

**A SUMMARY OF CRASH
FIRE AND INJURY RATES IN
HELICOPTER ACCIDENTS**

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This is a technical information report and does not
necessarily represent CAA policy in all respects.

A SUMMARY OF CRASH FIRE AND INJURY RATES IN HELICOPTER ACCIDENTS*

FOREWORD

The investigation covered by this report was conducted by the Civil Aeronautics Administration's Technical Development Center, Indianapolis, Indiana, under U. S. Army Transportation Research Contract 21X2040 709-9062 P 5030-07 S 44-019, Subtask 127AV, Project 9-89-02-000, dated December 11, 1956.

SUMMARY

A statistical analysis to determine the frequency of post-crash fires and personnel injuries for 1,317 rotary-wing aircraft accidents indicates that fire was experienced in 8.7 per cent of the accidents. The fatality rate in the nonfire accidents was 3.7 per cent and in the post-crash fire accidents, the fatality rate was 42.5 per cent. Of all fatalities, 60.4 per cent occurred in post-crash fire accidents.

INTRODUCTION

Statistical studies of fixed-wing transport aircraft accidents made a number of years ago have indicated that post-crash fire accidents are considerably more serious than nonfire accidents from the standpoint of occupant survival. One such study¹ of serious domestic and international scheduled air carrier accidents for the period January 1938 through June 1951, showed that crashes not followed by fire were fatal to 60.8 per cent of the aircraft occupants. In accidents followed by fire, the fatality rate increased to 84.6 per cent.

The increased use of rotary-wing-type aircraft in civil and military operations has resulted in speculation as to the seriousness of the survival problem in accidents of these aircraft. Because the statistical records for fixed-wing aircraft accidents indicated that the fatality rate was affected appreciably by the occurrence of post-crash fire, it was considered desirable to conduct a similar study of rotary-wing aircraft accidents.

The present statistical study was undertaken to determine the frequency of post-crash fires and to compare injury rates for the fire and nonfire accidents of military and civil rotary-wing aircraft for the years 1952 to 1957. Moreover, the frequency of post-crash fires has been determined for different makes and models of rotary-wing aircraft.

The records used in the preparation of this report were obtained from the Naval Aviation Safety Center, Army Aviation Safety Board, the Air Force Directorate of Flight Safety Research, and the Civil Aeronautics Board.

PERSONNEL INJURY AND AIRCRAFT DAMAGE CLASSIFICATIONS

The results of this study are based on records of accidents involving Army, Navy, Air Force, and civilian aircraft. In the presentation of data, the three branches of the military service are represented by the symbols A, B, and C. The identification of these symbols with particular branches of the military service has been omitted intentionally.

*Reprinted for general distribution from a limited distribution report dated June 1957.

¹Summary of Fatalities in Scheduled Passenger Air Carrier Operation from 1938 through June 1951,(unpublished), Civil Aeronautics Board, Washington, D. C.

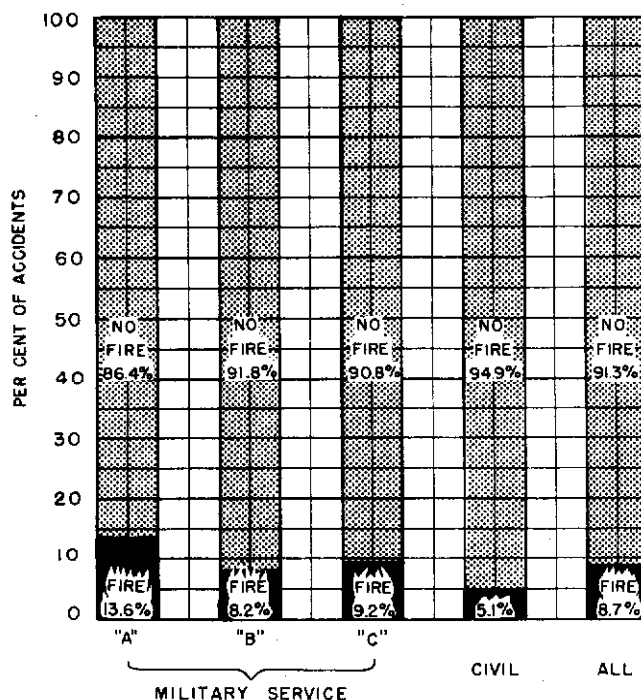


Fig. 1 Percentage Distribution of Fire and Nonfire Accidents of Military and Civil Helicopters

In this statistical study, consideration has been given only to the final results of the accidents. No attempt has been made to determine causes of the accidents or to relate the injury statistics to the number of aircraft flown, flying time, or the type of mission.

The fire and injury data are presented for serious accidents involving 2,810 occupants of 1,317 aircraft. A serious accident is considered to be one in which the aircraft experienced damage necessitating replacement or extensive repair to any major component of the aircraft. An accident is listed as a fire accident if the fire existed after the original impact.

Three classifications have been used to describe injuries sustained in the accidents. The classifications are fatal, major, and minor. A major injury is considered as one in which the occupants required a period of hospitalization and medical treatment and were expected to recover. A minor injury is considered as any injury less serious than a major injury and includes those cases wherein the aircraft occupants sustained no injury.

RESULTS AND DISCUSSION

The frequency of post-crash fires for serious rotary-wing aircraft accidents is shown in Fig. 1. The data presented in this figure show that post-crash fires occurred in 13.6 per cent of all helicopter accidents of military service A, 8.2 per cent of all such accidents for military service B, 9.2 per cent for military service C, and 5.1 per cent of civil helicopter accidents. The diagram for all accidents shows that fire occurred in 8.7 per cent of all accidents.

Information on personnel injuries for all accidents is shown in Fig. 2. A of Fig. 2 shows the distribution of injuries for the nonfire accidents, and B of Fig. 2 shows the distribution of injuries for those accidents involving post-crash fires. These data indicate that the fatality rate for all nonfire accidents was 3.7 per cent, whereas the fatality rate for the post-crash fire accidents was 42.5 per cent. In the nonfire accidents, as shown in A of Fig. 2, there appears to be no significant variation in the distribution of fatal injuries between the military accidents and the civilian accidents. However, the records show that a greater percentage of major injuries occurred in accidents involving the aircraft of military service C than occurred in accidents which involved the aircraft of military services A and B and those of civilian operators.

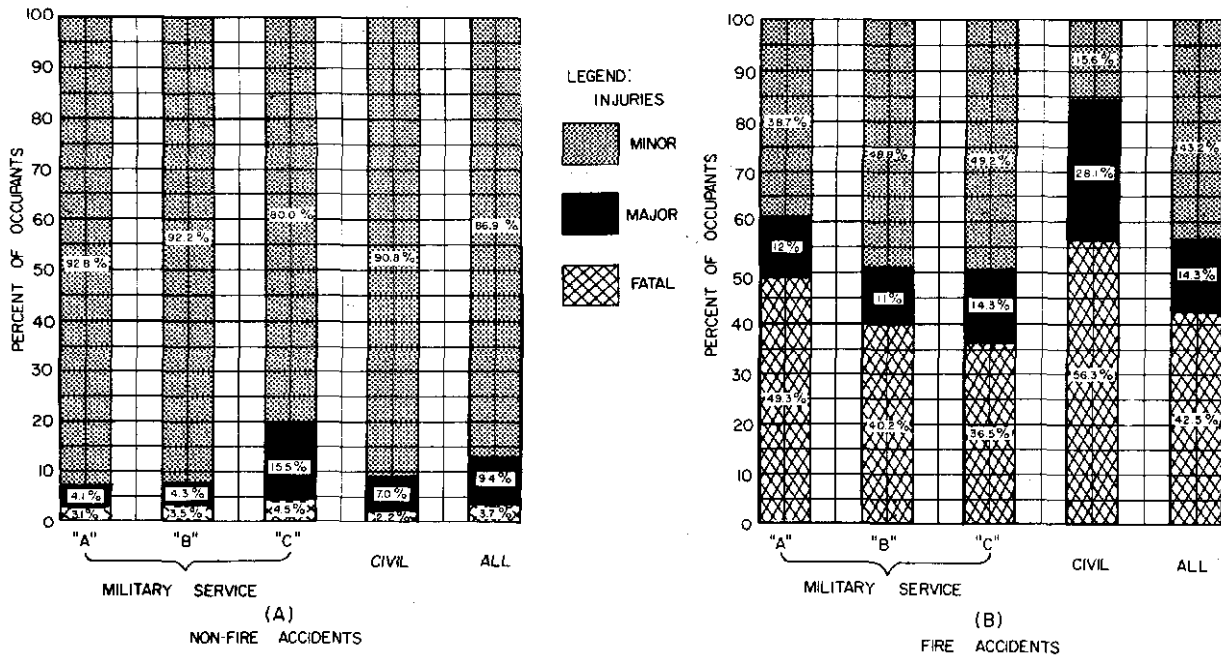


Fig. 2 Percentage Distribution of Personnel Injuries Experienced in Accidents of Military and Civil Helicopters

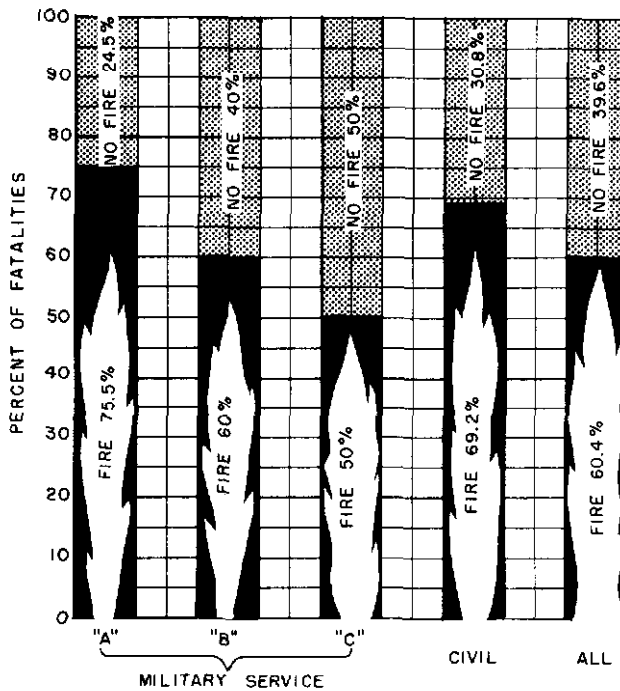


Fig. 3 Percentage Distribution of Fatalities Experienced in Fire and Nonfire Accidents of Military and Civil Helicopters

In the accidents involving post-crash fires, the rate of fatal and major injuries for civil aircraft accidents is appreciably greater than the rates for the three military services. In the civil accidents, only 15.6 per cent of the aircraft occupants escaped with minor or no injuries compared to 38.7, 48.8, and 49.2 per cent, respectively, for accidents of the military services A, B, and C.

The percentage distribution of fatalities experienced in fire and nonfire accidents is shown in Fig. 3. The data in this figure show that 60.4 per cent of all fatalities occurred in the post-crash fire accidents. This is even more significant when it is realized that post-crash fires occurred in only 8.7 per cent of all the accidents.

The number of fire and nonfire accidents studied for various makes and models of rotary-wing aircraft is summarized in Table I. For those types of aircraft involved in more than 100 accidents, fires occurred in 5.3 to 12.0 per cent of the accidents. The number of post-crash fires for aircraft types involved in less than 100 accidents is not considered to be significant statistically.

TABLE I
HELICOPTER FIRE AND NONFIRE ACCIDENTS
BY MAKE AND MODEL

Helicopter Make and Model	Accidents				
	Total	Nonfire	Per Cent Nonfire	Fire	Per Cent Fire
Sikorsky S51, H5, HO3S	66	62	93.9	4	6.1
Bell 47, H13, HTL	478	450	94.1	28	5.9
Sikorsky S52-2, H18, HO5S	52	51	98.1	1	1.9
Sikorsky S55, H19, HO4S, HRS	341	300	88.0	41	12.0
Piasecki PD22, H21, HRP	36	29	80.6	7	19.4
Hiller 12B, H23, HTE	154	142	92.2	12	7.8
Piasecki PD18, H25, HUP	131	124	94.7	7	5.3
Sikorsky S58, H34, HSS, HUS	17	11	64.7	6	35.3
Kaman HTK	9	8	88.9	1	11.1
Bell 61, HSL	4	1	25.0	3	75.0
Kaman HOK	18	14	77.8	4	22.2
Sikorsky R4B	1	1	100.0	0	0.0
Hiller S60	5	5	100.0	0	0.0
Hiller HJ1	1	0	0.0	1	100.0
Kaman 225	1	1	100.0	0	0.0
McCulloch MC4C	1	1	100.0	0	0.0
Jensen 21	1	1	100.0	0	0.0
Kaman 190	1	1	100.0	0	0.0