. In most instances, injuries to flight attendants were sustained while they were performing normal cabin service functions.

Figure 4 shows the severity of injuries caused by evasive maneuvers. Injuries can be anticipated because of the unexpected nature of the maneuver, particularly when persons are out of their seats or when they are seated but are not properly restrained by seatbelts.

Self-initiated in-flight injuries are summarized in Figure 5. These injuries usually resulted when a person tripped or fell over objects in the aisle. No reported injuries were attributable to consumption of alcoholic beverages served in flight.

The relationship of injuries to location in the airplane cabin is shown in Tables 1 and 2. Although passenger and flight attendant locations have not always been noted or described in accident reports, it is apparent from the 1968-1971 reports that most injuries were sustained by passengers who were located in the rear cabin area. Similarly, most injuries to flight attendants occurred in galley areas, particularly in galleys located in the rear of the cabin.

The number of passenger injuries which occurred in lavatories or adjacent lavatory waiting areas is notable. One explanation would seem to be that many passengers, in disregard of seatbelt signs, left their seats to wait outside occupied lavatories. Another explanation would seem to be the inability of passengers and flight attendants to observe, or their failure to heed, seatbelt signs when they are inside lavatories or galley areas.

For each of the years under study, the maximum acceleration excursion (vertical g force) indicated on the flight data recorder was tabulated by airplane model for the two types of turbulence as well as for evasive maneuvers. It should be noted that the accelerometer, which senses vertical acceleration, is located at or near the airplane's center of gravity. Consequently, the g excursions shown in Figure 6 are not fully indicative of accelerations imposed on the rear cabin where most injuries occur. The magnitude of fuselage vertical and lateral acceleration, as well as angular displacement, can produce a high relative motion among persons, loose cabin equipment, and fixed cabin interior components. Neither of these acceleration parameters is recorded on flight data recorders currently in use. Without such data, it is not possible to determine accurately the airplane reaction, the trajectories of cabin occupants, or how injuries were sustained.

Tables 3 through 6 summarize the severity of injuries sustained by flight attendants and passengers as a result of turbulence, evasive maneuver, and self-initiated action. Injuries are classified as either serious or minor.

Incidents

In order to identify possible injury trends, a review was made of in-flight incidents, reported on FAA Form 2819, in which personal injury or airplane damage was not severe enough to be classified as an accident [1].

Incident reports for 1968-1971 were reviewed for evidence of in-flight injuries attributable to turbulence; Figure 7 shows the number of such incidents reported by each of six major air carriers during this period. It is noteworthy that the single air carrier which has experienced no turbulence incident has had in effect since 1968 a turbulence forecasting, reporting, and avoidance program.

SEVERITY OF INJURIES RESULTING FROM TURBULENCE ACCIDENTS

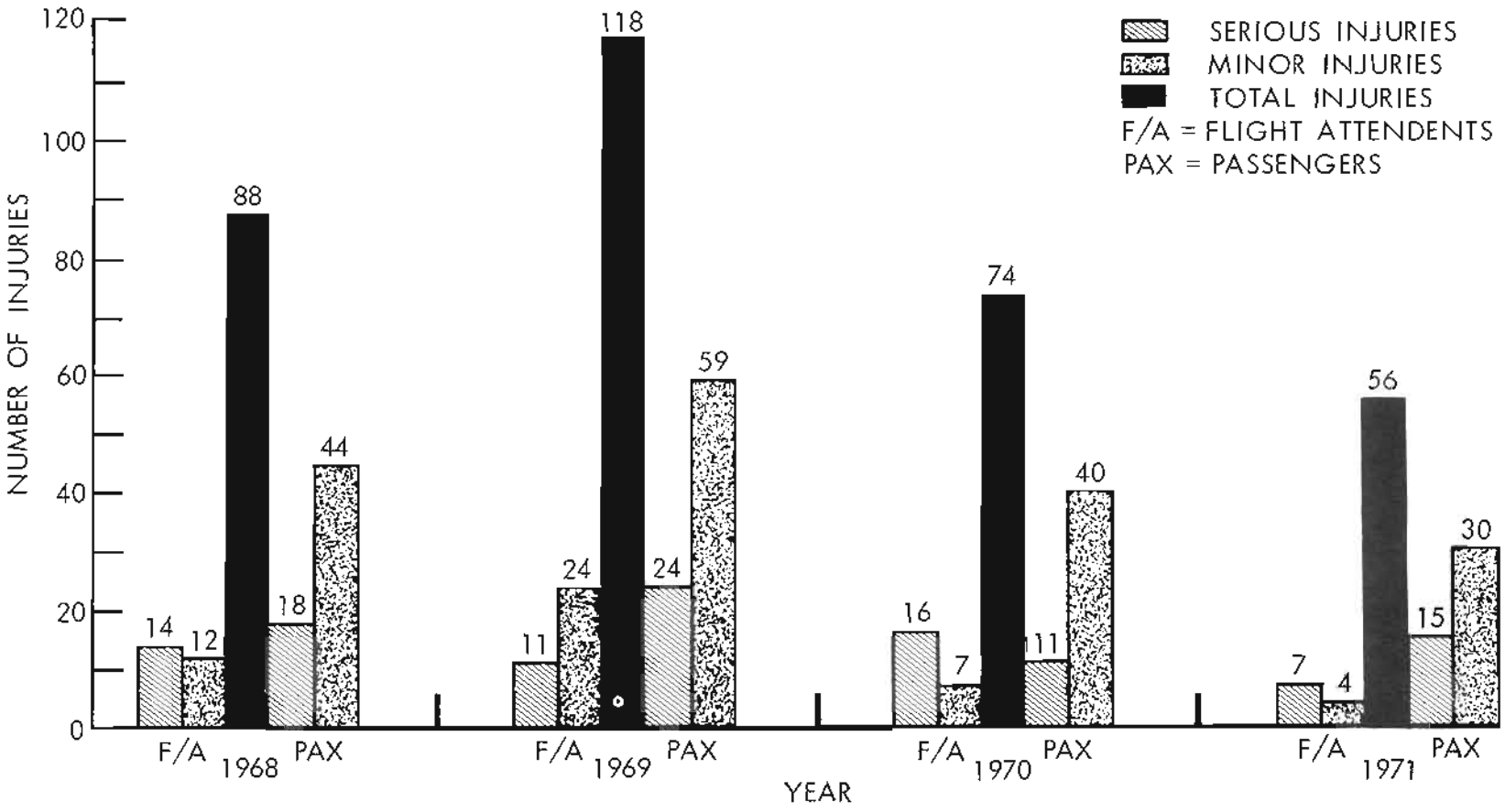


FIGURE 3

SEVERITY OF INJURIES RESULTING FROM EVASIVE MANEUVERS

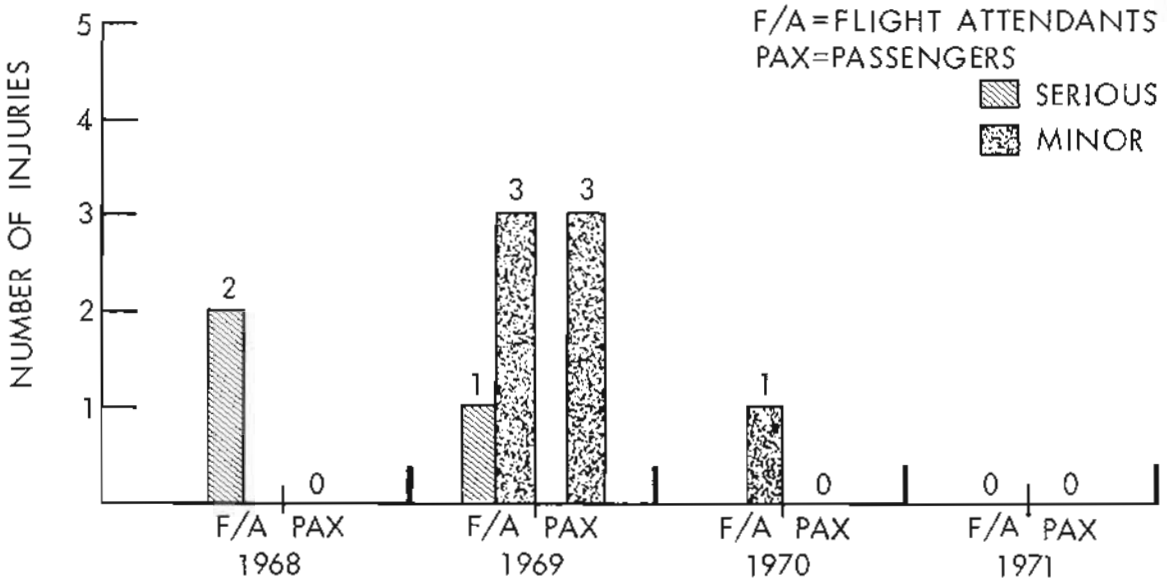


FIGURE 4

INJURIES RESULTING FROM SELF-INITIATED ACTIONS

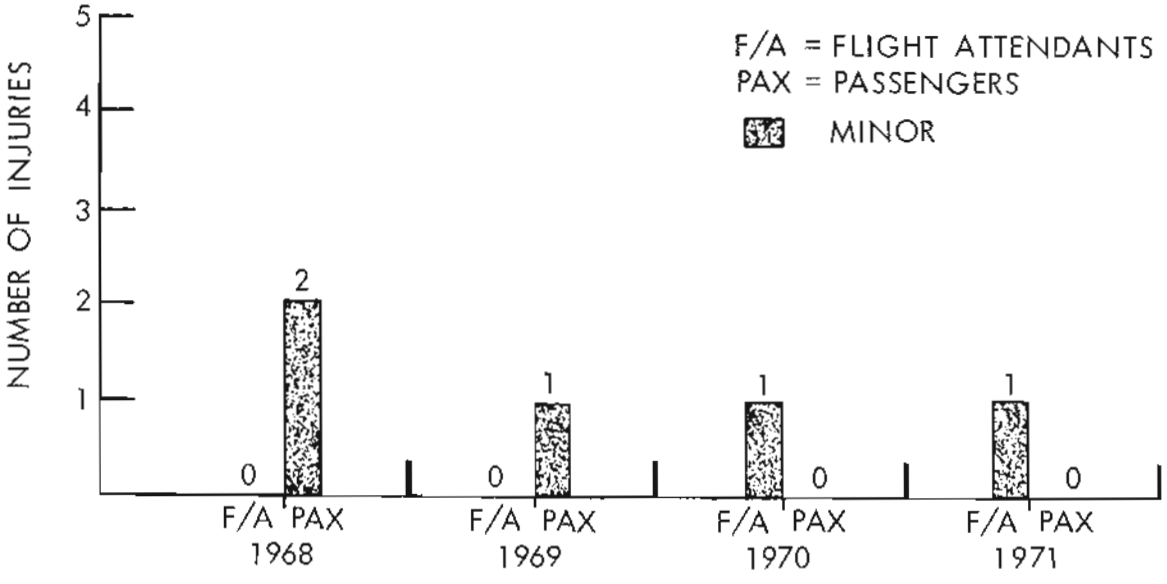


FIGURE 5

TABLE 1

PASSENGER INJURIES AS A RESULT OF LOCATION IN THE AIRPLANE

	YEAR							
	1968		1969		1970		1971**	
LOCATION*	S	M	S	M	S	M	S	M
FORWARD CABIN		1	1		1			
MID-CABIN	6	30	1	1	1	4		
REAR CABIN	4	1	3	22	2	14		3
GALLEY/BUFFET	3		7	4	1	1		
LAVATORY/LAV. AREA	5	6	4	2	1	4	4	

*DATA ON PASSENGER LOCATIONS ARE NOT ALWAYS REPORTED. THESE FIGURES REPRESENT MINIMUMS

**1971 DATA ARE INCOMPLETE

S = SERIOUS INJURY

M = MINOR INJURY

TABLE 2

FLIGHT ATTENDANT INJURIES AS A RESULT OF LOCATION IN THE AIRPLANE

	YEAR							
	1968		1969		1970		1971**	
LOCATION*	S	M	S	M	S	M	S	M
FORWARD CABIN	1				3	1		
MID-CABIN	3	2		2	1	2		1
REAR CABIN	3	1	5	10	2	1		2
GALLEY/BUFFET	7	2	5	14	10	4	4	1
(REAR)	(4)	(2)	(3)	(11)	(8)	(3)	(1)	
LAVATORY	1		2	1				

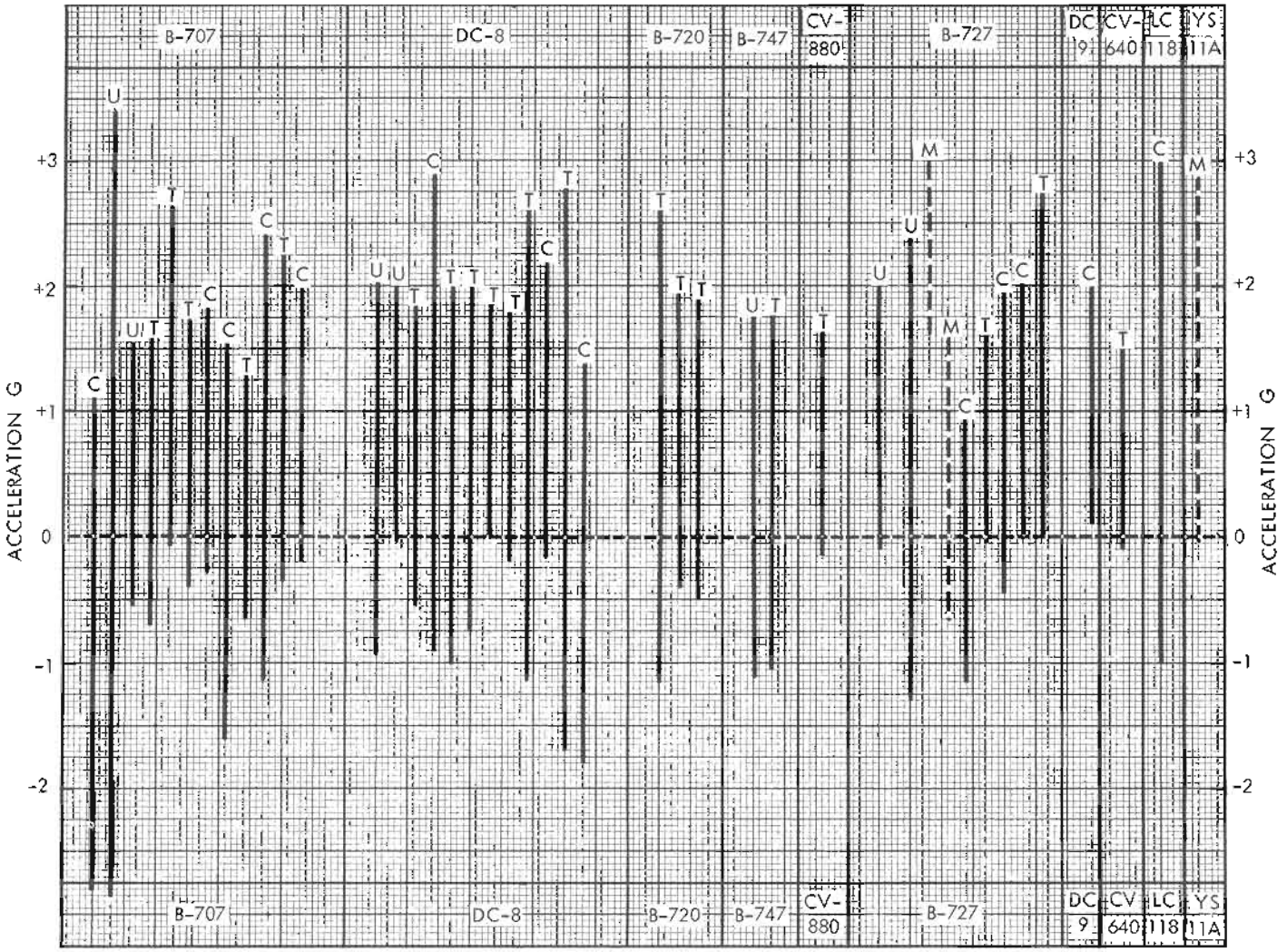
*DATA ON FLIGHT ATTENDANT LOCATIONS ARE NOT ALWAYS REPORTED. THESE FIGURES REPRESENT MINIMUMS

**1971 DATA ARE INCOMPLETE

S = SERIOUS INJURY

M = MINOR INJURY

EXCURSION OF FLIGHT RECORDER ACCELERATION TRACE FOR TURBULENCE AND EVASIVE MANEUVERS
1968 THROUGH 1971 INCLUSIVE



AIRPLANE MODEL

FIGURE 6

NOTES

C: ATTRIBUTED TO CLEAR AIR TURBULENCE

T: ATTRIBUTED TO NEAR THUNDERSTORM

M: EVASIVE MANEUVER

U: TYPE OF TURBULENCE EITHER NOT REPORTED OR ACCIDENT IS STILL UNDER INVESTIGATION

VERTICAL ACCELERATION IS SENSED AT OR NEAR AIRCRAFT CENTER OF GRAVITY

+1 G IS NORMAL STEADY-STATE ACCELERATION

YEARLY SUMMARY OF NONFATAL FLIGHT ATTENDANT AND PASSENGER INJURIES

TABLE 3
1968

TYPE OF INJURIOUS SITUATION	NUMBER OF REPORTED ACCIDENTS	INJURIES						TOTAL		
		FLIGHT ATTENDANTS			PASSENGERS					
		S	M	N	S	M	N	S	M	N
TURBULENCE										
CAT	6	3	1	40	5	0	339	8	1	379
THUNDERSTORM	7	4	8	38	5	39	425	9	47	463
UNKNOWN	7	7	3	51	8	5	442*	15	8	493*
SELF-INITIATED	3	0	0	12	2	0	155	2	0	167
EVASIVE MANEUVER	1	2	0	4	0	0	85	2	0	89
TOTAL	24	16	12	145	20	44	1446	36	56	1591

*TOTAL NUMBER OF PERSONS ONBOARD UNKNOWN

S = SERIOUS M=MINOR N=NONE

TABLE 4
1969

TYPE OF INJURIOUS SITUATION	NUMBER OF REPORTED ACCIDENTS	INJURIES						TOTAL		
		FLIGHT ATTENDANTS			PASSENGERS					
		S	M	N	S	M	N	S	M	N
TURBULENCE										
CAT	8	4	11	42	7	9	532	11	20	574
THUNDERSTORM	11	7	13	70	17	50	1183	24	63	1253
UNKNOWN	0								0	
SELF-INITIATED	1	0	0	6	1	0	89	1	0	95
EVASIVE MANEUVER	1	1	3	3	0	3	47	1	6	50
TOTAL	21	12	27	121	25	62	1851	37	89	1972

S=SERIOUS M=MINOR N=NONE

YEARLY SUMMARY OF NONFATAL FLIGHT ATTENDANT AND PASSENGER INJURIES

TABLE 5
1970

TYPE OF INJURIOUS SITUATION	NUMBER OF REPORTED ACCIDENTS	INJURIES						TOTAL		
		FLIGHT ATTENDANTS			PASSENGERS					
		S	M	N	S	M	N	S	M	N
TURBULENCE										
CAT	5	2	0	32	3	0	244	5	0	276
THUNDERSTORM	9	12	7	54	3	29	796	15	36	850
UNKNOWN	2	2	0	23	5	11	172	7	11	195
SELF-INITIATED	1	1	0	14	0	0	76	1	0	90
EVASIVE MANEUVER	1	1	0	3	0	0	16	1	0	19
TOTAL	18	18	7	126	11	40	1304	29	47	1430

S=SERIOUS M=MINOR N=NONE

TABLE 6
1971

TYPE OF INJURIOUS SITUATION	NUMBER OF REPORTED ACCIDENTS	INJURIES						TOTAL		
		FLIGHT ATTENDANTS			PASSENGERS					
		S	M	N	S	M	N	S	M	N
TURBULENCE										
CAT	4	2	3	23	2	1	373	4	4	396
THUNDERSTORM	6	4	1	52	7	29	680	11	30	732
UNKNOWN	5	1	0	34*	6	0	369*	7	0	403*
SELF-INITIATED	1	1	0	6	0	0	75	1	0	81
EVASIVE MANEUVER	0		0			0			0	
TOTAL	16	8	4	115	15	30	1497	23	34	1612

*TOTAL MAY NOT BE COMPLETE FOR 1971 ACCIDENTS

S=SERIOUS M=MINOR N=NONE

Injuries sustained by attendants and passengers, as shown in Figures 8 and 9, were minor in all cases reported. The most common injuries were contusions and lacerations which resulted from a person's being thrown to the floor or against adjacent seats and other passengers, and head and back injuries which resulted from striking overhead paneling.

Information regarding seatbelt announcements and seatbelt signs was available for only 16 of the 36 incidents reported. Of the 16 cases reviewed, most injuries could have been prevented, or at least minimized, if passengers had heeded seatbelt signs and verbal announcements and had kept their seatbelts snugly fastened.

An attempt was made to correlate occupant location within the cabin to injury susceptibility. Again, in only 16 cases were passenger and attendant locations reported. Seatbelt information was similarly lacking, as was information regarding the type of injuries sustained and the injury source.

IV. INJURIES AS RELATED TO LOCATION AND MOBILITY

Available in-flight injury data were examined to determine the relationship between the nature and the severity of injury and occupant location, activity, or restraint. This analysis led to the development of a hierarchy of risks for potential injuries which is depicted graphically in Figure 10. The available data indicate that the farther a person is located from the aircraft's center of gravity, the higher is his potential for injury. Thus, occupant injury potential is greatest in the rear of the aircraft.

Figure 10 indicates that mobility within the aircraft is a significant factor in injury risk. Since flight attendants move about the cabin more frequently than passengers, their risk of injury is much greater – associated as it is with the nature of their duties and proximity to injurious objects in galley areas and on serving carts or trays. Figure 10 illustrates a definite correlation between passenger and flight attendant mobility, seatbelt discipline, airframe response at various cabin locations, certain aspects of interior design, and the locations for lavatories, lounges, and galleys.

V. FACTORS WHICH MAY LEAD TO IN-FLIGHT INJURIES

Potentially injurious in-flight situations – turbulence, evasive maneuver, and self-initiated action – were examined to identify those factors which contribute most significantly to personal injury. The following factors are noteworthy:

Passenger Information

Information regarding the use of seatbelts and other aircraft safety features is presented in four ways: pretakeoff briefing by flight attendants, safety cards located in seatback pockets, signs, and announcements. As indicated below, there are certain inherent shortcomings in each method of instruction.

The pretakeoff briefing includes a short description of the location of exits, use of seatbelts, and demonstrations of the use of oxygen masks. To augment the briefing, passengers are requested to refer to the safety cards for additional information. Certainly, the most opportune time to acquaint air travelers with the necessity for the continuous wearing of seatbelts is during the pretakeoff briefing. However, the reasons given for the continuous wearing of seatbelts are sometimes worded so that passengers are not properly informed of the real intent: to prevent or minimize injuries if an evasive maneuver must be made or if turbulence is encountered.

If briefings are given in a factual and forthright manner and presented in an interesting way to encourage more forcefully the continuous wearing of seatbelts, the briefings can be instrumental in significantly reducing the frequency and severity of in-flight injuries. Several approaches to improving aural and written passenger-safety instructions have been explored by

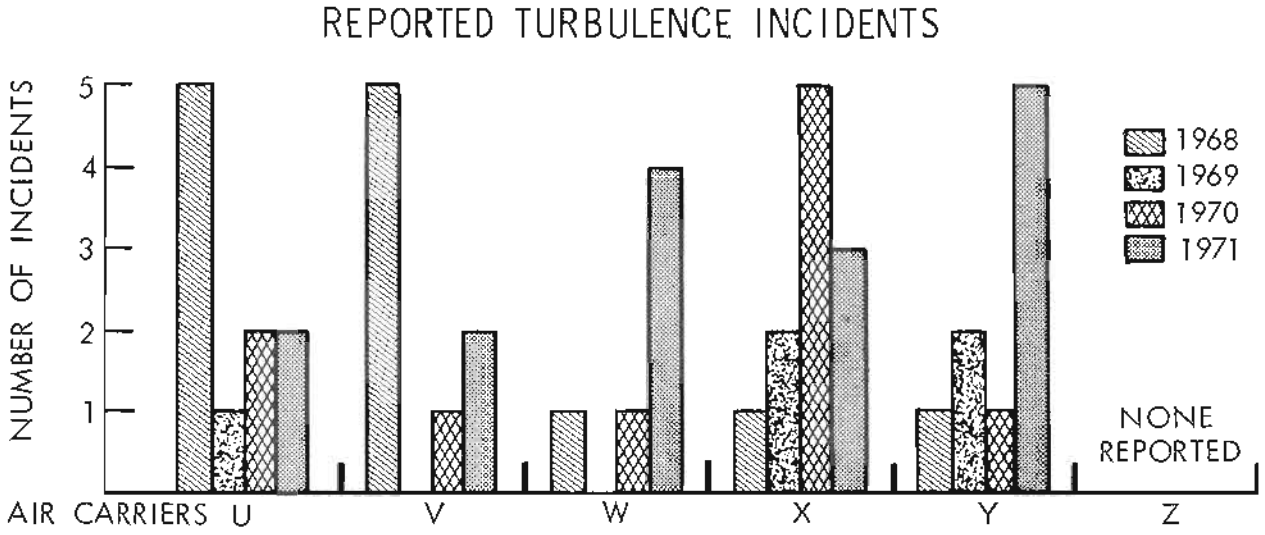


FIGURE 7

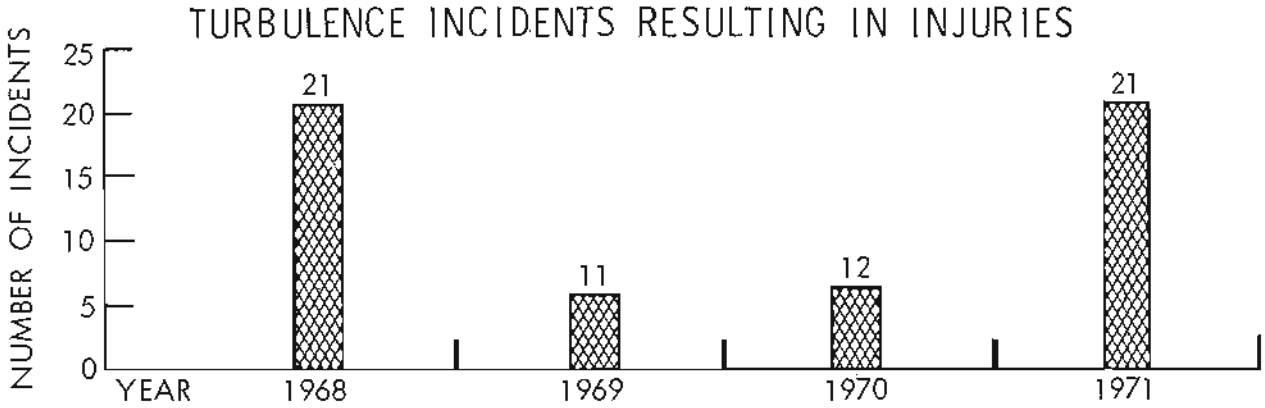


FIGURE 8

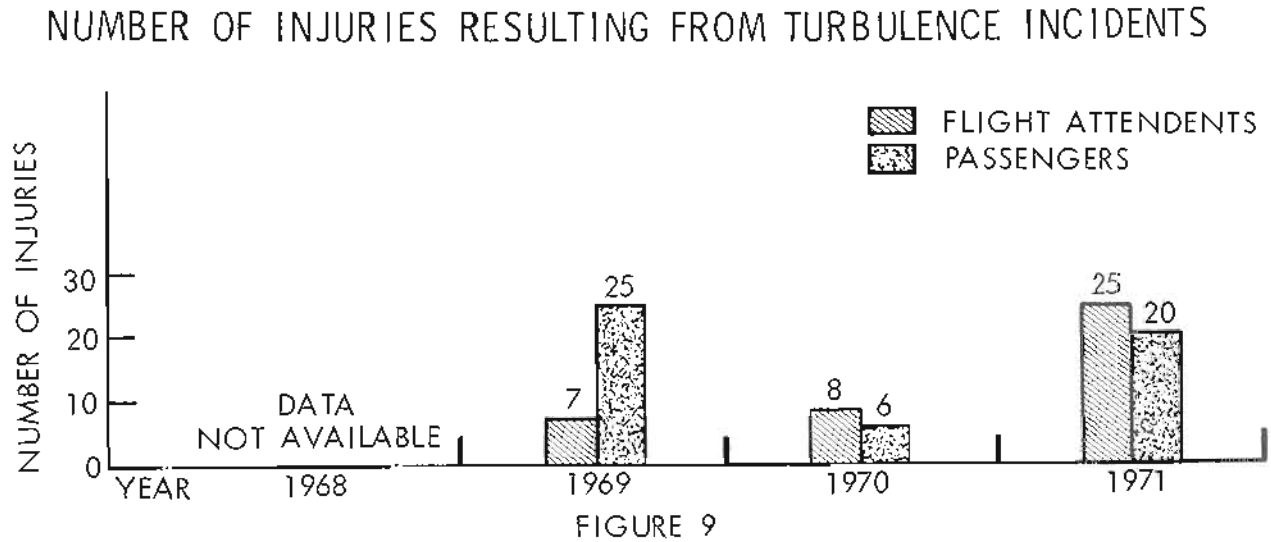


FIGURE 9

HIERARCHY OF RISKS FOR POTENTIAL INJURIES

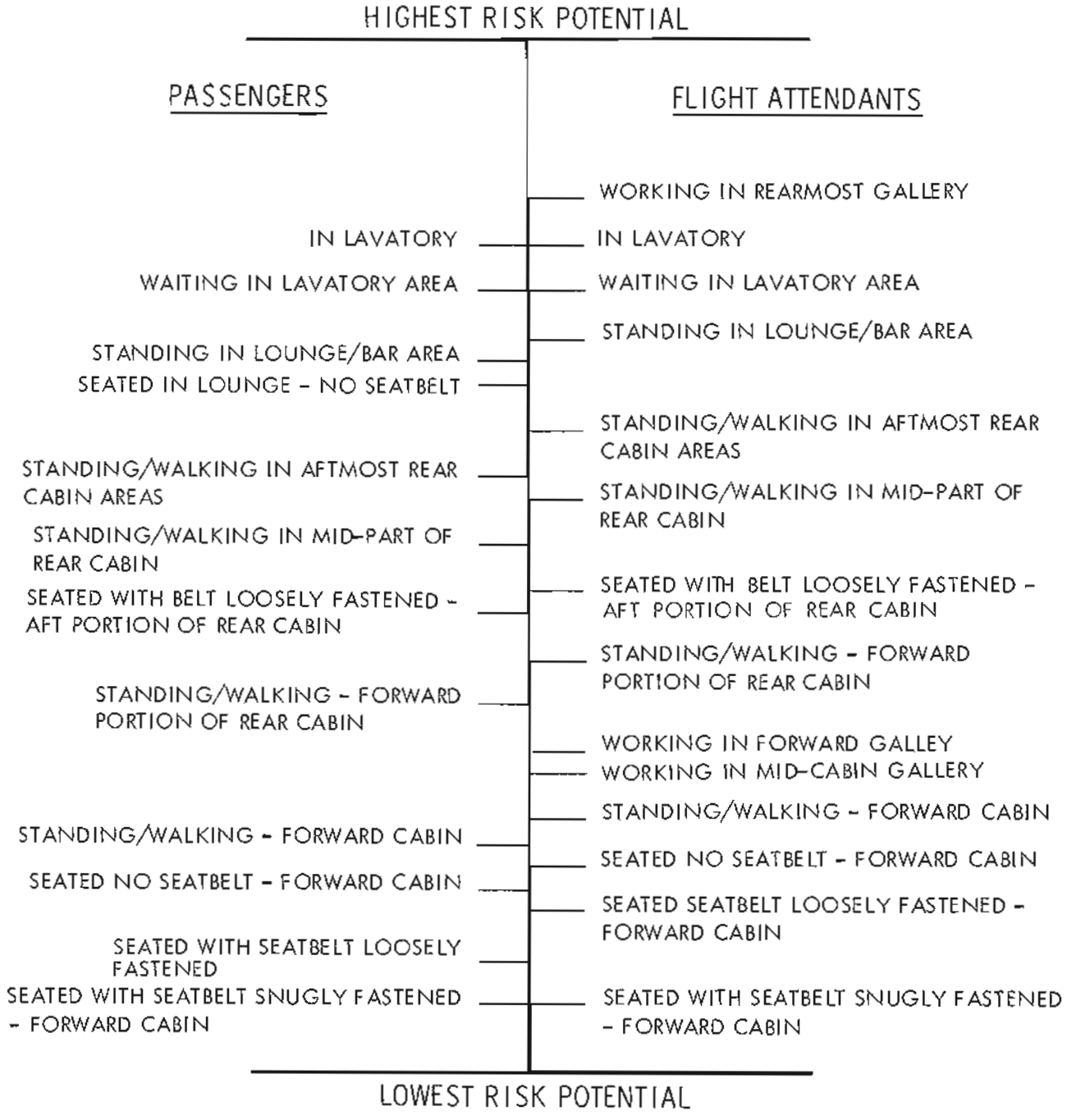


FIGURE 10

the Douglas Airplane Division, McDonnell Douglas Corporation, where research has been conducted to identify methods of presenting safety-card information clearly and in an interesting format. However, additional effort of this sort is indicated.

The ability of passengers to hear and understand the pretakeoff briefings as well as the in-flight announcements, may be further compromised by such factors as the flight attendant's voice inflection, the degree of interest projected during presentation of the briefing, and the ambient noise inside the cabin. Since flight attendants may be required to present many takeoff briefings during a typical multistop day, familiarity with the briefing content, plus the number of times it must be given during short-trip segments, can lead to a less-than-optimum presentation. This, in turn, may lead to passenger indifference to the briefing. A practice of rotating briefing presentations among the flight attendants could be used to maintain the necessary level of interest.

Passenger Indifference to Safety

Reports of recurring instances in which passengers fail to heed repeated seatbelt announcements of anticipated turbulence indicate the existence of a continuing, serious problem. Several explanations may account for this indifference to personal safety. First, many air travelers may not understand fully the reasons for having seatbelts fastened at times other than during takeoff and landing. A second explanation may be the rejection of personal safety due, in part, to the passenger's experience as a "seasoned traveler" who has flown for years without experiencing either an evasive maneuver or turbulence severe enough to cause discomfort or injury. His nonchalance may stem from the attitude: "It can't happen to me!"

Although much publicity has been directed to the public concerning the advantages of seatbelts in automobiles, indifference toward this publicity is evidenced by data from a controlled study by the Insurance Institute for Highway Safety [3]. This study shows that a recent television campaign which stressed the need for wearing seatbelts had no effect on seatbelt usage. These data, although applicable to automobiles, may also be indicative of an inherent objection by the traveling public to the use of voluntary safety devices. It may be argued that as compared to an automobile, an airplane cabin is a more controlled environment, where flight attendants check seatbelts and where seatbelt announcements are made and seatbelt signs are turned on when necessary. Nevertheless, it is apparent that some passengers, in the absence of an obviously dangerous situation such as turbulence or an evasive maneuver, seem to feel that the wearing of a seatbelt is a needless encumbrance and completely unwarranted. To other passengers, continued reminders to wear seatbelts may constitute a threat to their feeling of well-being and to their freedom of movement.

A final explanation which can lead to passenger indifference to safety may stem from the inconsistency between some airline advertising, which encourages passenger mobility on wide-bodied airplanes, and the responsibility of flightcrews to ensure passenger safety. Some airline advertisements tend to encourage passengers to remain out of their seats by depicting passengers congregating in lounge areas and around standup bars, casually sitting on armrests, or occupying lounge seats and sofas with seatbelts unfastened. Greater mobility of passengers aboard these large airplanes and the distance passengers must walk to visit lounge areas or lavatories tend to increase the risk of injury if passengers are out of their seats at the time the airplane encounters turbulence or makes an evasive maneuver. Although no passenger injuries have been reported as a result of their congregating in rear cabin lounge areas, it seems only a matter of time until injuries will occur in those locations.

Locating lounges and lavatories close to the aircraft center of gravity would minimize the effects of turbulence on passengers when using such facilities.

Timely Warning of Turbulence

The timeliness of an alert that turbulence is expected is a major operational factor which affects the likelihood and severity of passenger injury. The timely alerting of flight attendants has a direct bearing on the degree of preparedness and, consequently, on the amount of injury protection afforded to cabin occupants. Reports indicate that there was, in some cases, insufficient time between the warning to passengers and flight attendants and the occurrence of turbulence. In other cases reviewed, passengers who were out of their seats, but were attempting to comply with the alert, were injured when turbulence was encountered.

Timely alerting has a significant bearing on the flight attendants' ability to configure the cabin properly for turbulence. Essential preparation takes time; if time is short, cabin safety can be compromised.

Coordination Between Flight Attendants and Cockpit Crew

The captain is responsible for determining when the seatbelt sign is to be turned on, either in anticipation of turbulence or when turbulence is encountered. On larger airplanes, in which cockpit acceleration in turbulence may be much less than acceleration in the rear cabin, it is difficult for the cockpit crew to assess correctly the roughness of the ride experienced in the rear of the airplane. Unless the captain is advised routinely of the difficulty which flight attendants are having in providing cabin services or of the difficulties experienced by the passengers, the captain may not be aware of the potentially hazardous conditions existing in the cabin. Air carriers should periodically remind flightcrews of the need for coordination between cockpit and cabin personnel when they enter areas of known or suspected turbulence.

Another concern is the timing of the captain's decision to order the flight attendants either to postpone or to suspend cabin services because of turbulence. Again, it may be necessary for the captain to rely on information supplied by the flight attendants regarding the severity of the turbulence. A too conservative approach on the part of the captain may lead to his having flight attendants remain seated for an unnecessarily long time. This practice may tempt attendants to make up for lost time when they are permitted to resume cabin service. Yet, a less-than-conservative approach on the part of the captain in ordering attendants to be seated can result in their being caught unaware or being warned too late to prepare the passengers, secure food and beverage service items, and then be seated.

Workload of Flight Attendants

Workload often compromises the flight attendants' opportunity adequately to monitor passenger seatbelt discipline. An accident occurring over Lake Charles, Louisiana, on January 4, 1972, serves as an example. Four attendants were serving meals to 268 passengers in the rear coach sections of a Boeing-747. Because turbulence was anticipated, a number of seatbelt announcements were made by the captain and attendants. Approximately 30 minutes after the first announcement, one jolt was experienced, and four attendants and more than 30 passengers received injuries which ranged in severity from minor to serious. The flight attendants' workload while they were serving meals required their time to maintain passenger seatbelt discipline during the 30-minute period.

It is the Safety Board's view that flight attendants should be made aware when a safety priority exists, and, when seatbelt announcements are made, that cabin service should be resumed only after attendants have verified that all passengers are seated, with seatbelts fastened snugly.

Current flight attendant-to-passenger ratios are predicated upon providing the necessary number of attendants to assist in emergency evacuations. Based on the limited data available,

a more equitable distribution of attendants between first-class and coach cabins could assist in maintaining passenger seatbelt discipline and accomplishing other cabin safety duties.

Passengers tend to remove their seatbelts if no apparent turbulence danger exists over a prolonged period. Without a sufficient number of attendants in areas occupied by the majority of passengers, the flight attendants' ability to monitor seatbelt discipline is compromised. A practice which has been suggested by several flight attendants to assist somewhat in alleviating the problem is to instruct flight attendants to request that seatbelts be fastened prior to beverage or meal service. This could help to minimize the possibility that serving trays and utensils may become momentarily airborne during an evasive maneuver or turbulence. A further benefit of fastening seatbelts prior to meal service would be to avoid the inconvenience to passengers if the seatbelt sign should be illuminated while serving trays are in place.

Alcoholic Beverage Service

During 1960, when regulations regarding the serving of alcoholic beverages were being considered, primary concerns of the FAA were to prevent intoxicated passengers from boarding aircraft and to prevent passengers, once aboard, from imbibing from their own bottles.

For a number of years, air carriers did observe a voluntary limit of two in-flight alcoholic drinks per passenger. This practice was abandoned by several air carriers on November 3, 1969.

Early in 1970, the FAA Administrator wrote to the presidents of all scheduled and supplemental passenger air carriers regarding the industry's abandonment of the two-drink limit and requested recommendations concerning the feasibility of air carriers' reestablishing an effective industry code. In response, the Safety Board agreed that self-imposed restrictions by the airlines would be the best solution to the problem, but, that if such measures should not prove effective, the FAA might consider instituting rulemaking proceedings. The FAA accepted voluntary industry controls. (See Appendix A.)

Within the past year, the Safety Board and the Civil Aeronautics Board have received numerous public inquiries regarding alleged hazards, on air carrier aircraft, which resulted from consumption of alcoholic beverages – allegations that since abandonment of the two-drink limit, intoxicated passengers have created disturbances, have been injured, have inflicted injuries on others, and have caused accidents. The Safety Board reviewed reported incidents and accidents within its own files and the files of the FAA covering the period 1968-1971 to determine the number of instances in which alcohol consumption was cited as a cause, or a causal factor, of either an incident or an accident involving an air carrier airplane. These records disclosed no accidents caused by intoxicated passengers nor any instance in which intoxicated passengers prevented, or otherwise hampered, evacuation of an airplane following an emergency landing.

FAA files disclosed 118 incident reports of passenger disturbances during the 4-year period under study. Disturbances were divided into four categories:

1. Disruptive passengers (encompassing reports of crew interference, intoxicated passengers, and threats of bodily harm against the crew or other passengers).
2. Threats to hijack.
3. Attempts to hijack.
4. Armed passengers.

For purposes of this study, only reported incidents regarding disruptive passengers were examined. These totaled 56 for the years 1968-1971. In 1968, the number of these incidents was 10. The number rose to 13 in 1969, and to 22 in 1970. Only 11 cases were noted for 1971.

Alcohol-related incidents are shown in Table 7. In only 25 of the 118 cases of passenger disturbance did reports indicate that alcohol might have played a role. In the 2-year period from November 3, 1969, 23 cases were reported wherein passenger disturbance could have been

TABLE 7

ALCOHOL-RELATED INCIDENTS

	1968*	1969	1970	1971	TOTAL
TOTAL INCIDENTS REPORTED	27	44	31	16	118
DISRUPTIVE-PASSENGER CASES	10	13	22	11	56
ALCOHOL-RELATED CASES	2	7	10	6	25
TYPE OF ALCOHOL-RELATED PROBLEM REPORTED:					
THREAT TO HIJACK		1			
ATTEMPT TO HIJACK		2		2	
ARMED PASSENGER		1			
DISRUPTIVE PASSENGER WHO:					
Attempted to board airplane while intoxicated, but was stopped			1		
Boarded aircraft while intoxicated and takeoff was postponed until passenger was removed		1	1		
Fought with crewmembers or other passengers		1	4	1	
Drank from own bottle		1		1	
Became unruly, belligerent, or verbally assaulted crewmembers or other passengers			4	2	
	2*	7	10	6	

SOURCE: Federal Aviation Administration incident reports.
*Data for 1968 are incomplete..

attributed in some degree to the consumption of alcohol. There were six instances of hijacking attempts or threats, or armed passengers; the other 17 cases dealt exclusively with varying degrees of passenger intoxication, and therefore they are the incidents reportable to the FAA.

Table 7 indicates that the more frequent occurrences involved intoxicated passengers who became verbally abusive to attendants or to other passengers. The second, a more common type of incident, involved intoxicated passengers who physically assaulted either a crewmember or another passenger.

FAR Section 121.575 states that no certificate holder may allow any person to board any of its aircraft if that person appears to be intoxicated. Since the boarding agent has personal contact with all passengers, he is responsible to the air carrier for ascertaining not only certain behavioral aspects of potential hijackers, but also for making a judgment of the level of intoxication of boarding passengers. Although the data of Table 7 suggest that the boarding of intoxicated passengers is infrequent, additional reports of intoxicated passengers who were permitted to board were found in the files of associations which represent flight attendants.

The need for airlines to project goodwill, the reluctance of gate personnel to disrupt normal airplane boarding and possibly precipitate a public spectacle, and the flightcrew's concern with adherence to scheduled departure can all combine to permit an apparently intoxicated passenger to board, regardless of a flight attendant's assessment. This happens rarely, but attendants have reported such cases to their companies and associations. It follows logically that if an attendant should rebuff an apparently intoxicated passenger or request that the passenger not be allowed aboard, she could be embarrassed during the flight if she had been overruled by the captain or gate personnel. Where such passenger/flight attendant confrontations have ensued, situations have arisen in which apparently intoxicated passengers have assaulted others, both verbally and physically.

Although there are few reported incidents involving passengers who were found drinking from their own bottles, those incidents which did occur often resulted in a disturbance when they were informed that they were violating a Federal regulation and that the bottles had to be put away. In incidents which involved the use of alcohol, flight attendants normally informed the captain, who either talked personally to the passenger or sent another flightcrew member to resolve the matter. Such efforts generally have been adequate.

Other facts to be considered in the interpretation of the data on alcohol-related incidents are: First, reported incidents were relatively few when compared with the number of passengers carried each day by scheduled air carriers. Second, only when an intoxicated passenger created a disturbance was a company report filed. When the captain decided that a disturbance was minor, or when the passenger became docile or fell asleep following the disturbance, no report was filed. Third, a disparity exists between the number of cases found in the files of the FAA and those of flight attendant associations. This disparity could stem fron several conditions. Often, the in-flight screening by the captain determines whether a company report is to be filed. Also, a form of screening occurs when an attendant chooses not to report a minor disturbance to the company but rather elects to report it to the association. When the flightcrew and an air carrier deem a disturbance to be serious, the air carrier is required, by FAR 121.575, to report the occurrence to the FAA within 5 days.

In order to assess properly the significance of both the abandonment of the two-drink limit and the number of passenger disturbances, more complete data must be made available. Similarly, until more service experience is gained with the use of lounges and standup serving bars, no meaningful assessment can be made of the effects which these interior design features have on the frequency of passenger disturbances attributable to intoxication.

FAA's interest in determining the extent of alcohol involvement in passenger disturbances is evidenced by the survey requested in FAA Notice N 8430.192 of January 17, 1972 [4]. These data and findings should further aid in determining whether a serious problem exists.

VI. POTENTIALLY INJURIOUS CABIN FURNISHINGS

This review of injury reports disclosed a marked similarity in the manner in which injuries were inflicted. The most common cabin items capable of producing injury were found to be passenger seats, ceilings and side walls, lavatories, galleys and food-service items. (See References 5 through 10 which describe previous injury studies and suggested solutions to minimize or prevent injuries sustained in the cabin environment.)

Passenger Seats

The severity of injury to a person when he forcefully strikes a seat structure is determined by several factors. First, the severity of turbulence or an evasive maneuver obviously affects the magnitude of acceleration loads on a seat occupant. Second, the distance from the airplane's center of gravity can influence these loads as well as the translation of the passenger who is not properly seatbelted. Whether the person's seatbelt is fastened snugly, loosely, or not at all during turbulence, will obviously influence the amount of motion he experiences with relation to the seat and surrounding cabin furnishings.

Severity of injuries increases with a decrease in seatbelt security. Injury reports revealed that rib fractures were common when armrests were struck. Facial fractures occurred when seatbacks were struck. Fractures to extremities resulted from impacting the seat in front or adjacent seats. Abdominal bruising and internal injuries also resulted from impacts with seatbelts loosely worn.

The most severe injuries were sustained by passengers whose seatbelts were not fastened at all when an abrupt change in flightpath was experienced. As can be expected, the same accelerative loads which cause minor injuires to passengers who are snugly seatbelted are likely to cause unrestrained persons to be thrown from their seats. Once a person is thrown from his seat, certain predictable results can occur. Depending upon the magnitude and direction of the force, a person's trajectory can cause him to strike other persons, the ceiling or floor of the cabin, overhead baggage bins, adjacent seats, galleys, or food serving carts. Typical injuries have included multiple fractures, internal injuries, head injuries, and severe lacerations.

Ceiling, Overhead Baggage Bins, and Side Panels

Among the most common materials used in cabin interiors are vacuum-formed plastics and fiberglass-reinforced plastics. Sometimes these materials are covered with padding to provide a cushioned surface. The ductility of these materials, the type of surface padding, the absence of protrusions, and the methods used to attach ceiling and side panels to the cabin structure can all tend to distribute forces evenly over large areas upon impact. However, instances have been reported in which loosened ceiling panels fell on cabin occupants, and in some cases these panels have been punctured and splintered on impact.

Generally, when cabin occupants strike side panels, windows, and window frames, only minor head, face, shoulder, and arm bruises result. This is true because most turbulence encounters result in vertical displacement of passengers, with only relatively small, secondary lateral displacement.

Lavatories and Adjacent Areas

Acceleration and fuselage displacement may be greatly amplified at the aft cabin location of most rear lavatories. During turbulence, the

most common injuries sustained in these often confined areas were fractures of extremities, internal injuries, facial and head lacerations, multiple abrasions, and contusions. These injuries occurred when persons struck – and, sometimes, penetrated – ceiling panels. Other injuries occurred when persons struck galley equipment, boarding doors, flight attendant seats, cabin dividers, coat closets, and lavatory bulkheads.

Although it may not be practical to afford maximum protection against all eventualities for passengers who are waiting in these areas, airplane manufacturers should recognize, nevertheless, that these areas are frequently highly congested and that additional efforts to make them less hazardous are warranted.

Inside the lavatories, persons have been buffeted between ceiling and floor. Because of the small size of these lavatories, injuries have been sustained when side walls, sinks, commodes, and miscellaneous fixtures were struck. Serious injuries have been sustained when hard, unyielding stainless steel counter tops, sinks, fixtures, etc., were struck.

Finally, great difficulty has been reported in removing an injured person from a lavatory, essentially because of the difficulty in readily unlocking the door from the outside or because an incapacitated or unconscious person who is lying on the floor blocks the inward opening of the door. Difficulties have been experienced by flightcrews and flight attendants in attempting to remove doors in order to extricate injured persons.

Food and Beverage Service Items

Injuries which result when persons impact stowed seatback-mounted trays are generally limited to minor head and face abrasions and contusions, assuming, of course, that the person has his seatbelt fastened snugly. However, a snugly fastened seatbelt can still permit the seat occupant to strike an unstowed, seatback-mounted tray or other type of tray provided by the flight attendant. Obviously, the degree of tightness of the seatbelt determines how far the passenger will move vertically into the food service trays. If breakable glassware, china, heavy casserole dishes, or other beverage or food utensils are on the serving trays, passengers are, of course, exposed to additional hazards during turbulence or evasive maneuvers.

Within the past few years, beverage and food service carts have become larger, heavier, and capable of carrying more serving utensils, dinnerware, food, and beverages. Reports show that turbulence has caused unrestrained and unlocked service cart contents to become projectiles. Although no serious injuries have thus far resulted, there have been instances in which heavy serving dishes and utensils inflicted minor injuries and the spilling of hot food or beverages scalded passengers and flight attendants.

Galley Equipment

The most common and most time-consuming passenger-service function for flight attendants is the preparation and serving of beverages and meals. As indicated in Table 2, attendants receive injuries most frequently during turbulence if they are located in galley areas. Furthermore, risks are higher if the galleys are located farthest aft in the fuselage. Some reports indicate that locking mechanisms have failed under moderate in-flight loading, thereby causing the spilling of contents from ovens, drawers, and storage cabinets. Failure of locking mechanisms has been attributed to wear or to poor design. If locks are capable of failing under moderate flight loadings and if turbulence is encountered, open ovens, doors, or drawers, as well as their contents, constitute extremely hazardous objects to flight attendants and passengers.

Although attempts have been made to remove hazards in galleys aboard newer airplanes, a number of recurring hazardous features still exist; e.g., latches which unlock under moderate in-flight loads, sharp edges on work counters and

doors, and inadequate means for securing loose items on counter tops.

In addition to the aforementioned problems, it is pointed out that some flight attendants are prone to leave certain miscellaneous service items on counter tops, even after meals or beverages have been served. It should be emphasized that good housekeeping practices are essential at all times in order to minimize the injury potential of food and beverage service utensils which can become dangerous missiles when the flightpath abruptly changes.

Lounge Furnishings

Although available information does not indicate a definite causal relationship between in-flight injuries and the furnishings found in typical lounge areas, some examples of potentially injurious furnishings can be cited. Relatively sharp edges and corners of tables and cabin separators pose a hazard. The lack of padding on tables and other hard surfaces also can contribute to injury. Decorative articles, such as lanterns, lighting fixtures, and plaques which are attached to walls and cabin separators are potential sources of lacerations and puncture wounds upon impact. Exposed, free-standing stairways and decorative banister-type cabin separators which have little or no padding can entrap extremities.

Manufacturers and air carriers should recognize that lounge furnishings must be noninjurious, as well as being decorative, esthetically pleasing, and functional.

Finally, the security of large liquor bottles atop standup service bars merits concern. Because of the possible location of bars in the rear cabin of wide-bodied airplanes, and because of the tendency of the aft fuselage to react more severely in turbulence, a definite need exists to secure bottles adequately at all times. A glass 4/5-quart liquor bottle or a magnum of champagne, when full, can weigh more than 2.5 pounds. A number of such bottles, unsecured on the bar when an abrupt change in flightpath is experienced, can become lethal missiles within the lounge. The proper stowage of bottles when they are not in use and a change to nonbreakable bottles would constitute prudent measures to help prevent in-flight injuries.

VII. TREATMENT OF INJURIES

In Flight

It has been contended that extensive first-aid training of flight attendants and the maintenance of large amounts of first-aid supplies aboard air carrier aircraft are not necessary, since most in-flight injuries are sustained near airports or within approximately 2 hours' flying time from an airport where professional medical assistance is available. The validity of this rationale may be refuted in light of a Boeing 747 takeoff accident and several in-flight turbulence accidents which also involved wide-bodied airplanes.

In the takeoff accident at San Francisco, California, on July 30, 1971, two passengers were injured seriously; one sustained almost complete amputation of a leg and suffered severe bleeding from upper shoulder injuries. The other passenger sustained lacerations which caused profuse bleeding. More than 2 hours elapsed from the time of the accident until the airplane was able to return to the airport. This accident, as well as several Boeing 747 turbulence accidents which resulted in many serious injuries, prompted the Safety Board to examine the adequacy of first-aid kits maintained aboard aircraft and to make related recommendations to the FAA. (See Appendix B.)

In some turbulence accidents, many passengers and attendants who were seriously injured have been required to wait more than 2 hours for the airplane to land, either because the captain chose to continue on to the planned destination or because of other mitigating circumstances, i.e., flying over the ocean, dumping fuel, etc.

If there is no doctor on board, the captain must appraise the seriousness of any injury and determine whether to continue the trip or to land at the first available airport. In either event, flight attendants are expected to provide first aid.

While it is totally unrealistic to expect flight attendants to be able to diagnose the myriad external and internal injuries which may occur, it is expected, nonetheless, that they have the capability – as readily as anyone who has received advanced first-aid training – to recognize the more common illnesses and injuries and to determine appropriate first-aid treatment. In addition, flight attendants should be able to provide the proper first-aid treatment calmly and efficiently and with confidence.

At least three airlines presently meet FAA first-aid training requirements by providing a 4-hour training period for new flight attendants. However, it is possible that these programs, which consist of lectures, movies, and limited class participation in mouth-to-mouth resuscitation, do not realistically prepare flight attendants to cope confidently with other than minor in-flight injuries.

At Destination

It was not within the purview of this study to review all aspects of postlanding rescue, removal, and treatment of persons injured in flight. However, one problem area does warrant consideration.

Fire department and ambulance personnel have experienced difficulty in removing stretcher-borne injured persons from aircraft to awaiting ambulances. It is especially difficult within confined cabin areas to lift persons suspected of having spinal fractures or internal injuries, particularly in view of the narrow aisles and high seatbacks which interfere with the handling of loaded stretchers inside the aircraft. Therefore, fire department and ambulance personnel should be made aware of the fact that seatbacks can be pushed forward to provide more clearance along the aisles. The Safety Board has recommended to the FAA that firm, narrow stretchers be used when handling injured persons within aircraft. (See Appendix C.)

Finally, it would be beneficial if airport authorities, in cooperation with local hospitals and airport fire departments, would encourage training drills in removing stretcher-borne injured persons from air carrier aircraft which operate regularly from their airport.

VIII. CONCLUSIONS

Based upon the facts presented in this study, the following conclusions have been reached:

1. At this time, there is no Federal Aviation Regulation which requires the reporting of minor in-flight injuries. However, the FAA does collect, on a selective basis, a limited amount of data on minor injuries.
2. Potentially injurious conditions which may predispose in-flight injuries are either environment-initiated or self-initiated. Of the environment-initiated mishaps, turbulence accounted for the majority of in-flight injuries to passengers and flight attendants. Sudden evasive maneuvers and instances during which persons fell or tripped in the airplane cabin were very infrequent.
3. Encounters with turbulence in the vicinity of thunderstorms caused more injuries than encounters with clear air turbulence.
4. Passengers sustained minor injuries more often than did flight attendants in both types of turbulence encounters. Flight attendants sustained far more serious injuries as a result of these same turbulence encounters.
5. The more common minor injuries sustained by passengers and flight attendants were contusions, abrasions, lacerations, and head and back injuries.
6. The more common serious injuries included fractured extremities, face and

head lacerations and fractures, and internal injuries.

7. A hierarchy of risks for potential injuries to passengers and flight attendants is apparent. This hierarchy is based upon the location and the mobility of cabin occupants, passenger seatbelt discipline, response of the airframe at various cabin locations, certain cabin furnishings, and the location of lavatories, galleys, and lounges.
8. The longer distances which passengers and flight attendants must walk to visit lounges and lavatories on wide-bodied airplanes increase their risk of being out of their seats when an abrupt change in flightpath is experienced.
9. Most injuries were sustained by passengers who were in the rear of the aircraft. This was the result of fuselage acceleration and displacement in the rear cabin, which caused persons to strike objects within lavatory and galley areas while they were out of their seats.
10. The vertical accelerometers at or near the center of gravity on large airplanes do not permit the determination of vertical acceleration in the rear cabin where most injuries occur.
11. Most passenger injuries which occurred in the rear of the cabin involved persons who were either waiting in the aisles for a lavatory to become vacant or who were occupying lavatories. These persons were unaware that seatbelt signs were on or did not hear seatbelt announcements.
12. On the basis of available data, no correlation was found between the consumption of alcoholic beverages and airborne injury patterns, injury severity, or injury frequency. In addition, trends which would attribute increases in passenger injuries to standup bars or lounges could not be found.
13. There is no evidence to indicate that passenger evacuation after an emergency landing has been either compromised or impeded by intoxicated passengers.
14. No injuries reported were attributable to the in-flight consumption of alcoholic beverages by passengers.
15. Airplane manufacturers and air carriers should recognize that lounge furnishings must be noninjurious as well as decorative, esthetically pleasing, and functional.
16. The timely alerting of flight attendants by the cockpit crew, as well as the maintenance of close coordination between cockpit and cabin crewmembers, is essential in preparing for turbulence. Frequently, flight attendants are not given warning prior to entering areas of turbulence in adequate time to prepare the passengers and to stow cabin service items.
17. Workload has often prevented flight attendants from monitoring passenger seatbelt discipline. It should be noted that without a sufficient number of attendants in cabin areas occupied by the most passengers, the attendants' time to monitor seatbelt discipline may be further reduced.
18. The inability of cabin attendants to maintain seatbelt discipline effectively and the capriciousness exhibited by passengers who refuse to heed warnings of anticipated turbulence are major contributory factors in in-flight passenger injury.
19. The pretakeoff passenger briefing can sometimes suppress the real reason for passengers to wear their seatbelts continuously. Passenger briefings, with proper content and manner of presentation, can be instrumental in reducing the frequency as well as the severity of in-flight injuries.
20. A passenger's indifference to his own safety can probably be attributed to his failure to understand the reasons that seatbelts are to be worn at all times and

that injuries are possible if certain precautions are not followed. Furthermore, the objection by some passengers to the use of voluntary safety devices and air carrier advertising which encourages passengers to remain out of their seats tend to foster indifference to personal safety.

21. Flight attendants have sustained injuries while they were performing normal cabin service duties, such as preparing and serving beverages and meals.
22. Most injuries to flight attendants were sustained in galley areas, particularly those galleys located in the rear of the cabin.
23. Equipment for storing, preparing, and serving beverages and meals appears to be the most common source of injuries to flight attendants. Contents of galleys and serving carts tend to become hazardous missiles when turbulence is encountered or an evasive maneuver is made.
24. First-aid training of flight attendants appears to be adequate for most minor in-flight injuries. However, certain inadequacies exist in the ability of attendants to treat serious in-flight injuries.
25. Postlanding treatment is hampered by the inability of rescue personnel to transfer the injured from the airplane to ambulances in safety and comfort. Narrow aisles, high seatbacks, and the necessity to maneuver stretchers within confined cabin areas present problems to those who handle heavily loaded stretchers.

IX. RECOMMENDATIONS

As a result of this study, the National Transportation Safety Board recommends that the Federal Aviation Administration:

1. Require that each galley, lavatory, lavatory waiting area, lounge, and standup bar area be so designed and constructed that persons using these areas will not be likely to suffer serious injury if turbulence or evasive maneuvers should be experienced in flight. Specifically, particular attention should be directed toward the improvement of padding on hard surfaces and protuberances, the elimination of sharp edges and corners, and the improvement of the security of items in galley areas. (Recommendation A-73-2)
2. Amend section 121.317 of the Federal Aviation Regulations to require that seatbelt signs be legible to each person, whether he is seated or standing, located in galleys, lounges, lavatories, or lavatory waiting areas. (Recommendation A-73-3)
3. Require that "Lavatory Occupied" signs be installed. These signs should be of sufficient size, color, and brightness as to be legible to all persons in the cabin, whether the persons are seated or standing (Recommendation A-73-4)
4. Prohibit the use of inwardly opening lavatory doors on new and refurbished aircraft, and provide means for rapidly unlocking lavatory doors from the outside without resorting to special implements. (Recommendation A-73-5)

The National Transportation Board recommends that the Air Transport Association of America and member air carriers:

1. Initiate a study to develop innovative methods for informing passengers of safety equipment and seatbelt usage. The work of Douglas Airplane Division, McDonnell Douglas Corporation, may serve as a guide to the more effective techniques for presenting passenger safety information. (Recommendation A-73-6)
2. Provide standardized guidelines to enable gate agents and other station personnel to identify apparently intoxicated persons and, subsequently, to handle these persons effectively. (Recommendation A-73-7)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H. REED
Chairman

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

Francis H. McAdams, Member, did not participate.
March 14, 1973.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

APPENDIX A

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

5 JAN 1970

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D. C. 20591

Dear Mr. Chairman:

Enclosed is a sample of a letter which I have sent, today, to the Presidents of all scheduled and supplemental passenger carrying air carriers, as well as a few scheduled intra-state commercial operators.

I would appreciate receiving your views on this matter.

Sincerely,

/s/
J. H. Shaffer
Administrator

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

APPENDIX A

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

I am writing you personally about a matter that is of mutual concern: drinking aboard air carrier flights.

My concern is directed solely to safety - the safety not only of immoderate drinkers, but far more importantly, the safety of the great majority with whom they travel - the moderate or non-drinkers.

Two events have triggered my interest: (1) a petition to the Federal Aviation Administration from an organization, representing a large number of flight attendants, to impose, by safety regulations, a so-called "2-drink limit" per flight; and (2) the termination by several domestic air carriers on 3 November 1969 of an industry agreement on the serving of alcoholic beverages aboard aircraft.

In reviewing the history of the present safety regulations, I find the agency's original concern was primarily with intoxicated passengers boarding aircraft, and with passengers drinking from their own bottles. Enforcement records show that those are still the most acute problems.

In regulatory actions taken back in 1960-1961 we took into account both existing and planned industry agreements to voluntarily control drinking on air carrier flights. It is our understanding that at one time 10 carriers subscribed to an agreement and that some carriers voluntarily established company policies similar to those in the agreement. We now understand that the voluntary agreement has gone by the boards and that most internal company policies have suffered a similar fate.

The intent of the agency and the spirit of the industry in coping with this problem was succinctly stated in the preamble to safety regulations issued by the Federal Aviation Administration on 6 January 1960:

> "Two of the carriers proposed that action on the proposed regulation be delayed to permit the air carrier industry to develop a code which would control the amount and time of serving alcoholic beverages aboard aircraft. The Agency is strongly in favor of any such voluntary agreements that can be reached among the carriers. To the extent that they are in effect and complied with, they would clearly contribute to decreasing any safety hazard arising from the consumption of alcoholic beverages aboard air carrier aircraft. On the other hand, a code of this kind could not reach the principal problem involved - that of uncontrolled consumption by a passenger of his own liquor supply. Therefore, the adoption of a code, while extremely helpful, would not meet the entire problem. The adoption of this regulation will not in any way inhibit the industry from adopting their own code, and in fact such a move would be viewed with favor by this Agency."

The agency wishes to reaffirm the above statement and again express its support of any action to set up an effective industry wide agreement to control the amount and time of serving alcoholic beverages aboard air carrier aircraft.

The complex and delicate nature of this problem is appreciated. Nevertheless, in the absence of some assurance that drinking by passengers will be reasonably controlled by the industry, we must re-examine the present safety regulations that already place a heavy responsibility on the air carriers. Therefore, to assist us in evaluating the above-mentioned rulemaking petition, I would appreciate receiving any views or suggestions you may have in this matter, including any recommendations concerning the feasibility of air carriers re-establishing an effective industry code.

Sincerely,

J. H. Shaffer
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

OFFICE OF
THE CHAIRMAN

February 13, 1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Shaffer:

Thank you for your letter of January 5, 1970, forwarding a copy of your letter addressed to the presidents of scheduled and supplemental air carriers.

Our records fail to indicate any occasion in which passenger drinking has contributed to the cause of an air carrier accident. However, we believe that unrestricted drinking in flight could present a potential hazard, particularly in the event of an emergency evacuation.

The best solution is for the air carriers to impose their own restrictions. Should it be concluded that such control is not effective, we recommend that you consider instituting a rulemaking proceeding.

Sincerely yours,

/s/
Louis M. Thayer
Acting Chairman

UNITED STATES OF AMERICA
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 11, 1972

Adopted by the NATIONAL TRANSPORTATION SAFETY BOARD
at its office in Washington, D. C.
on the 14th day of June 1972

FORWARDED TO:
Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION A-72-102 & 103

The National Transportation Safety Board has under investigation the National Airlines Boeing B-747, Flight 41, turbulence accident which occurred on January 4, 1972, near Grand Isle, Louisiana.

Our investigation has disclosed an area of concern regarding the adequacy of first-aid supplies on board the airplane. The number of first-aid kits, as well as the contents of the kits, appeared to have been inadequate to treat the 38 passengers and four stewardesses who sustained injuries. It was necessary for more than 2 hours to use makeshift arrangements to immobilize fractures, stop bleeding, and dress wounds.

As you know, the requirement for providing first-aid kits is contained in FAR 121.309. Appendix A of Part 121 specifies the type of first-aid kit and the kit contents based upon the capacity of the airplane. Thus, a No. 1 kit is required for airplanes of one to five persons capacity, a No. 2 kit is required for airplanes of six to 25 persons capacity, and a No. 3 kit is required for airplanes of over 25 persons capacity. The types of supplies in these kits are essentially the same; however, the quantities of items are in ratios of approximately one, two, and three, respectively.

Although the rationale of relating kit size to aircraft occupant capacity is logical, it appears to us that the present requirement does not consider adequately the large differences in capacity of today's airline aircraft. In this regard, it would seem highly unlikely that one kit size would be appropriate for capacities ranging from 26 to the more than 300 passengers. We believe that a ratio specifying some minimum number of revised No. 3 kits should be required for airplanes capable of carrying 26 to 300 plus occupants. Two further considerations are suggested. First, kit size should be kept to a minimum to assure ease of handling

in confined spaces. Second, kits should be strategically located throughout the cabin to permit ready access for treatment of in-flight injuries. Also, the location of kits should be considered from the standpoint of accessibility following cabin deformation resulting from survivable takeoff and landing accidents, as well as ditchings.

Although the stewardesses on National Flight 41 were aided by trained medical personnel, assistance of this type is not always available, nor can it be expected. A sufficient supply of materials should be available to permit the treatment of lacerations and immobilization of fractures without having to rely on makeshift arrangements to compensate for the lack of certain supplies. Additionally, existing first-aid kit contents should be augmented by including, for example, larger compresses, adhesive tape, additional triangular bandages, aspirin, tongue depressors, and inflatable splints.

Moreover, although a large percentage of accidents occur in the vicinity of airports, the aforementioned accident illustrates that two or more hours' time may elapse from the time that injuries are incurred until ground-based treatment is administered. Current requirements for on-board medical supplies appear inadequate to afford appropriate means for treatment for such time periods.

In view of the situation illustrated by this accident, the Safety Board recommends that the Federal Aviation Administration:

1. Amend FAR 121.309 to provide a more appropriate basis for determining the number, type, and location of first-aid kits required on airplanes capable of carrying more than 25 persons.

2. Upgrade the required first-aid kit contents to ensure satisfactory capability for treatment of fractures and severe lacerations for extended periods of time.

Our technical staff is available for any further information or clarification, if required.

These recommendations will be released to the public on the issue date shown above. No public dissemination of the contents of this document should be made prior to that date.

Reed, Chairman; McAdams, Thayer, Burgess, and Haley, Members, concurred in the above recommendations.

/s/
By: John H. Reed
Chairman

UNITED STATES OF AMERICA APPENDIX C

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C.

ISSUED: April 28, 1971

Adopted by the NATIONAL TRANSPORTATION SAFETY BOARD
at its office in Washington, D. C.
on the 7th day of April, 1971

FORWARDED TO:
Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Department of Transportation
Washington, D. C. 20590

SAFETY RECOMMENDATION A-71-25 thru 30

As a result of a recent incident involving a Boeing 747 which encountered severe turbulence, six passengers and one stewardess were hospitalized, and 15 passengers and one stewardess were treated for minor injuries. All injuries were the result of the severe turbulence encountered while climbing through flight level 280 at an indicated air speed of 280 knots.

The National Transportation Safety Board believes the following areas require review by the Federal Aviation Administration:

Seatbelt Discipline: During this accident, seatbelt signs were on throughout the flight; however, of two hospitalized passengers, one indicated she did not have her seatbelt fastened, and another had his seatbelt fastened, but it was very loose because he was not able to take up the slack of the belt. Both of these passengers were injured when their heads struck the ceiling on the initial sharp downdraft but were able to maintain their seated position during the remaining turbulence encounter.

The Safety Board recommends that:

1. Seatbelt discipline be strictly enforced when the seatbelt sign is on. Attendants should make a careful visual inspection of all seatbelts before takeoff and offer assistance to anyone encountering difficulty with a snug fit. When the seatbelt sign is on for prolonged periods, a public address announcement should be made regular intervals.

747 Overhead Bin Failures: During this encounter with turbulence, several of the overhead storage bins in the passenger compartment dropped open, allowing their contents to spill out. It is not known if these reported failures contributed to any injuries of cabin occupants. However, the Safety Board recommends that:

2. Locking mechanisms be inspected and either be replaced with locks of a new design or the defective lock mechanisms be returned to serviceable condition by rework or repair.

3. The FAA correct any crashworthiness deficiencies in Boeing 747 overhead storage bins by establishing a deadline date for compliance with any modification requirements.

Economy Seat Headrest Separation: During this accident, several seat headrests were reported to have been thrown from their seat units. Examination of like headrests in another PAA 747 revealed that all such units tested were easily removed by hand without deactivating the lock mechanism. It is not known if these reported failures contributed to injuries, but the Safety Board recommends that:

4. FAA examine these seats with a view toward improving the crashworthiness of seats/headrests and establishing a deadline date for compliance with any modification requirements.

Narrow Aisle Stretchers: Following the abort of the flight and the landing, difficulty was encountered in removing from the aisle passengers suspected of having back injuries. This was because the aisle widths were too narrow for standard stretchers, resulting in great difficulty transferring patients from lying positions in the aisle to stretchers. The Safety Board recommends that:

5. The FAA advise medical facilities serving airports to stock narrow "carrying boards" or narrow stretchers that can be easily used in the space of an air carrier passenger compartment aisle to facilitate removal of non-ambulatory patients.

Air Carrier Policy on Deviation of Flight: Following this encounter with turbulence, the flight service director went forward to the cockpit and advised the captain that several passengers were severely injured or ill. The captain requested the service director to return to the passenger compartment and to reassess the situation. After reassessing the cabin injuries, the attendant reported to the captain a second time that several persons appeared to be severely injured. Ten to fifteen minutes elapsed between the initial report of passenger injuries and the captain's decision to divert the flight and return to his destination. The aircraft was met by the chief physician at John F. Kennedy International Airport. The Safety Board recommends that:

6. The FAA review and, where appropriate, amend air carrier policy concerning in-flight assessments of injury or illness of passengers in order to preclude unnecessary delays in securing necessary medical assistance.

Members of the Safety Board staff would be pleased to discuss these recommendations with your staff should you feel further clarification is required.

These recommendations will be released to the public on the issue date shown above. No public dissemination of the contents of this document should be made prior to that date.

Reed, Chairman; Laurel, McAdams, Thayer and Burgess, Members, concurred in the above recommendations.

/s/
By: John H. Reed
Chairman

REFERENCES

1. NTSB Procedural Regulation Section 430.2: "Aircraft accident" means an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which any person suffers death or serious injury as a result of being in or upon the aircraft or by direct contact with the aircraft or anything attached thereto, or the aircraft receives substantial damage.
   "Serious injury" means any injury which (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) involves lacerations which cause severe hemorrhages, nerve, muscle, or tendon damage; (4) involves injury to any internal organ; or (5) involves second or third degree burns, or any burns affecting more than 5 percent of the body surface.
2. "Study of Lessons to be Learned from Accidents Attributed to Turbulence," Report No. NTSB-AAS-71-1, National Transportation Safety Board, Washington, D. C., December 15, 1971.
3. "A Controlled Study of the Effects of Television Messages on Safety Belt Use," L. S. Robertson, et al. Insurance Institute for Highway Safety, Watergate 600, Washington, D. C. 20037, June 1972.
4. FAA Notice N 8430.192, January 17, 1972: "Serving alcoholic beverages aboard air carrier aircraft."
5. "Exposure to In-flight Injuries," Gerard M. Bruggink, Air Safety Investigator, presentation before Seventh Annual Air Safety Forum of the Steward & Stewardess Division of the Air Line Pilots Association, July 8-10, 1969, Atlanta, Georgia.
6. "Tolerances of the Human Face to Crash Impact," J. J. Swearingen, CAMI Report 65-20, FAA, AD621434.
7. "Evaluation of Head and Face Injury Potential of Current Airline Seats During Crash Decelerations," J. J. Swearingen, CAMI Report 66-18, FAA, AD653869.
8. "Evaluation of Various Padding Materials for Crash Protection," J. J. Swearingen, CAMI Report 66-40, FAA, AD647048.
9. "Impact Injury to the Pregnant Female and Fetus in Lap Belt Restraint": R. G. Snyder; C. C. Snow; W. M. Crosby; P. Hanson; J. Fineg; and R. Chandler, CAMI Report 68-24, FAA, AD689359.
10. "Experimental Comparison of Trauma in Lateral (+ Gx), and Forward Facing (- Gx) Body Orientations when Restrained by Lap Belt Only," R. G. Snyder; C. C. Snow; J. W. Young; G. T. Price; and P. Hanson: CAMI Report 69-13, FAA, AD707185.