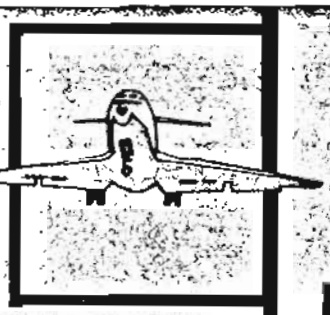

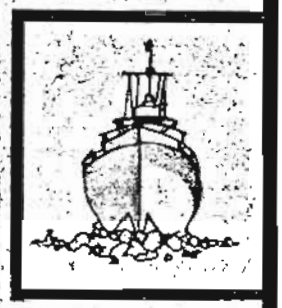

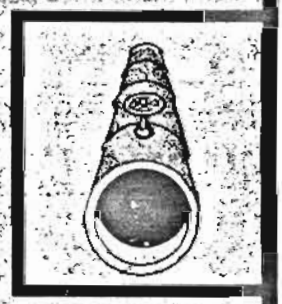

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SPECIAL STUDY

U.S. AIR CARRIER ACCIDENTS INVOLVING FIRE 1965 THROUGH 1974 AND FACTORS AFFECTING THE STATISTICS

REPORT NUMBER: NTSB-AAS-77-1

UNITED STATES GOVERNMENT

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16. Abstract

This study presents the statistical data on U. S. air carrier accidents involving fire from 1965 through 1974. The statistics are compared with data contained in Bureau of Safety Pamphlet (BOSP) 7-6-3, which treats the same subject for the years 1955 through 1964. The study concludes that there have been significant improvements in occupant survivability. While fire still occurs in about 20 percent of the accidents in scheduled passenger operations, the ratio of fatalities from all causes to exposed occupants has declined 65 percent in this study period and the ratio of fatalities from the effects of fire and smoke to exposed occupants has declined 37 percent. The almost exclusive use, in this study period, of turbojet-powered aircraft, their improved reliability, and the use of kerosene-type fuel are factors influencing the statistics. The anticipated upgrading of the Federal Aviation Regulations and the expected effects of the recently implemented requirements of 14 CFR 139 are expected to improve even further occupant survivability of accidents involving fire.

17. Key Words	18. Distribution Statement
Aircraft accident; fire statistics; occupant survivability; fire exposure; kerosene fuels; Federal Aviation Regulations; flammability of materials; toxic out-gassing; crash/fire/rescue facilities.	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151.

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INTRODUCTION

From 1965 through 1974, fire erupted during 141 United States certificated air carrier aircraft accidents. Of the 7,043 persons aboard those aircraft, 1,848 were killed. About 292 deaths were a result of fire.

From 1955 through 1964, fire erupted during 153 United States air carrier accidents. Of the 4,559 persons aboard, 1,955 were killed; 297 occupants died as a result of fire.

This study updates data from a report entitled, "A Study of United States Air Carrier Accidents Involving Fire, 1955 - 1964," which was published as Bureau of Safety Pamphlet 7-6-3 (BOSP) by the Civil Aeronautics Board on March 30, 1966. In addition, this study will compare two 10-year periods, 1955 through 1964 and 1965 through 1974, and will discuss variables which may have affected the statistics. Fire accidents in passenger-only operations are discussed separately in order to compare overall fire data. In view of the provisions of 14 CFR 139 regarding crash/fire/rescue aspects of airport certification, air carrier accidents on or near airports also are included in this study.

The study includes all U. S. certificated air carrier accidents in which fire or explosion were coded into the NTSB's automated accident files as a cause or as a factor in the accident cause. As in the previous study, accidents are included in which fire or explosion was not a key aspect in the cause or may not have been a factor in survivability. These accidents nevertheless are included to insure consistency with previous data and to provide complete U. S. air carrier fire-related accident data.

RESULTS FROM THE 1955 THROUGH 1964 STUDY

The summary statistics of the previous study (BOSP 7-6-3) are presented in Table 1. These accidents were categorized into four groups according to survivability.

Accidents involving fire were divided into the following four categories:

° Group I -- Accidents in which all occupants were killed;

° Group II -- Accidents in which some occupants survived;

° Group III -- Accidents in which all occupants survived, but some were injured seriously;

° Group IV -- Accidents in which all occupants received either minor or no injuries.

The accidents were further classified within each group according to the phase of operation in which fire erupted, as follows:

° Phase A -- Fire began in flight.

° Phase B -- Fire began as a result of impact.

° Phase C -- Fire began on the ground, but was not related to impact.

More extensive details on each of the accidents included in this study are contained in Appendix C. The study concluded that fire deaths and injuries can be reduced substantially through improvements in the areas of aircraft crashworthiness design, evacuation provisions and procedures, and airport firefighting and rescue provisions. Specifically, the study stated that occupant protection and survival in fire-involved accidents might be enhanced by improvements in the following general areas:

1. Increased strength of environmental structures and occupant restraint systems.

2. Further development of fuel inerting, fire suppression, and fire extinguishing systems.

3. Suppression or elimination of toxic fumes from burning cabin materials.

4. Improved mobility and effectiveness of airport firefighting and rescue facilities.

During the 10 years following this study, almost all of these areas have been the subject of numerous Safety Board recommendations and have, indeed, been improved.

° The inherently stronger design features of the new pressurized jet aircraft, which have virtually dominated the fleet since the study, have improved the structural environment for aircraft occupants. Furthermore, improvements in occupant restraint systems, such as increased seat strength requirements, have increased occupant survivability in accidents, including surviability in fire-involved accidents.

° Although fuel inerting has not been incorporated in air carrier aircraft, the dominant use of the less volatile kerosene-type fuel by jet aircraft has contributed to improved fire accident statistics. Considerable advances have been made also in suppression and extinguishing systems to prevent engine fires.

° No substantive improvements have been made regarding toxic outgassing from burning cabin materials; however, there are numerous efforts

TABLE 2

SUMMARY OF U.S. AIR CARRIER ACCIDENTS INVOLVING FIRE

1965 THROUGH 1974

	ACCIDENTS													AIRCRAFT DAMAGE				OCCUPANT STATUS											
	TYPE ACCIDENT	GROUP I			GROUP II			GROUP II			GROUP IV							TOTAL EXPOSURE			INJURIES								
	TOTAL	A	B	C	A	B	C	A	B	C	A	B	C	DE-STROYED	SUB-STANTIAL	MINOR	NONE	TOTAL	CREW	PAS-SENGER	FATAL			SERIOUS			MINOR/NONE		
																					TOTAL	CREW	PAX	TOTAL	CREW	PAX	TOTAL	CREW	PAX
1965	20	–	4	–	–	3	–	–	1	1	2	8	1	11	9	–	–	1012	105	907	252	29	223	97	15	82	663	61	602
1966	15	2	4	–	–	1	–	–	3	–	3	1	1	10	5	–	–	353	51	302	161	24	137	20	2	18	172	25	147
1967	22	4	4	–	–	2	–	–	3	–	6	3	–	10	12	–	–	732	91	641	230	36	194	18	2	16	484	53	431
1968	16	–	3	–	–	5	–	–	3	–	1	3	1	12	4	–	–	360	61	299	167	20	147	52	6	46	141	35	106
1969	6	–	2	–	–	1	–	–	–	1	–	1	1	4	2	–	–	291	29	262	30	10	20	16	0	16	245	19	226
1970	16	–	3	–	–	3	–	–	1	3	1	2	3	8	6	1	2	980	101	879	138	20	118	72	16	56	770	65	705
1971	10	1	3	–	–	1	–	–	–	1	1	2	1	5	4	1	–	463	52	411	197	23	174	4	1	3	262	28	234
1972	14	1	1	–	–	3	–	–	1	4	2	–	2	6	4	3	1	1038	92	946	161	15	146	96	15	81	781	62	719
1973	11	1	2	–	–	2	–	–	1	1	1	3	–	6	4	1	–	732	50	712	146	16	130	14	4	10	602	30	572
1974	11	1	2	–	–	2	–	1	2	2	1	–	–	6	1	4	–	1052	93	959	366	35	331	21	2	19	665	56	609
TOTALS	141	10	28	0	0	23	0	1	15	13	18	23	10	78	50	10	3	7043	725	6318	1848	228	1620	410	63	347	4785	434	4351
		38			23			29			51																		

During 13 Group III accidents, fire erupted on the ground not as a result of impact forces. Six of these were on takeoff -- two were brake or wheel fires and four were engine fires. Three occurred while the aircraft were parked at the gate -- an engine fire, torching of an auxiliary power unit (APU), and an oxygen fire. Three accidents occurred during taxi -- an engine fire, smoke in the cockpit, and a wheel-brake fire. The remaining accident involved an engine fire during landing roll. Twenty-five persons were injured seriously in the 13 accidents; 1,788 persons received minor or no injuries.

Group IV Accidents

There were 51 Group IV accidents which involved 1,923 occupants. These accidents usually involved low-impact forces. During 18 accidents, fire began in flight and involved 783 persons. All persons received minor or no injuries. Fourteen of these accidents resulted from engine failures and engine fires. Two accidents followed wheelbrake fires; one was an electrical fire in the cabin; and one was an airframe fire.

In twenty-three accidents involving 614 occupants, fire began as a result of impact. Fifteen accidents occurred during landing, seven occurred during takeoff, and one during taxi when the aircraft hit a ground power unit. The impact forces generated in these accidents were minor to moderate.

Ten accidents involved fire that began on the ground; impact forces were not involved. The 526 occupants received minor or no injuries. Two accidents occurred on landing, one on takeoff, and the remaining seven while parked or taxiing.

COMPARISON OF THE 10-YEAR PERIODS

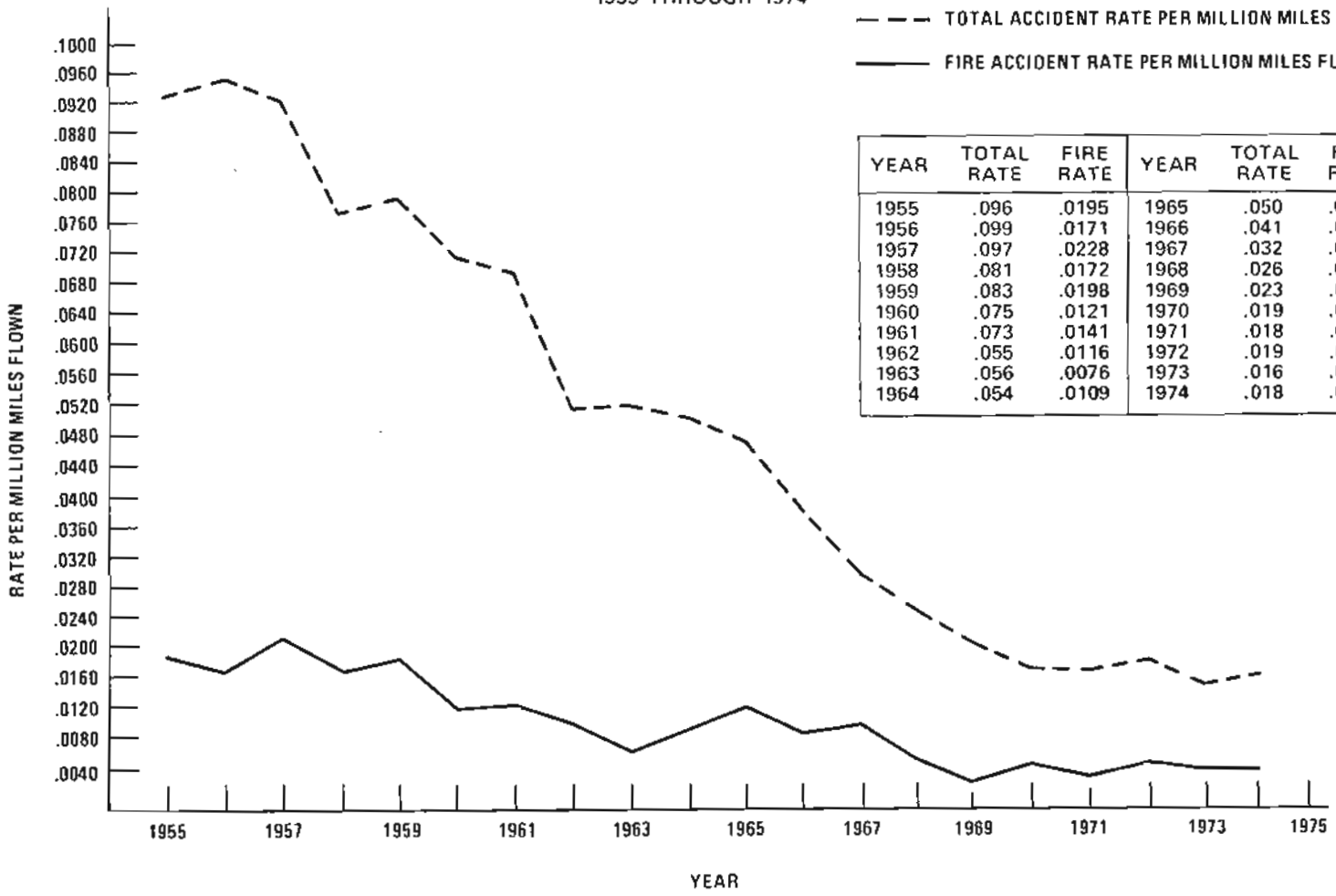
Accident data for 1965 through 1974 are comparable to the data from the previous 10-year study. The total number of fire accidents for the two periods has decreased only slightly -- 153 between 1955 and 1964 and 141 between 1965 and 1974. The total number of persons exposed to fire increased from 4,559 in the first 10-year study to 7,043 in the second 10-year study.

U.S. certificated air carriers experienced a tremendous growth during the 20 years covered by the two studies. The total aircraft-miles flown by U. S. certificated air carriers in all operations grew from 819,581,000 in 1955 to 2,385,000,000 in 1974 (a three-fold increase). Similarly, the number of passenger-miles flown by U. S. air carriers (scheduled passenger service) grew from 25,152,000,000 in 1955 to 173,350,000,000 in 1974 (a seven-fold increase). During the same period, the number of passengers carried by the U. S. air carriers in domestic and international passenger operations grew from 41,444,000 in 1955 to 207,449,000 in 1974 (a five-fold increase). This period of

FIGURE 1

U.S. CERTIFICATED ROUTE AIR CARRIERS
(ALL OPERATIONS)

1955 THROUGH 1974



YEAR	TOTAL RATE	FIRE RATE	YEAR	TOTAL RATE	FIRE RATE
1955	.096	.0195	1965	.050	.0136
1956	.099	.0171	1966	.041	.0089
1957	.097	.0228	1967	.032	.0106
1958	.081	.0172	1968	.026	.0067
1959	.083	.0198	1969	.023	.0023
1960	.075	.0121	1970	.019	.0046
1961	.073	.0141	1971	.018	.0039
1962	.055	.0116	1972	.019	.0055
1963	.056	.0076	1973	.016	.0043
1964	.054	.0109	1974	.018	.0046

FIGURE 3

RATIO OF FIRE ACCIDENTS TO TOTAL ACCIDENTS

U.S. CERTIFICATED ROUTE AIR CARRIERS

(ALL OPERATIONS)

1955 THROUGH 1974

YEAR	%	YEAR	%
1955	20.0	1965	27.4
1956	13.8	1966	21.7
1957	23.1	1967	33.3
1958	21.2	1968	25.8
1959	23.7	1969	9.8
1960	15.9	1970	32.7
1961	14.1	1971	21.3
1962	20.6	1972	29.2
1963	13.6	1973	27.5
1964	20.0	1974	24.4

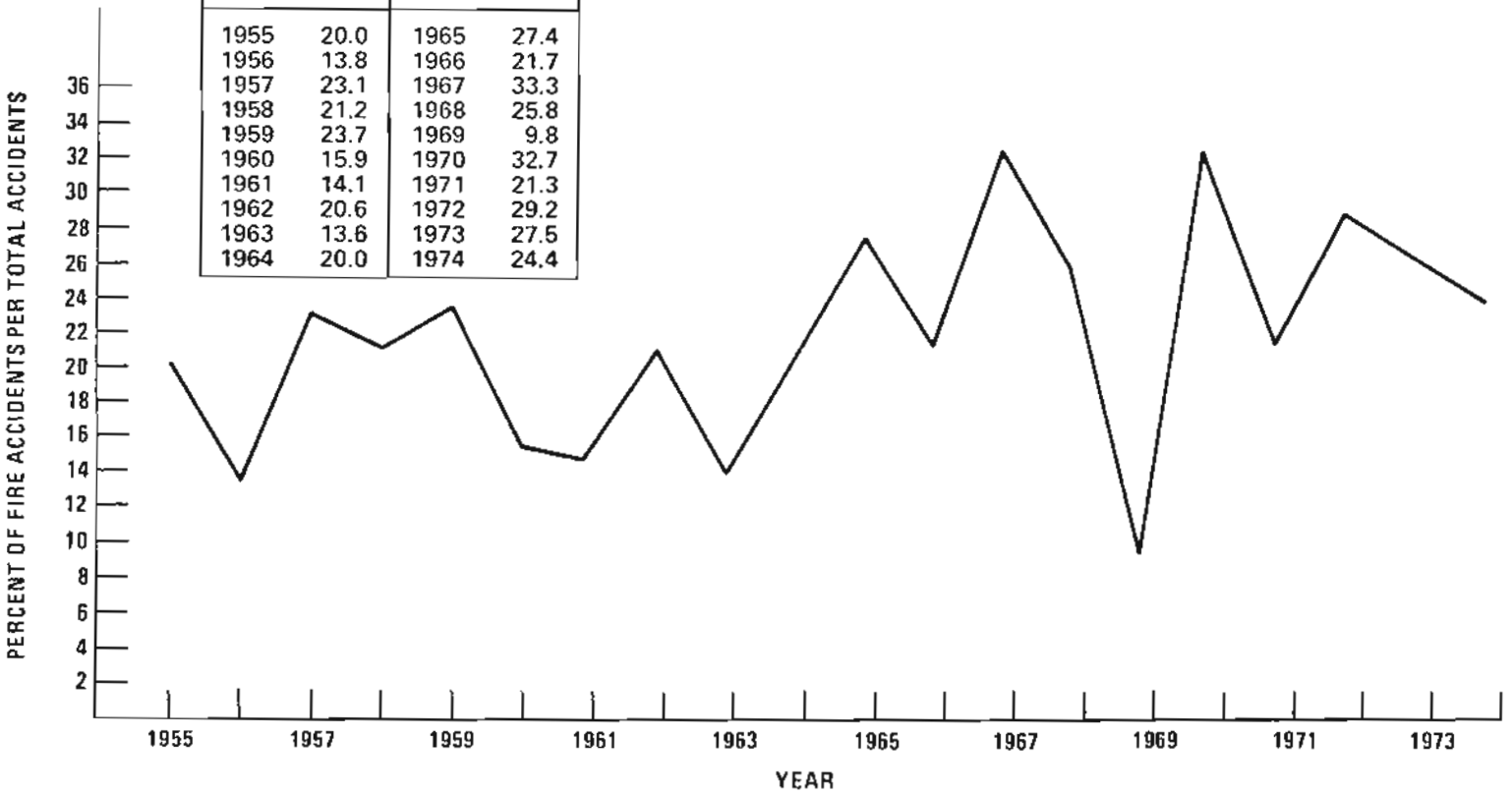
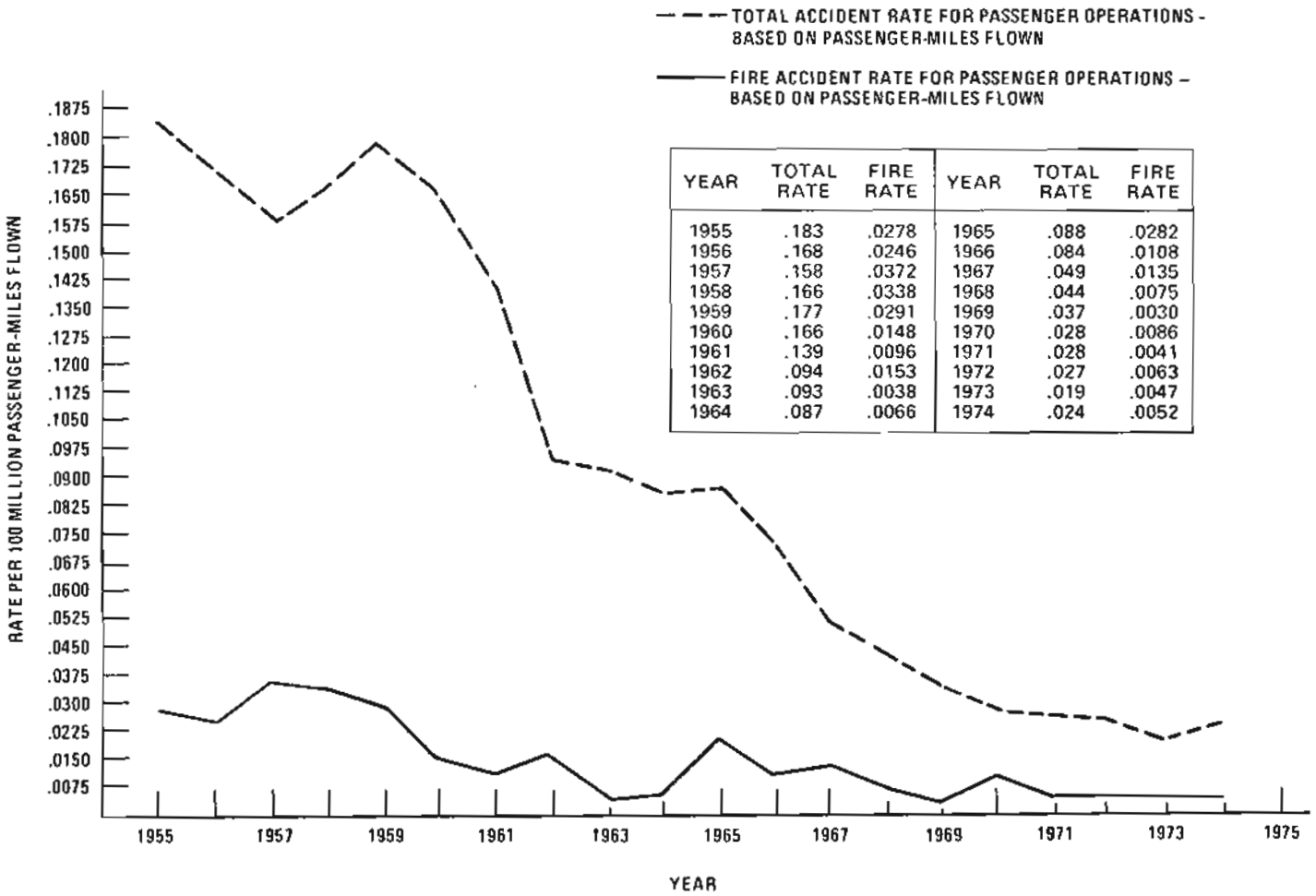


FIGURE 4

U.S. CERTIFICATED ROUTE AIR CARRIERS
SCHEDULED DOMESTIC AND INTERNATIONAL PASSENGER OPERATIONS

1955 THROUGH 1974



YEAR	TOTAL RATE	FIRE RATE	YEAR	TOTAL RATE	FIRE RATE
1955	.183	.0278	1965	.088	.0282
1956	.168	.0246	1966	.084	.0108
1957	.158	.0372	1967	.049	.0135
1958	.166	.0338	1968	.044	.0075
1959	.177	.0291	1969	.037	.0030
1960	.166	.0148	1970	.028	.0086
1961	.139	.0096	1971	.028	.0041
1962	.094	.0153	1972	.027	.0063
1963	.093	.0038	1973	.019	.0047
1964	.087	.0066	1974	.024	.0052

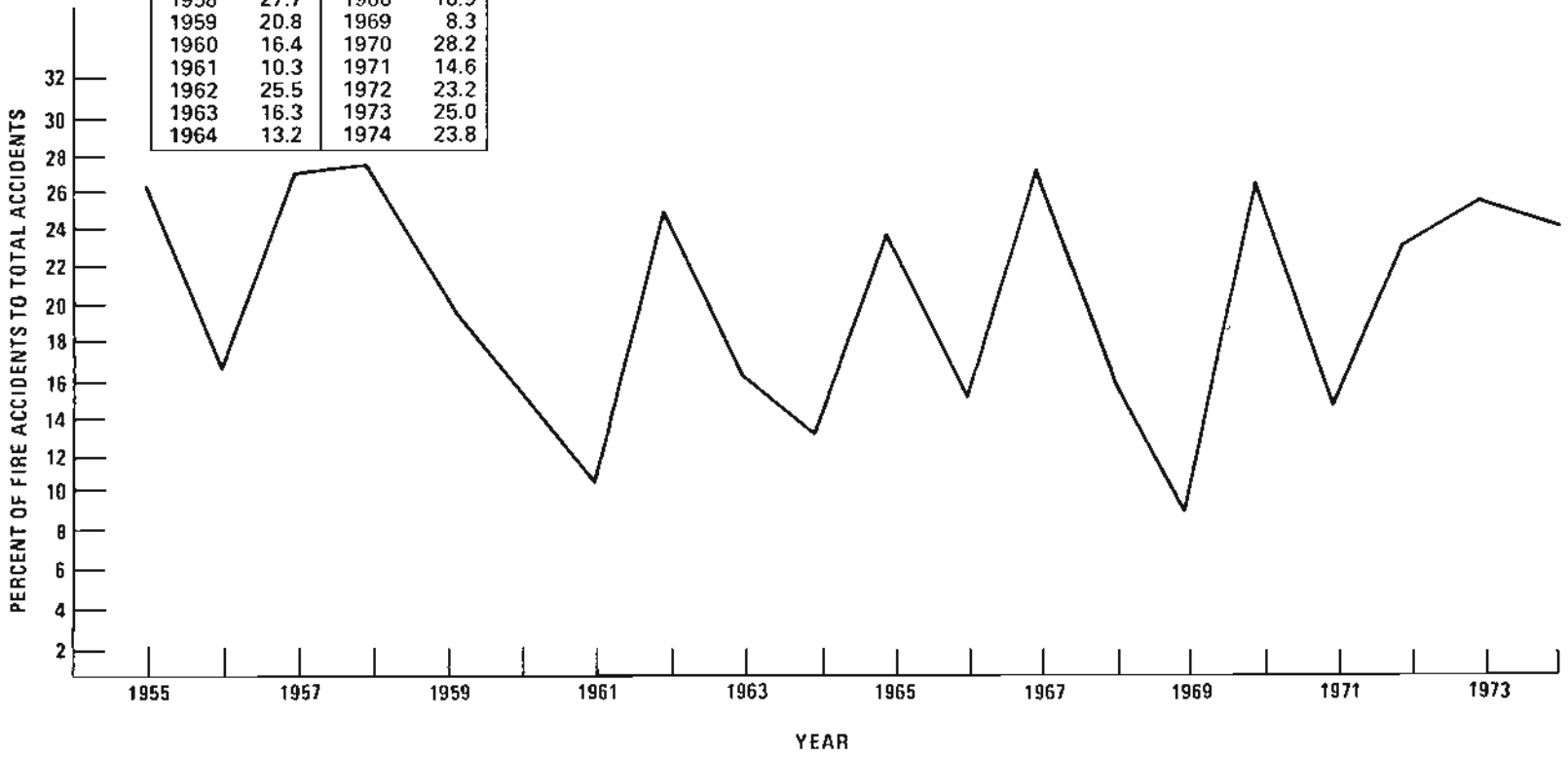
FIGURE 6

RATIO OF FIRE ACCIDENTS TO TOTAL ACCIDENTS

U.S. CERTIFICATED ROUTE AIR CARRIERS

IN DOMESTIC AND INTERNATIONAL PASSENGER OPERATIONS

YEAR	%	YEAR	%
1955	26.1	1965	23.8
1956	16.6	1966	15.0
1957	27.4	1967	27.4
1958	27.7	1968	16.9
1959	20.8	1969	8.3
1960	16.4	1970	28.2
1961	10.3	1971	14.6
1962	25.5	1972	23.2
1963	16.3	1973	25.0
1964	13.2	1974	23.8



The passenger load for fire-involved accidents was not plotted; however, an analysis of these data shows that the average number of occupants exposed per fire accident in all operations was 29.8 for the years 1955 through 1964 and 49.9 for the years 1965 through 1974 -- a 67-percent increase. Therefore, despite the improving fire accident rates discussed previously, the increased number of occupants exposed in each accident has caused the number of fatalities caused by fire to remain relatively constant (297 killed between 1955 and 1964 and 292 killed between 1965 through 1974).

FACTORS INFLUENCING FIRE ACCIDENT DATA

There are several factors which affect the air carrier accident data; however, for purposes of this study, only those factors which directly affect fire potential will be discussed. Three factors which can influence fire data significantly are aircraft type (engine and fuel type); Federal regulations governing aircraft fire protection; and crash/ fire/rescue facilities.

Aircraft Type (Engine and fuel type).

During the 20-year study period, the type of engine power used in the air carrier fleet virtually reversed from the use of reciprocating engines (piston-powered) to the almost exclusive use of turbojet engines. Figure 8 shows the accident rates per 100,000 hours flown by type of engine power for the years 1960 through 1969; the accident rate of turbo-prop powered aircraft also is shown. A steady decline of the accident rate of turbojet aircraft is indicated.

For comparison, the fire-involved air carrier accident rates by type of engine power are plotted in Figure 9. The quantum jump in the piston-powered accident rate is explained by the fact that, while these aircraft were being phased out, a few fire-involved accidents affected significantly the accident rate because of the small number of operations.

The principal characteristics of the turbojet aircraft which account for the accident rate improvement are: Reliability, increased structural integrity, automation, the changed operating environment, and the use of a different fuel.

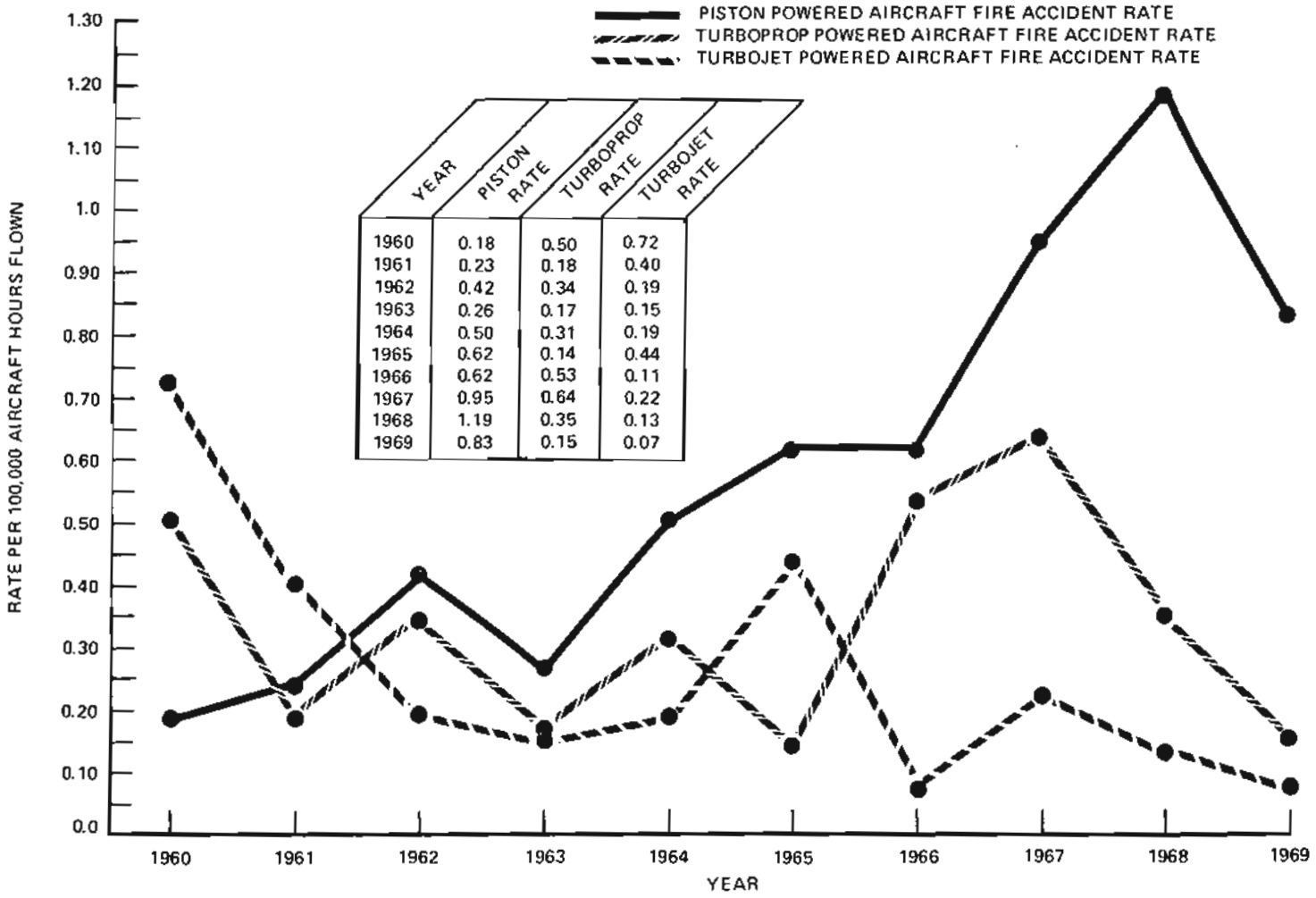
The turbojet aircraft operated by U. S. carriers generally use kerosene-type fuel, while the piston aircraft use gasoline exclusively. It has been well documented that the overall fire hazards for kerosene-type fuel are less than for the more volatile gasoline fuels. 1/ The kerosene-type fuels have been found to be less hazardous than gasoline in ground handling and refueling situations. Moreover, the kerosene-type fuel is less likely to produce a flammable or explosive mixture in-flight than the gasoline-type fuel. Lastly, the fire hazards after a survivable crash or following a minor incident on the ground are reduced by the use of kerosene-type fuels.

1/ NASA TMX 71437, "An Evaluation of the Relative Hazards of Jet A and Jet B for Commercial Flight," Hibbard and Hacker, 1973.

FIGURE 9

FIRE—INVOLVED ACCIDENT RATE BY TYPE OF ENGINE POWER

U.S. CERTIFICATED ROUTE AIR CARRIERS
(ALL OPERATIONS) 1960 THROUGH 1969



YEAR	PISTON RATE	TURBOPROP RATE	TURBOJET RATE
1960	0.18	0.50	0.72
1961	0.23	0.18	0.40
1962	0.42	0.34	0.19
1963	0.26	0.17	0.15
1964	0.50	0.31	0.19
1965	0.62	0.14	0.44
1966	0.62	0.53	0.11
1967	0.95	0.64	0.22
1968	1.19	0.35	0.13
1969	0.83	0.15	0.07

During this time, concern was expressed regarding the problem of smoke emissions from burning aircraft materials. Consequently, both industry and Government groups engaged in research to develop smoke standards for aircraft materials.

On July 29, 1966, the FAA issued Notice of Proposed Rule Making (NPRM) 66-26. This NPRM proposed more stringent standards for cabin materials flammability. However, when the FAR's were eventually amended on October 24, 1967, some of the proposed standards were relaxed because the materials which could meet the proposed specifications at that time were not commercially available in sufficient quantities for aircraft production.

The new standards required that some specified interior materials must be self-extinguishing after flame removal while all other materials not specified to be self-extinguishing had to be at least flame-resistant. These standards were effective on October 24, 1967, for new aircraft. To cover aircraft already in-service, the amendments added a paragraph to Sub-part K of Part 121 of the FAR's requiring that during the first major overhaul or refurbishing of a cabin interior after October 24, 1968, all materials had to meet the new standards for flammability.

The FAA continued research in cabin materials flammability and smoke emission characteristics, but no regulations were issued to establish minimum standards for smoke emissions from burning aircraft materials.

On August 12, 1969, the FAA issued NPRM 69-33 which proposed to improve air carrier crashworthiness standards, including flammability of materials requirements. During the time of consideration of this NPRM, the Boeing Company, the McDonnell-Douglas Company, and the Lockheed Aircraft Company were issued type certificates for the Boeing 747, the DC-10, and the L-1011, respectively. Because of the unique and novel characteristics of these airplanes, the FAA issued Special Conditions for these three "wide-bodied" aircraft, which specified updated cabin materials flammability standards essentially identical to the standards proposed in NPRM 69-33. NPRM 69-33 subsequently was adopted in May 1972. The Special Conditions for the wide-bodied aircraft, as well as these new amendments, effective May 1, 1972, required more stringent flammability standards for some cabin materials, while the standards for other materials remained unchanged.

There were no smoke emission standards adopted in the regulations as a result of this rulemaking.

To cover existing aircraft, the amendments specified that during refurbishing or major overhaul of the interior of an aircraft, for which application for a type certificate was made before May 1, 1972, the replacement materials must meet the requirements in effect on April 30, 1972. On aircraft for which application for a type certificate was made after May 1, 1972, the materials must meet the requirements which were in effect on the date of certification. Thus, aircraft certificated before May 1, 1972, need only meet the flammability standards established in 1967 and then only at the time of refurbishing or major overhaul.

Finally, NPRM 75-3 was issued in February 1975 to establish smoke density standards for emissions from burning cabin materials. This NPRM proposed to specify smoke emission optical density limits for burning cabin furnishings. Also, a test method to show compliance with such rules was proposed. The proposed rules also contained a retroactive requirement for compliance by all air carrier aircraft, 5 years after the effective date of the proposed amendment.

In summary, the fire prevention efforts for transport category aircraft regarding engine fires and other in-flight fires have proved highly successful in eliminating such fires in recent years. Proposals for new cabin fire prevention rules and rules governing smoke emission characteristics of burning cabin materials currently are under study. When such rules are implemented, it is expected that the occupant survivability rates will improve.

Crash/Fire/Rescue Aspects

The data contained in this study and those in the previous study (BOSP-7-6-3) were examined to determine the effect of crash/fire/rescue (CFR) facilities on the overall fire accident statistics.

The previous study determined that 18 persons involved in 2 accidents would have survived had adequate CFR facilities been available. Those 2 cases were among the 13 accidents which accounted for all of the fatalities from fire for that period. In eight other accidents, the crash site was inaccessible to rapid CFR response because of dense fog or adverse terrain features. The remaining three accidents involved adequate CFR response; however, the exits were badly damaged in one accident which prevented rescue while, in the other two cases, extremely rapid fire propagation prevented evacuation and precluded effective CFR activities.

In the current study, 11 accidents accounted for all the fire fatalities. Six accidents were inaccessible to CFR facilities and one other accident was difficult to locate because of dense fog. In the remaining four cases, response of the CFR facilities was timely; however, their effectiveness was minimal because of rapid fire propagation and explosions.

There has been considerable controversy recently regarding the need for and the effectiveness of CFR equipment and personnel at air carrier airports, as a result of the requirements levied on owners and operators of air carrier airports by the provisions of 14 CFR 139. These requirements were a result of the Airport and Airway Development Act of 1970, passed by the U. S. Congress in May 1970 and authorized the FAA to establish minimum safety standards for the operation of airports. Specifically, the Act provided that airports serving CAB certificated air carriers be awarded an operating certificate if they met standards established by the FAA. Among those standards were requirements for CFR facilities and emergency plans to minimize the effects of aircraft accidents.

TABLE 3

ACCIDENT LOCATION TO AIRPORT PROXIMITY FOR ACCIDENTS INVOLVING FIRE

U.S. CERTIFICATED ROUTE AIR CARRIERS
(ALL OPERATIONS)
1965 THROUGH 1974

ACCIDENT LOCATION	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	TOTAL
ON THE AIRPORT	7	2	9	6	4	12	5	11	8	5	69
IN THE TRAFFIC PATTERN	1		2	2		1					6
WITHIN ¼ MILE	1	1									2
WITHIN ½ MILE		1	1	1		1					4
WITHIN ¾ MILE	1	1		1							3
WITHIN 1 MILE		1				1	1				3
WITHIN 2 MILES	2	2						1			5
WITHIN 3 MILES	1			1					1		3
WITHIN 4 MILES			1							1	2
WITHIN 5 MILES			2		1						3
BEYOND 5 MILES	7	7	7	5	1	1	4	2	2	4	40
UNKNOWN/NOT REPORTED										1	1
TOTAL	20	15	22	16	6	16	10	14	11	11	141

3. From 1965 through 1974, 11 accidents accounted for all of the 292 deaths attributable to the effects of fire and smoke.

4. While the average number of persons exposed to fire accidents has increased 67 percent from 1955 through 1974, the actual number of occupants killed by fire has not changed significantly (297 killed from 1955 through 1964 and 292 killed between 1965 and 1974).

5. Because 14 CFR 139, which includes requirements for crash/fire/rescue facilities at airports, was only recently implemented, no appreciable effects on air carrier fire-involved accident statistics are noticeable. Consequently, justification for or against expanded CFR facilities at airports cannot be established by this study.

RECOMMENDATIONS

This study primarily is of a statistical and informational nature. Since the major areas that appear to warrant further improvement already are being addressed by the FAA and other organizations, this study does not support additional safety recommendations.

However, to afford the reader the benefit of experience in this aspect of air carrier safety, some of the significant fire safety recommendations that have been made by the Safety Board are listed below:

Lightning Strike Protection. -- Following the Pan American Boeing 707 accident in Elkton, Maryland, on December 8, 1963, the Safety Board recommended that:

". . . static discharge wicks be installed on all turbine-powered aircraft not so equipped.

". . . the FAA reevaluate problems associated with the incorporation of flame arrestors in fuel tank vent outlets.

". . . the mixture being emitted from the vent outlet be rendered nonignitable by the introduction of air into the vent tube.

". . . an inner wall to the surge tank be provided instead of utilizing the wing skin as part of the surge tank walls.

". . . consideration be given to limiting fuel for commercial use to Jet A only.

". . . every effort be expanded to practically eliminate flammable air/vapor mixtures from the fuel tanks, either by introduction of an inert gas in space above fuel or sufficient air circulation into tanks to maintain too lean a mixture for combustion."

Fuel Fire and Rapid Propagation of Fire by Explosions. -- Following the Allegheny CV-580 accident at New Haven, Connecticut, on June 7, 1971, the Safety Board recommended that:

". . . the FAA initiate action to incorporate in its airworthiness requirements a provision for fuel system fire safety devices which will be effective in the prevention and control of both in-flight and postcrash fuel system fires and explosions.

". . . the rulemaking action (called for in the above recommendation) specifically apply to future passenger-carrying aircraft in transport category, and consideration be given to an adaption of all other passenger-carrying aircraft now in service."

In-Flight Cabin Interior Fire. -- Following the Varig Boeing 707 accident in Paris, France, on July 11, 1973, the Safety Board recommended that:

". . . the FAA require a means for early detection of lavatory fires on all turbine-powered, transport-category aircraft operated under FAR Part 121.

". . . full-face smoke masks be required on emergency oxygen bottles for each cabin attendant on turbine-powered transport aircraft to permit attendants to combat lavatory and cabin fires.

". . . the FAA reevaluate certification compliance with Section 4b.381(d) of the CAR on Boeing 707 series aircraft.

". . . the FAA organize a government/industry task force on aircraft fire prevention to review design criteria and formulate specific modifications for improvements with respect to fire potential of enclosed areas, such as lavatories, in turbine-powered aircraft operating under Part 121 of FAR."

APPENDIX A

GROUP I ACCIDENTS

Accidents in Which All Occupants Sustained Fatal Injuries

Date	Air Carrier	Type Aircraft	-Injuries- Fatal	Serious	Minor/None	Total	Remarks
PHASE A --- Fire Inflight			334	--	--	334	10 Accidents
8/6/66	Braniff	BAC 111	42	--	--	42	Wing Failure in Turbulence
6/16/66	Zantop	C-46	2	--	--	2	Midair Collision
3/9/67	TWA	DC-9	25	--	--	25	Midair Collision
6/23/67	Mohawk	BAC 111	34	--	--	34	Fire Inflight--Loss of Control
7/19/67	Piedmont	B-727	79	--	--	79	Midair Collision
6/22/67	Airlift	L-1049A	7	--	--	7	Midair Collision
6/6/71	Hughes Airwest	DC-9	49	--	--	49	Midair Collision
6/29/72	North Central	CV-580	5	--	--	5	Midair Collision
11/3/73	Pan Am	B-707	3	--	--	7	Smoke in Cockpit-Loss of Control-Detonation of Explosive Device
9/8/74	TWA	B-707	88	--	--	88	Loss of Control
PHASE B --- Fire After Impact			603			603	28 Accidents
8/16/65	United Air Lines	B-727	30	--	--	30	Crashed into Lake Michigan during Approach
2/8/65	Eastern Air Lines	DC-7B	84	--	--	84	Near Midair Collision - Crashed into Ocean
12/15/65	Flying Tiger	L-1049	3	--	--	3	Pilot Disoriented-Hit Mountain
9/17/65	Pan Am	B-707	30	--	--	30	Crashed during Descent--Pilot Lost
10/1/66	West Coast Airlines	DC-9	18	--	--	18	Descent Below Clearance Limit - Reason Unknown
8/21/66	Alaska Coastal-Ellis	G-21A	9	--	--	9	Uncontrolled Crash into Glacial Crevasse - Reason Unknown.
11/15/66	Pan Am	B-727	3	--	--	3	Crashed During Approach-Undetermined
12/24/66	Flying	CL-44	4	--	--	4	Crashed on Final Approach.

GROUP I ACCIDENTS - Cont'd

Date	Air Carrier	Type Aircraft	-Injuries- Fatal	Serious	Minor/ None	Total	Remarks
PHASE B --- Fire After Impact-Continued							
4/22/74	Pan Am	B-707	107	--	--	107	Hit Mountain During Descent for Landing

NOTE: There were no Group I accidents which occurred on the ground (Phase C).

GROUP II ACCIDENTS - Cont'd

Date	Air Carrier	Type Aircraft	-Injuries- Fatal	Serious	Minor/ None	Total	Remarks
PHASE B --- Fire After Impact - Continued							
12/20/72	North Central	DC-9	10	9	26	45	Crashed After Collision with Other Aircraft During Takeoff
12/8/72	United	B-737	43	12	6	61	Crashed into Houses on Final Approach
7/31/73	Delta	DC-9	88	1	--	87	Struck Seawall During Landing
7/23/73	Ozark	FH-227B	38	6	--	44	Loss of Control - Downdraft and Rain
1/30/74	Pan Am	B-707	96	5	--	101	Hit Trees During Final Approach
9/11/74	Eastern	DC-9	71	10	1	82	Crashed During Approach for Landing

GROUP III ACCIDENTS - Cont'd

Date	Air Carrier	Type Aircraft	- Injuries - Fatal	Serious	Minor/ None	Total	Remarks
PHASE C --- Fire on Ground - Continued							
3/2/70	United	B-720	-	1	94	95	Engine Fire During Start
6/9/70	Trans Caribbean	DC-8	-	2	226	228	Brake Fire During Takeoff
5/18/70	United	B-727	-	1	71	72	Smoke in Cabin During Taxi
7/23/71	United	B-747	-	1	198	199	Engine Fire During Taxi
9/1/72	TWA	B-747	-	8	345	353	Wheel Brake Fire During Taxi
3/3/72	United	DC-8	-	1	128	129	APU Torched During Engine Start
11/1/72	TWA	B-707	-	1	80	81	Engine Fire During Landing Roll
6/10/72	American	B-727	-	2	75	77	Oxygen Fire While at Gate
6/20/73	Overseas National	DC-8	-	3	258	261	Fire in Brakes on Takeoff
1/4/74	United	B-727	-	1	117	118	Fire in Brakes on Take-off
11/25/74	Pan Am	B-707	-	1	29	30	Engine Fire on Takeoff

GROUP IV ACCIDENTS - Cont'd

Date	Air Carrier	Type Aircraft	-Injuries- Fatal	Serious	Minor/ None	Total	Remarks
PHASE B - Fire After Impact - Continued							
5/29/65	Reeve-Aleutian	DC-3	--	--	5	5	Crashed on Takeoff - Wind Shift
4/13/65	TWA	CV-880	--	--	4	4	Stalled on Initial Takeoff
3/26/65	Pan Am	B-707	--	--	170	170	Dragged Wingtop on Landing Roll
10/16/65	Eastern	DC-7	--	--	62	62	Gear Collapsed on Landing
10/14/65	Zantop	AW-650	--	--	3	3	Engine Failure - Forced Landing
10/17/65	United	DC-6	--	--	16	16	Gear Retracted on Takeoff
3/21/66	Flying Tiger	CL-44	--	--	6	6	Hard Landing - Nosed Over
3/23/67	Universal	DC-7	--	--	3	3	Taxied into APU
6/26/67	Northern Consolidated	DC-6A	--	--	2	2	Loss of Directional Control During Landing
1/23/67	Caribbean Atlantic	CV-640	--	--	28	28	Landed Short - Stall Mush
1/1/68	Southern	M-404	--	--	3	3	Gear Collapsed-Landing
6/24/68	North Central	CV-580	--	--	22	22	Hit Guy-Wire During Circling Approach
7/2/68	Universal	DC-7	--	--	3	3	Loss of Directional Control-Hydroplaning
10/16/69	Seaboard	DC-8	--	--	5	5	Aborted Takeoff-Gear Collapsed
8/24/70	Universal	L-188	--	--	3	3	Nosed Over on Takeoff.
9/29/70	Braniff	B-720	--	--	54	54	Gear Retracted-Landing
3/18/71	Saturn	GA-382	--	--	4	4	Roll
3/18/71	Saturn	GA-382	--	--	4	4	Ground Loop - Wind Gusts
8/16/71	Wien	PC 6-HZ	--	--	2	2	Gear Collapsed-Landed Short
3/5/73	American	B-707	--	--	3	3	Loss of control on Takeoff - Engine Out
10/28/73	Piedmont	B-737	--	--	96	96	Hydroplaning-Overran Runway
12/17/73	Eastern	DC-9	--	--	89	89	Loss of Directional Control-- Landing Ice on Runway

APPENDIX B

CASE HISTORIES

Eleven Group II accidents accounted for all but one of the fatalities from fire in air carrier operations for the years 1965 through 1974. The following synopses contain relevant facts, conditions, and circumstances regarding these accidents including the fire aspects.

Case 1. On November 8, 1965, American Airlines Flight 383, a Boeing 727, N1996, en route from LaGuardia Airport, N. Y., to the Greater Cincinnati Airport at Covington, Kentucky, struck a tree with its right wing and crashed into a wooded hillside about 2 miles from the intended landing runway. There were 55 passengers and a crew of 6 aboard.

The aircraft remained relatively intact as it slid through scrub trees and ground foilage for about 340 feet. It then struck and came to rest among a group of large trees. A survivor stated that he saw flames coming forward from the rear of the cabin as he escaped out of the front of the aircraft which was completely missing. He said that shortly after he had escaped, the aircraft exploded and began to burn intensely. Only 4 occupants out of the 62 aboard survived the impact and ensuing fire. The number of occupants who died from fire was not determined, although the circumstances of the accident suggest that some occupants probably survived the impact and died in the postcrash fire.

The accident site was inaccessible to the firefighting personnel and equipment which arrived in the accident vicinity about 15 minutes after the accident. (File No. 1-0031.)

Case 2. On November 11, 1965, United Air Lines Flight 227, a Boeing 727, N703U, en route from Denver, Colorado, to Salt Lake City, Utah, crashed during an attempted landing 335 feet short of the runway threshold and slid about 2,838 feet along the runway. The aircraft came to rest off the right side of the runway.

During the crash, the main gear was sheared off and the right main gear ruptured fuel lines. The aircraft caught fire during the ground slide and 41 of the 91 occupants died in the fire. Two others died several days after the accident as a result of their burns. The fatalities sustained no traumatic injuries which would have prevented their escape.

The airport firetrucks arrived at the accident scene about 3 1/2 minutes after the accident. Since the fire was generally propagating inside the fuselage, the effectiveness of the firefighting was reduced. It took about 38 minutes to bring the fire under control. Three survivors were rescued from the aft stairway area between 25 and 30 minutes after the accident. The other survivors escaped without assistance. (File No. 1-0032.)

the perimeter road. It came to rest on the slope of a hill beyond the road. The aircraft sustained extensive structural damage; an explosion near the left wing root occurred before fire erupted. The propagation of the fire reportedly was slow. The two fatally injured occupants died from burns.

The airport firefighting units responded instantly because the crash was witnessed by firefighting personnel. The equipment was not effective because of the location of the wreckage. The units had to retreat and the fire was not extinguished until the fuselage was destroyed. (NTSB AAR 72-8, File No. 1-0026.)

Case No. 6. On June 1971, Allegheny Airlines Flight 485, a Convair 340/440, N5832, crashed while attempting to land at Tweed-New Haven Airport, Connecticut. The aircraft struck three beach houses and power-lines before coming to rest about 4,890 feet short of the landing runway. There were 31 occupants aboard. The aircraft was destroyed in an intense fire which erupted immediately after the initial impact. Flame propagation was accelerated as fuel spilled from the fractured wings and secondary explosions occurred shortly after the impact. Twenty-seven of the 28 fatally injured occupants died from fire.

Two firefighting units arrived at the crash site about 5 minutes after the crash; however, they did not immediately see the burning aircraft and began to extinguish the burning buildings. (NTSB-AAR-72-20, File No. 1-0006.)

Case No. 7. On May 30, 1972, Delta Air Lines, Flight 9570, a Douglas DC-9, N3305L, crashed while attempting a go-around at the Greater Southwest International Airport, Fort Worth, Texas. Flight 9570 was a training flight with three crewmembers and one captain trainee aboard. The aircraft encountered turbulence from a Douglas DC-10 which preceded Flight 9570 on a "touch-and-go" landing. The aircraft oscillated about its longitudinal axis, rolled 90° to the right, and its right wing hit the runway. The main fuselage then struck the runway nearly inverted causing the fuselage and empennage to separate and slide about 2,400 feet along the runway. When the right wingtip contacted the runway, the wing fuel tank ruptured, initiating the fire. The one occupant of the passenger cabin died as a result of the fire.

The airport fire department crash crew responded to the crash before the alarm was sounded. They were on the scene very quickly and the fire was extinguished but not before the fuselage was extensively burned. (NTSB-AAR-73-3, File No. 1-0003.)

Case No. 8. On December 8, 1972, United Air Lines Flight 553, a Boeing 737, N9031U, crashed while making a nonprecision approach to Midway Airport, Chicago, Illinois. The aircraft stalled, impacted trees,

The fire progressed very rapidly and only four occupants survived. All of the fatally injured occupants were burned severely. Only one fatality received traumatic impact injuries.

The cabin area was entirely intact following this crash; however, none of the primary exits were opened and fire prevented the use of exits on the right side. Only the left overwing exits were used by survivors.

The airport fire department had difficulty reaching the crash site. Their response, which took about 14 minutes, was hampered by weather, obstacles across the response route, and uncertainty about the location of the fire. No rescue efforts could be accomplished until after the fire was extinguished. (NTSB-AAR-74-15, File No. 1-0001.)

Case No. 11. On September 11, 1974, Eastern Air Lines Flight 212, a Douglas DC-9 crashed while conducting a nonprecision approach to Douglas Municipal Airport, Charlotte, North Carolina. The aircraft crashed 3.3 miles from the airport after striking trees and the ground before breaking up and bursting into flames. There were 82 occupants aboard the aircraft.

The aircraft wreckage came to rest about 1,000 feet from the initial impact point. The cockpit section broke off as did the aft fuselage. Both wings had struck trees and were sheared off before the fuselage came to rest.

Thirty-nine of the occupants succumbed to the effects of fire or a combination of impact and fire injuries.

Volunteer Fire Department units were on the scene within 11 to 12 minutes of the accident. Rescue activities were confined to the outside of the aircraft, and the fire was under control within 5 minutes of arrival at the scene.

The survivors were either thrown clear of the wreckage or escaped through holes in the fuselage. Three occupants escaped through a cockpit window. (NTSB-AAR-75-9, File No. 1-0020.)

APPENDIX C

Accidents In Which All Occupants Sustained Fatal Injuries (continued)

Date	Air Carrier	Type Aircraft	Fatalities Total	Crew	Psgrs.	Remarks
4/6/58	CAP	V-700D	47	3	44	Stalled, spun in during weather.
4/21/58	UAL	DC-7	47	5	42	Hit F-100 head on. Crashed and burned.
5/20/58	CAP	V-700D	11	4	7	Hit T-33 in air. Crashed and burned.
11/16/58	Capitol Airways	C-46F	2	2	0	Hit mountain after engine failure in instrument conditions.
6/26/59	TWA	L-1649A	68	9	59	Broke up in flight. Burned at impact.
8/15/59	AA	B-707	5	5	0	Lost control and crashed.
9/12/59	PanAm	DC-4	3	3	0	Hit ridge of valley and burned.
9/24/59	RV	DC-4	16	5	11	Hit mountain and burned.
11/16/59	NAL	DC-7B	42	6	36	Cause unknown. Burned on water contact.
1/18/60	CAP	V-700D	50	4	46	Loss of engine power in icing conditions. Crashed.
3/17/60	NWA	L-188C	63	6	57	Broke up in flight. Burned at impact.
5/23/60	DAL	CV-880	4	4	0	Lost control and crashed.
7/27/60	CH	S-58	13	2	11	Structural failure in flight.
10/15/60	Capitol Airways	C-46F	2	2	0	Inflight wing failure.
10/28/60	NWA	DC-4	12	4	8	Lost control in mountainous terrain.
12/16/60	UAL	DC-8	84	7	77	Midair collision over New York
	TWA	L-1049	44	5	39	City
7/21/61	AS	DC-6	6	6	0	Hit short of runway on GCA approach.
9/1/61	TWA	L-049	78	5	73	Control failure in flight.
9/17/61	NWA	L-188C	37	5	32	Mechanical failure in flight.
10/4/61	CH	Bell 47G2	1	1	0	Mechanical failure in flight.
3/1/62	AA	B707-123B	95	8	87	Control system malfunction.
4/18/62	Purdue	DC-3	3	3	0	Stalled after takeoff. Lost control.
11/23/62	UAL	V-700D	17	4	13	Collided with swan. Lost horizontal stabilizer.
12/14/62	FTLX	L-1049H	5	3	2	Loss of control after pilot became incapacitated.
1/29/63	CAL	V-812	8	3	5	Loss of control due to ice accumulation
2/12/63	NWA	B-720B	43	8	35	Broke up in flight. Widely scattered.
10/14/63	NY	Vertol 107-11	6	3	3	Rotors hit together and failed.

APPENDIX C

GROUP II

Accidents In Which Some Occupants Survived
While Others Sustained Fatal Injuries

Date	Air Carrier	Type Aircraft	Occupants Total	Crew F	Crew S	Crew M/N	Psgrs. F	Psgrs. S	Psgrs. M/N	Remarks
A. FIRE IN FLIGHT			177	6	4	13	33	8	113	FOUR ACCIDENTS
3/25/58	BNF	DC-7C	24	0	3	2	9	7	3	Inflight engine fire. Crashed during emergency landing.
10/26/59	PAL	DC-3	19	1	1	1	0	1	15	Inflight engine fire. Crashed during emergency landing.
7/14/60	NWA	DC-7C	58	0	0	7	1	0	50	Inflight engine fire. Aircraft successfully ditched.
9/23/62	FTLX	L-1049H	76	5	0	3	23	0	45	Inflight engine fire. Ditching procedures poorly executed.
B. FIRE AT IMPACT			984	49	23	28	400	158	326	TWENTY-FOUR ACCIDENTS
7/17/55	BNF	CV-340	43	2	1	0	20	11	9	Hit signboard on landing approach. Crashed and burned.
9/8/55	Currey Air Transpt.	DC-3	33	2	1	0	0	1	29	Hit power line during approach for emergency landing.
11/17/55	Peninsular Air Transpt	DC-4	74	1	0	3	27	0	43	Power stalled after takeoff due to engine overspeed.
4/1/56	TWA	M-404	36	1	2	0	21	5	7	Struck ground after takeoff. Windmilling propeller.
8/19/56	AK	PA-20S	3	1	0	0	1	1	0	Stalled on approach to landing on lake
2/1/57	NEA	DC-6A	101	0	3	3	20	25	50	Crashed after takeoff in instrument weather.
5/13/57	USOA	DC-4	3	2	1	0	0	0	0	Crashed on ice cap in instrument weather.
6/22/57	WE	UC-64AS	4	1	0	0	0	2	1	Stalled and crashed in narrow canyon.
9/15/57	NEA	DC-3	24	2	1	0	10	11	0	Struck trees during instrument approach.
10/19/57	NY	Bell 47H	3	0	1	0	1	1	0	Rotor blade struck flagpole and crashed.
6/4/58	CAP	DC-3	3	1	2	0	0	0	0	Struck trees during single engine climbout. Training.

APPENDIX C

GROUP III

Accidents In Which All Occupants Survived
But Some Received Serious Injury

Date	Air Carrier	Type Aircraft	Occupants Total	Crew S	Crew M/N	Psgrs. S	Psgrs. M/N	Remarks
A. FIRE IN FLIGHT			74	1	12	1	60	TWO ACCIDENTS
11/14/55	AL	M-202	3	1	2	0	0	Inflight engine fire. Gear collapse on landing.
8/25/58	TWA	L-1649A	71	0	10	1	60	Inflight engine fire and loss of propeller.
B. FIRE AT IMPACT			249	13	24	26	186	TWELVE ACCIDENTS
11/30/56	NY	S-55	2	2	0	0	0	Hard landing followed by fire during demonstration.
3/10/57	EAL	N-404	34	0	3	1	30	Hard landing caused wing separation and fire.
4/30/57	PanAm	DC-7C	6	2	4	0	0	Gear retraction before becoming airborne. Nosed over.
11/6/57	ASA	C-46A	2	2	0	0	0	Engine failure. Remaining engine inadequate to reach airport.
2/13/58	WAL	CV-240	21	0	3	5	13	Wing leading edge separated in flight. Crash landed.
8/28/58	NWA	DC-6B	62	1	3	18	40	Hit airport boundary fence on take-off. Crashed.
10/15/59	USOA	DC-54G	2	2	0	0	0	Lost engine power. Hit trees when ditching in lake.
8/3/61	EAL	L-1049C	3	1	2	0	0	Gear collapsed during taxi for takeoff.
3/5/62	WE	BE-D-18	3	0	1	1	1	Hit ground short of runway during snowstorm.
12/21/62	FAL	CV-340	42	1	2	0	39	Struck ground short of runway. Severe impact.
2/16/63	ZANX	C-46F	2	2	0	0	0	Engine overspeed during takeoff. lost control. Crashed.
5/28/63	Standard	L-1049G	70	0	6	1	63	Landed short of runway due to engine reversal.
TOTAL GROUP III			323	14	36	27	246	FOUTEEN ACCIDENTS

NOTE: No accidents occurred on the ground.

GROUP IV (continued)

Date	Air Carrier	Type Aircraft	Occupants Total	Crew	Psgrs.	Remarks
B. FIRE AT IMPACT			949	142	807	THIRTY-FOUR ACCIDENTS
1/10/55	NAL	L-18	13	3	10	Crashed on takeoff. Fuel tank ruptured and aircraft burned.
1/22/55	Resort	C-46F	2	2	0	Hit trees on ILS approach. Struck ground and burned.
1/31/56	WE	Noorduyn	2	1	1	Lost control on takeoff and hit parked airplane.
4/24/56	Capitol Airways	C-46	2	0	2	Right gear collapsed on landing roll.
5/4/56	WE	DC-3	9	3	6	Bounced off runway after hard landing.
6/7/56	TWA	M-404	31	3	28	Hit approach lights on landing.
7/25/56	CAP	V-700D	4	4	0	Wheels up landing due to loss of electrical power.
1/7/57	SLIX	C-46	2	2	0	Hit dike on landing, collapsing gear. Slid to stop.
3/26/57	Capitol Airways	C-46F	2	2	0	Prop blade failure on takeoff tore off engine. Aborted.
4/18/57	CAP	DC-4	55	4	51	Engine fire on go-around after hitting embankment.
6/28/57	EAL	DC-7B	4	4	0	Nose steering malfunction.
	EAL	L-1049	0	0	0	Hit parked aircraft. Burned.
8/29/57	NWA	DC-4	2	2	0	Turned off wet runway and struck ditch.
8/30/57	NY	S-58C	2	2	0	Hard landing dislodged engine, starting small fire.
11/14/57	EAL	M-404	5	3	2	Hard landing tore engine from aircraft.
3/1/58	AA	CV-240	8	3	5	Premature gear retraction on takeoff. Engine caught fire.
3/17/58	EAL	M-404	10	3	7	Hit gravel pile on landing. Gear collapsed on rollout.
8/6/58	Westair Transport	C-46F	47	5	42	Landed gear up. Engine fire developed.
11/10/58	SB	L-1049D	5	5	0	Prop reversal on takeoff. Hit
	TCA	Viscount	0	0	0	parked aircraft on ramp.
1/15/59	EAL	DC-7B	55	5	50	Wheels up landing. Started fire in #2 engine.
2/20/59	PanAm	DC-7C	3	3	0	Hard landing caused structural damage and fire.
3/15/59	AA	CV-240	2	2	0	Hit Tower on approach. Slid into railroad yard and burned.
4/10/59	PanAm	B-377	10	5	5	Hit embankment on approach and burned.

C. FIRE ON GROUND (continued)

Date	Air Carrier	Type Aircraft	Occupants Total	Crew	Psgrs.	Remarks
6/21/59	PanAm	DC-6A	8	6	2	Aborted takeoff when engine separated and aircraft burned.
11/1/62	PI	F-27	36	3	33	Electrical short caused gear to collapse after engine start.
1/5/64	PanAm	DC-3	2	2	0	Fuel vent leak torched and exploded on engine start.
TOTAL GROUP IV			1608	253	1355	SIXTY ACCIDENTS

Cause of Death (continued)

Date	Air Carrier	Type Aircraft	Total Occupants	Fatalities			Cause of Death								
							Impact			Fire			Other		
				Total	Crew	Psgrs.	Total	Crew	Psgrs.	Total	Crew	Psgrs.	Total	Crew	Psgrs.
8/15/59	AA	B-707	5	5	5	0	5	5	0						
9/12/59	PanAm	DC-4	3	3	3	0	3	3	0						
9/24/59	RV	DC-4	16	16	5	11	16	5	11						
9/29/59	BNF	L-188	34	34	7	27	34	7	27						
10/26/59	PAL	DC-3	19	1	1	0	1	1	0						
11/16/59	NAL	DC-7B	42	42	6	36	42	6	36						
11/24/59	TWA	L-1049H	3	3	3	0	3	3	0						
12/1/59	AAL	M-202	26	25	4	21	25	4	21						
1/18/60	CAP	V-700D	50	50	4	46	50	4	46						
3/17/60	NWA	L-188C	63	63	6	57	63	6	57						
5/23/60	DAL	CV-880	4	4	4	0	4	4	0						
7/14/60	NWA	DC-7C	58	1	0	1							(1)1	0	1
7/27/60	CH	S-58	13	13	2	11	13	2	11						
9/19/60	World Airways	DC-6B	94	80	7	73				80	7	73			
10/15/60	Capitol Airways	C-46F	2	2	2	0	2	2	0						
10/28/60	NWA	DC-4	12	12	4	8	12	4	8						
10/29/60	Arctic Pacific	C-46	48	22	2	20	9	1	7	13	1	13			
12/16/60	TWA	L-1049	44	44	5	39	44	5	39						
	UAL	DC-8	84	84	7	77	84	7	84						
1/22/61	Capitol Airways	C-46F	2	2	2	0	2	2	0						
7/11/61	UAL	DC-8	122	17	0	17				17	0	17			
7/21/61	AS	DC-6	6	6	6	0	6	6	0						
9/1/61	TWA	L-049	78	78	5	73	78	5	73						
9/17/61	NWA	L-188C	37	37	5	32	37	5	32						
10/4/61	CH	Bell 4702	1	1	1	0	1	1	0						
11/8/61	Imperial	L-049	79	77	3	74				77	3	74			
3/1/62	AA	B-707	95	95	8	87	95	8	87						
3/15/62	FTLX	L-1049	107	107	11	96	107	11	96						
3/15/62	FTLX	L-1049H	7	1	1	0				1	1	0			
4/18/62	Purdue	DC-3	3	3	3	0	3	3	0						
9/23/62	FTLX	L-1049H	76	28	5	23							(2)28	5	23
11/23/62	UAL	V-700D	17	17	4	13	17	4	13						

U. S. AIR CARRIER ACCIDENTS IN WHICH FATALITIES RESULTED FROM FIRE

1955-1964

Accident	Total Occupants	Total Survivors	Fatalities			Fire Fatalities			"X"	"Y"	Accident on Airport	Impact Severity (Occupied Area)	Circumstances	Remarks
			Total	Crew	Psgrs.	Total	Crew	Psgrs.						
2/1/57, Rikers Island, N.Y., NEA, DC-6A	101	81	20	0	20	20	0	20	20	0	No	Mod.	Crashed shortly after takeoff.	Crashed on island across river from airport. Fourteen serious fire injuries.
6/4/58, Martinsburg, W. Va., CAP, DC-3	3	2	1	1	0	1	1	0	1	0	No	Mod.	Stalled and crashed after abandoned single engine approach.	Crashed in wooded area not easily accessible. Two serious fire injuries.
8/15/58, Nantucket, Mass., NEA, CV-240	34	9	25	3	22	10	0	10	10	0	No	Extreme	Crashed $\frac{1}{2}$ mile short on landing approach.	Site not easily accessible from airport. Two serious fire injuries.
5/12/59, Charleston, W. Va., EAL, L-049	44	42	2	1	1	2	1	1	2	0	Yes	Minor	Overshoot. Crashed off end of runway.	Crash site not accessible by fire eqpt. One serious fire injury.
9/19/60, Guam,M.I. WRLB, DC-6B	94	14	80	7	73	80	7	73	80	0	No	Mod.	Crashed shortly after takeoff.	Crashed upslope on mountainside 2 miles from airport. Not easily accessible by fire eqpt. Seven serious fire injuries.
10/29/60, Toledo, Ohio, APAX, C-46F	48	26	22	2	20	14	1	13	14	0	Yes	Mod.	Crashed during takeoff.	Intense fog. Burning wreckage not seen by control tower. One serious fire injury.
7/11/61, Denver, Colo., UAL DC-8	122	105	17	0	17	17	0	17	17	17	Yes	Minor	Crashed during landing roll.	Standby emergency eqpt. utilized plus off field eqpt. Poor evacuation. Eleven serious fire injuries.