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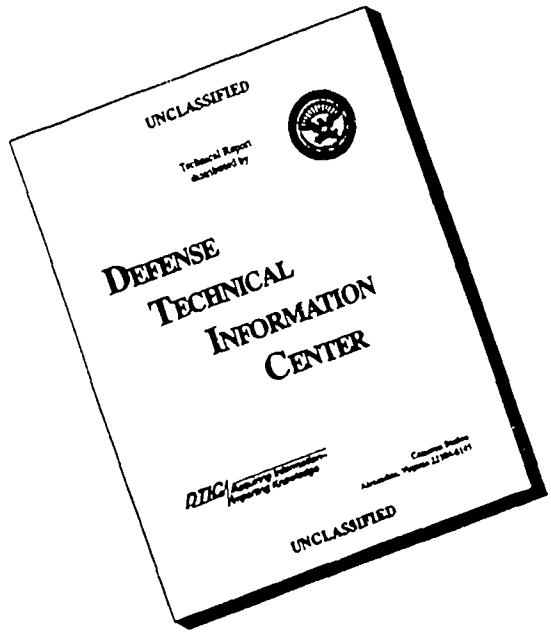

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MEMORANDUM REPORT NO. 2030

U. S. ARMY CASUALTIES ABOARD AIRCRAFT IN THE REPUBLIC OF VIETNAM (1962 through 1967) (U)

by

Roland G. Bernier
Horace C. Smith

March 1970

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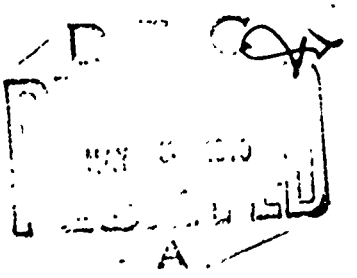

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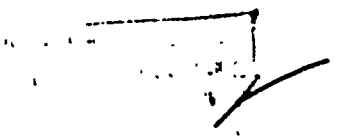

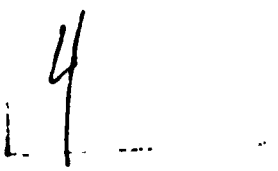

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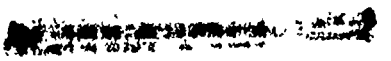

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U.S. ARMY CASUALTIES ABOARD AIRCRAFT IN THE REPUBLIC OF VIETNAM (1962 through 1967) (U).

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Horace C. Smith
Army Materiel Systems Analysis Agency

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MEMORANDUM REPORT NO. 2030

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March 1970

U.S. ARMY CASUALTIES ABOARD AIRCRAFT IN THE REPUBLIC OF VIETNAM (1962 through 1967) (U)

(UNCLASSIFIED) ABSTRACT

All the reported casualties to U.S. Army combat personnel aboard aircraft from December 1961 through December 1967 in the Republic of Vietnam are analyzed. Combat casualties include those wounded directly by projectiles, fragments, and impact debris, as well as those injured in crashes caused by ground-fire hit on the aircraft. The data exclude crash injuries resulting from pure accidents and hostile incidents without hits on the aircraft. Most casualties occurred on Army UH-1 helicopters. Casualties are classified by type, severity, crew station, anatomical location, cause, etc., in detailed appendixes. Discussion includes comments on casualty reduction and lessons learned.

(UNCLASSIFIED) ACKNOWLEDGMENTS

The authors gratefully acknowledge the cooperation and assistance of the Casualty Division, Adjutant General's Office, and of the Disposition Branch and Files Section, Office of the Chief of Support Services, in collecting the source data for this report.

(UNCLASSIFIED) TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

1. (CONFIDENTIAL) INTRODUCTION

This report analyzes all the reported combat casualties (4065) to U.S. Army personnel aboard aircraft in the Republic of Vietnam (RVN). The sample includes 478 fatal casualties. The period analyzed begins in December 1961 with the entry of U.S. Army CH-21's into Vietnam and was arbitrarily cut off on 31 December 1967. This report supersedes BRL Technical Note 1617 (Reference 1) which was the first formal publication by Aberdeen Research and Development Center (ARDC) on this subject, and in turn will be updated as more data accumulate. The sample deals exclusively with U.S. Army personnel; hence, the findings should be conservative. Comparable data were not available on Vietnamese or on other non-U.S. Army personnel who became casualties aboard U.S. Army aircraft. In other respects, the sample was selected to be most relevant to "combat" casualties; a serious attempt was made to exclude casualties resulting from (pure) accidents not involving ground-fire hits. Also excluded were casualties occurring to aircrew (and passengers) while off the aircraft and even while dismounting.

1.1 Objective.

The main objective of this study is to identify and define the different types of casualties that occur, their causes, frequency and circumstances, qualitatively and quantitatively as fully and as precisely as possible. Many efforts have already been devoted to increasing survivability of Army aircraft and aircrews, and such efforts should continue. But all such efforts require adding weight, and weight is critical to the performance of helicopters and other light aircraft.

The identification of casualty types, locations, and causes should suggest ways and means to prevent casualties; the relative frequency of the various casualty occurrences should suggest the proper perspective for minimizing casualties. Hopefully, clarification of these issues can provide a basis for designing new aircraft including seats, personnel armor and helmets, with maximum crew and passenger

survivability but with a minimum weight penalty and sacrifice to mission performance.

1.2 Approach and Procedure.

The basic approach of this study is a classification procedure. The two main types of casualties are wounds and injuries. A third minor type, called "Other" segregates combat casualties occurring on board aircraft which were not clearly wounds nor injuries as defined for this study. All the casualties were further classified by severity, aircraft type, crew station, anatomical location, ground fire type, type of injury or wounding agent, and various other groups that are (or appeared to be) potentially meaningful. Basically the classification procedure was limited only by the information available from the source reports.

All data sources pertinent to a given incident were coded and submitted to an "Information Recall" computer program capable of generating almost any desired correlation. Throughout these correlation tables, two general terms are used - Casualty Type and Casualty Severity - each of which is subdivided into three classes. The three casualty types are Wound, Injury, and Other; the three severities are Fatal, Serious, and Non-Serious. These and other significant terms are defined for this study in the following paragraph.

1.3 Definitions of Terms Used in This Report.

Casualty - U.S. Army personnel who, as a direct result of enemy action, is wounded, injured or hurt while aboard an aircraft.

Wound - A casualty resulting from a penetration or perforation of the body by a missile (bullet, fragment, spall, or aircraft debris) while the aircraft is involved in combat operations.

Injury - Casualty (not wounded as defined above) resulting from projectile impacts on the aircraft forcing it to land or crash with sufficient force to cause internal injuries, broken bones, etc., to occupants of the aircraft.

Other - Casualty (not a wound or injury as defined above) incurred while engaging a hostile force, not necessarily the result of projectile impacts on the aircraft or individuals aboard. For example: an aircraft occupant thrown against a hot machine-gun barrel and burned during ground-fire evasion maneuvers.

Severity - Degree or seriousness of casualties.

Fatal - Includes Wounded, Injured or Other type casualties who expire as a result of the incident, immediately or subsequently.

Serious - This degree of casualty (Wound, Injury or Other) severity includes the following categories as defined by AR 600-10: Very Serious, where life is imminently endangered; Serious, where cause for concern exists, but there is no imminent danger to life.

Non-Serious - Casualty (Wound, Injury or Other) where cause for immediate concern does not exist. Casualties classified as "non-serious" include loss of limb or sight, permanent disfigurement, or require extensive medical treatment and hospitalization. Consequence of wound or injury is not immediately significant and no danger to the life of the casualty is apparent.

Crash - Any ground-fire hit incident while the aircraft is in flight resulting in an uncontrolled landing, i.e., aircraft incapable of being governed, guided, or restrained at touchdown.

Forced Landing - Any ground-fire hit incident while the aircraft is in flight (not a crash) resulting in a controlled landing prior to its intended time.

Combat - For purposes of this report, a "combat incident" is defined as an actual projectile(s) impact(s) on the aircraft and/or individual(s) aboard. This definition excludes casualties classified as "due to hostile action" in AR 600-10, where ground-fire hits were not involved.

1.4 Sources.

The principal data sources used in this study are casualty reports from the Office of the Adjutant General (TAGO) as prescribed in AR 600-10 and reports concerning fatalities from the Office of the Chief of Support Services and the National Record Center as prescribed by AR 638-40 and AR 340-400.

Initially, a decision was made to base the study on these data sources because they furnished complete casualty information. However, a major change in the casualty reporting system occurred in April of 1966. In an attempt to reduce the administrative workload in South Vietnam, individual casualty reports were discontinued by TAGO for those persons not classified as very seriously or seriously wounded or injured and who did not wish their next of kin to be notified. These casualties are now tabulated on a casualty log sheet where such information as anatomical location of wound or injury and exact aircraft type are omitted. Thus, it became necessary to use supplementary casualty information found in aircraft ground-fire damage reports or other casualty information on aircraft hit incidents reported to Army Materiel Systems Analysis Agency (AMSAA). These facts account for the "unknown" entries found throughout the tables of this report.

A list of the major data sources used and sample forms for each are presented in Appendix A. A distribution of the number of casualties reported by each data source is presented in Table A-7, and the number of casualties reported by multiple data sources is presented in Table A-8.

1.5 Aircraft Types.

All of the casualties in this study were U.S. Army personnel and were aboard a variety of aircraft in the Republic of Vietnam. Although a few of these casualties occurred aboard U.S. Air Force and U.S. Marine Corps aircraft, most were aboard U.S. Army rotary wing and, in fact, the majority of these were aboard UH-1 helicopters. Casualty data

are presented herein by various aircraft types as warranted by sample size. Major characteristics of the aircraft involved are summarized in Appendix A, Table A-1; the inventory of each type of aircraft in Vietnam for every half-year is presented in Table A-2. Flying hours per half-year are presented for each aircraft type in Table A-3. To further assist in calculating casualty "risks," numbers of aircraft sorties hit are presented in Table A-4 and numbers of aircraft combat crashes are presented in Table A-5. These data were obtained from aircraft damage reports (other than casualty data sources) which are collected and analyzed separately. A bibliography pertinent to aircraft damage is contained herein. All of these data are presented in half-year increments to facilitate correlation with any other operations-type data which may be recorded on either fiscal or calendar year basis. Note that Army aircraft flew a total of over 4,000,000 hours in Vietnam from December 1961 through the end of 1967, and also note the escalation of activity especially in late 1965. Unfortunately "flying hours" is not the best index or basis for casualty (or any other combat data) analysis because it includes a significant amount of non-combat flying; however, it was utilized herein because no other type of data was available on all the aircraft for the period of interest. A total of over 10,000 aircraft hit incidents occurred (Table A-4). Other aircraft damage studies indicate an average ratio of approximately two hits per aircraft sortie hit. For complete perspective the crash statistics are also presented (Table A-5) as a means of relating casualty data to combat crashes without casualties.

1.6 Threat.

Studies concerning ground-fire damage inflicted on aircraft indicate that, for the period 1962-1967, the weapon threat was approximately 85 percent Caliber .30 type, 10 percent Caliber .50 type, and 5 percent miscellaneous, including booby traps and land mine detonations, usually in the landing zone. Unfortunately casualty reports were not specific on bullet caliber and weapon type, but the main cause of personnel casualties was small bullets. Booby traps and land mines,

detonated by rotor wash and on command, were techniques first employed by the enemy during the latter portion of the 1962-1967 period. Through 1967 this tactic resulted in 16 wound-type casualties (5 fatal and 11 non-serious) but no injury-type casualties.

1.7 Presentation.

Most casualty analyses in the past have selected "severity" as the first order of classification, i.e., fatal versus non-fatal casualties, and in many cases, only the fatalities were analyzed. In this report "casualty type" was selected as the first order of classification in the belief that separate treatment of "injuries" and "wounds" would bring out more clearly the causes of casualties, and hence the potential remedies. Detailed data and a large variety of correlations are presented in the Appendixes of this report and some gross general observations are presented in the following section primarily to describe the sample. However, it is felt that the most significant contributions of this study are presented in the separate sections on "injuries" and "wounds." To accomplish this, data on the "Other (Combat)" casualties were analyzed separately and found to be relatively insignificant. Significant subgroups of injuries and wounds are analyzed in detail in their respective sections. Crew station, aircraft type, threat, and other factors are discussed, but the primary effort was to identify relative frequency of each type of casualty and to correlate it with cause.

2. (CONFIDENTIAL) GENERAL CASUALTY ANALYSIS

The sample of data for this analysis consists of 4065 reported U.S. Army casualties. These casualties occurred aboard a variety of aircraft performing many different missions. Casualties were occupants of all crew and passenger positions with varying degrees of severity and from numerous causes. Two distinct major types of casualties occurred, i.e., wounds and injuries (as previously defined), and the significant variables of each type are discussed in the following sections. This

section analyzes variables common to casualties of both types and other aspects of significance to casualties in general.

2.1 Severity.

The sample includes 478 fatalities, which represent 11.8 percent of the total (4065) casualties. Perhaps the most significant observation of this study is that more than twice as many fatalities resulted from "Injuries" as from "Wounds" - 325 versus 153.

A total of 3587 non-fatal casualties occurred, which represent 88.2 percent of all casualties, or a non-fatal to fatal ratio of approximately 9:1. Most were reported as "non-serious," but 89 serious non-fatal cases were reported, representing 2.2 percent of the 4065 total casualties or 2.5 percent of the 3587 non-fatal casualties. For many statistical applications, these serious, non-fatal cases should be considered as important as the fatalities.

Of the reported casualties, most were reported as "non-serious" - 3498 out of 4065 or 86.0 percent. Undoubtedly, some very minor scratches and bruises were never officially recorded, and hence do not influence this study. Reports concerning "non-serious" cases were frequently lacking in detail, which accounts for the many "unknown" entries in the Appendix tables. As a rule, reporting was more detailed for the "fatal" and "serious" cases. While most of the fatalities were crash injuries rather than direct wounds, the opposite is observed for the non-fatal (mostly non-serious) casualties. Most were wounds caused by spall and debris resulting from bullet impact on aircraft materials rather than by bullets. Casualty severity is discussed further for the various types of casualties and for the other variables throughout this analysis.

2.2 Casualty Type.

In this analysis, the entire 4065 casualties were divided into three distinct types. The main types, Wounds and Injuries, plus the Other (Combat) casualties, are distributed as follows:

Wounded	2946 (72.5%)
Injured	873 (21.5%)
Other	246 (6.0%)
Total	4065

As referred to previously, however, the distributions of fatal and non-fatal casualties by types are significantly different:

FATAL CASUALTIES

Wounded	153 (32.0%)
Injured	325 (68.0%)
Other	0 (0.0%)
Total	478

NON-FATAL CASUALTIES

Wounded	2793 (77.8%)
Injured	548 (15.3%)
Other	246 (6.9%)
Total	3587

When these figures are compared, it becomes apparent that crash injuries (and burns) caused more combat fatalities than direct wounds, by a factor of more than 2 to 1. On the other hand, direct wounds account for more non-fatal casualties than injuries by a factor of more than 5 to 1. Hence, the distribution of total casualties, which suggests more wounds than injuries by a factor of more than 3 to 1, can be misleading. The distribution of total casualties suggests that greater reduction in casualties is possible by reduction of wounds, but fatality distribution suggests greater reduction is possible by reduction of injuries. Wounds can be reduced only by armoring personnel; reducing injuries requires aircraft improvement by a variety of means, only one of which is armoring; hence, separate analysis of wounds and injuries becomes essential to ensure proper guidance to all efforts for casualty reduction.

A legitimate question arises on the relative significance of "serious" non-fatal casualties. One means of consideration is to examine

the combined distribution of severity and type for the 4065 casualties as follows:

Type	Non-Serious	Serious	Fatal
Wounds	2744 (67.5%)	49 (1.2%)	153 (3.8%)
Injuries	511 (12.6%)	37 (0.9%)	325 (8.0%)
Others	243 (5.9%)	3 (0.1%)	0 (0.0%)
Total Casualties	3498 (86.0%)	89 (2.2%)	478 (11.8%)

Another way of looking at casualty distribution is to consider "serious" as important as fatal and combine them as follows:

Type	Non-Serious	Serious or Fatal
Wounds	2744 (67.5%)	202 (5.0%)
Injuries	511 (12.6%)	362 (8.9%)
Others	243 (5.9%)	3 (0.1%)
Total Casualties	3498 (86.0%)	567 (14.0%)

Still another point of view is to ignore the 3498 "non-serious" and "others" and to examine the distribution of the 567 serious and fatal wound and injury cases only, as follows:

Type	Serious	Fatal	Total
Wounds	49 (8.7%)	153 (27.1%)	202 (35.8%)
Injuries	37 (6.6%)	325 (57.6%)	362 (64.2%)
Total	86 (15.3%)	478 (84.7%)	564 (100.0%)

While the "numbers" can be varied to accommodate numerous degrees of concern, the basic conclusion remains the same; i.e., although injuries occur less often than wounds, injuries are generally more significant and hence offer more potential for reduction in severe casualties. Both classes are further analyzed in the following sections of this report.

2.3 Time Trends.

The sample of 4065 casualties (including 33 casualties aboard non-Army aircraft) represents the total accumulation of U.S. Army personnel combat casualties reported to BRL from the entry of Army

aircraft in the Republic of Vietnam (December 1961) through the end of calendar year 1967. During this period the number of U.S. Army aircraft deployed rose to 3536. In Appendix A statistics are presented for half-year periods to permit analysis by either fiscal year or calendar year as the need arises to compare combat casualty data herein with other Vietnam data. This history is summarized by calendar year in the following table:

TABLE 2.1 (C). FLYING HOURS, AIRCRAFT HIT, REPORTED CASUALTIES AND FATALITIES VERSUS CALENDAR YEAR (U)

Calendar Year	Thousands of Flying Hours	Total Aircraft Sorties Hit	Total Reported Casualties	Fatalities
1962	45	144	38	5
1963	166	626	166	19
1964	242	836	331	39
1965	531	1420	511	75
1966	1335	3310	1201	144
1967	2093	4341	1785	190
TOTAL	4412	10,677	4032[a]	472[a]

[a]Excludes casualties aboard non-U.S. Army aircraft.

Figure 2.1 illustrates the general escalation of U.S. Army aircraft operations in the Republic of Vietnam from 1962 through 1967. Flying hours, aircraft hit, total casualties, and fatal casualties all follow the same general trends by year.

2.4 Casualty Rates (Risk).

For all U.S. Army aircraft activity in the Republic of Vietnam, the average number of flying hours was 1100 per casualty and 9400 per fatality. (In more common accident terminology, these rates are respectively 91.2 casualties and 10.7 fatalities per 100,000 flying hours.) These statistics (Table B-3) vary significantly by aircraft type; U.S. Army fixed wing aircraft are significantly less exposed to

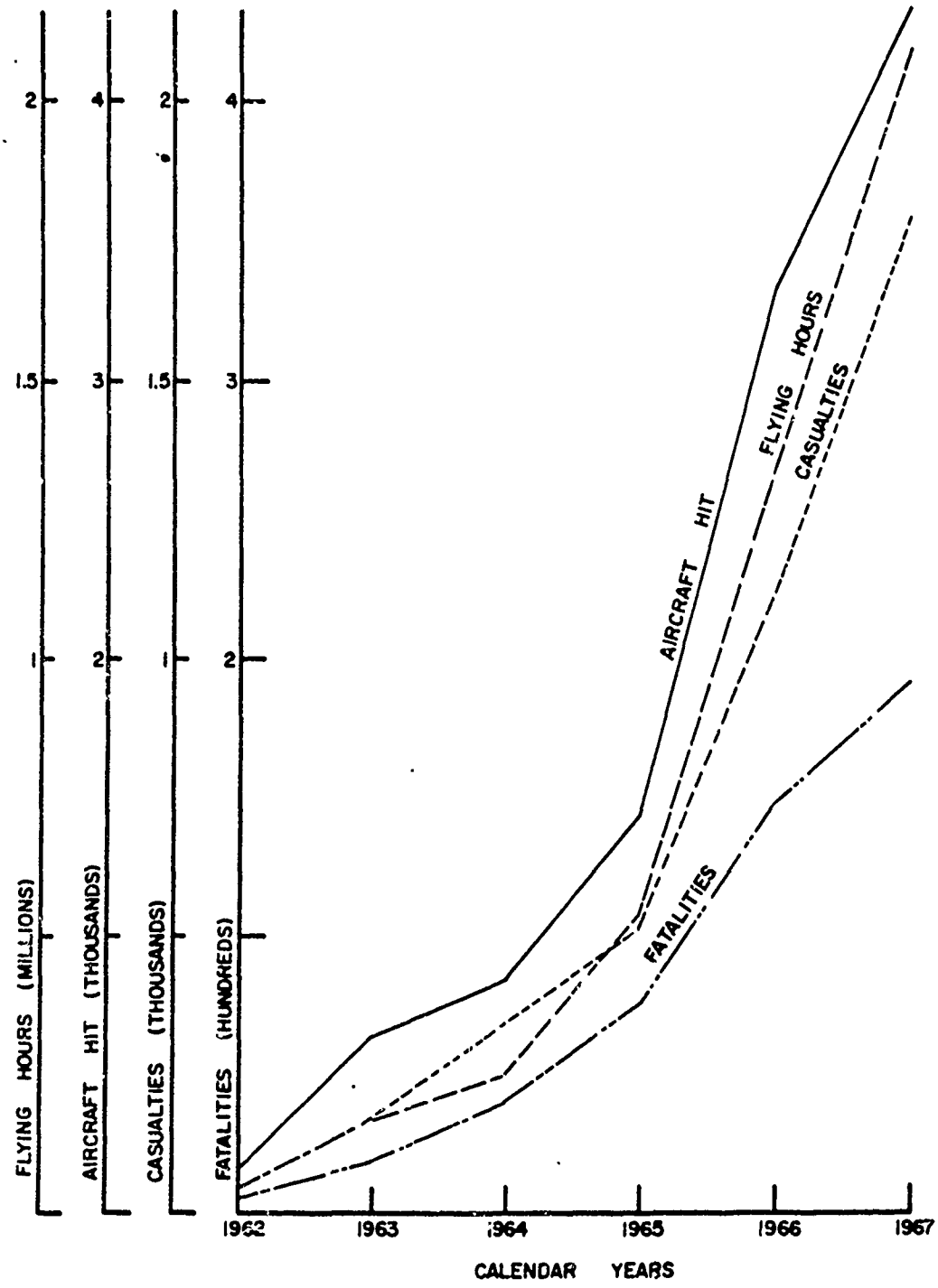

Figure 2.1 (C)—Flying Hours, Aircraft Hit, Reported Casualties & Fatalities For U.S. Army Aircraft in Vietnam vs Calendar Year (U)

combat casualties than the helicopters. These data are summarized in Table 2.2.

TABLE 2.2 (C). FLYING HOUR RATES PER CASUALTY VERSUS AIRCRAFT TYPE AND CALENDAR YEAR (U)

Rank	Aircraft	Average Number of Flying Hours	
		Per Casualty	Per Fatality
1	Armed UH-1B/C	400 ± 150[a]	2900 ± 400[a]
3	Transport UH-1D/H	1150 ± 250[a]	9500
2	CH-21C (1962-64)	680	6700
4	CH-47	1250	12600
5	OH-13S/23G	2100	16100
6	CH-54	4800	--
1	OV-1A/B/C	2000	22200
2	O-1	5400	32600
3	CV-2B	8800	83200
4	U-1A/6A/8D	18000	68200
	All UH-1's	780	6800
	All Helicopters	850	7400
	All Fixed-Wing	6220	41100
	All Army (1962-1965)	950	7200
	All Army (1966)	1110	9300
	All Army (1967)	1170	11000
	All U.S. Army	1100	9400

[a]UH-1 not specified whether Armed or Transport in some cases.

Note that risk of casualty (and fatality) is related to the "aggressiveness" of the missions assigned to the various classes of aircraft: Armed UH-1B/C and OV-1A/B/C, in the rotary-wing and fixed-wing classes, fly the highest-risk missions. the CH-54 Crane and the U-1A/6A/8D Utility aircraft are least-risk aircraft. Two main factors

probably account for the significantly lower risk of casualty in the fixed-wing aircraft: ability to overfly the main threat (which is small caliber weapons in Vietnam) and fewer personnel on board (usually). Other factors, such as relative speeds and personnel protection, may also have a minor influence. In general, fatality rates decreased in time (Table B-4) for nearly all classes of aircraft; the respective periods of usage in RVN differed for the various aircraft types.

2.5 Rate of Aircraft Hit Per Casualty.

Various ratios can be useful as a measure of casualty rate for different purposes. For aircraft users, flying hours per casualty is a useful index of overall survivability. For designers of aircraft and/or protection, the probability of casualty given a hit on the aircraft is more relevant.

Rates of aircraft sorties hit per casualty were calculated in Tables B-5 and B-6 and the significant groups are summarized in Table 2.3.

Note that the "rank" on an aircraft-sortie-hit basis is different than that on a flying hour basis (presented in Table 2.2). A factor such as "personnel density" seems best to explain the general ranking pattern - except for the CH-21. The UH-1 Transports rank first - and higher than the Armed UH-1's which are hit more often; the main mission of the UH-1 Transports is to carry troops into landing zones, thereby exposing more personnel to casualties than do other aircraft. The fixed-wing aircraft rank significantly lower than the rotary wings because, from below, their wings contribute large presented areas for hits (without possible casualties). The small OH-13/23's and O-1's rank higher than the large CH-47's and CV-2B'S because personnel in these represent a higher proportion of the volume and hence of the total aircraft presented area. Even the CH-21's apparent anomaly can be explained. While its role was primarily personnel carrier (like the UH-1D), it transported ARVN troops rather than U.S. Army personnel. Since good casualty data on ARVN troops were not available for this study, the CH-21 appears to rank with the CH-47 which to date has been

employed primarily in resupply work. Note that number of aircraft hit per casualty did not vary significantly with time, which suggests that it is characteristic of the number of people aboard.*

TABLE 2.3 (C). RATES OF SORTIES HIT PER CASUALTY VERSUS AIRCRAFT TYPE AND CALENDAR YEAR (U)

Rank	Aircraft	Average Number of Aircraft (Sorties) Hit	
		Per Casualty	Per Fatality
1	Transport UH-1D/H	2.3 ± 0.5[a]	18.8 ± 0.1[a]
3	Armed UH-1B/C	2.9 ± 1.0[a]	20.4 ± 2.7[a]
2	OH-13S/23G	2.8	19.8
4	CH-47	3.4	34.6
5	CH-21	3.7	36.0
6	O-1	6 ± 1[a]	35 ± 7[a]
7	U-1A/6A/8D	11 ± 6[a]	42 ± 23[a]
8	OV-1A/B/C	15 ± 3[a]	164 ± 30[a]
9	CV-2B	18 ± 6[a]	170 ± 58[a]
	All UH-1	2.3	19.7
	All Helicopters	2.4	20.5
	All Fixed-Wing	8.5	56.3
	All Army (1962-1965)	2.9	21.9
	All Army (1966)	2.8	23.0
	All Army (1967)	2.4	22.8
	All U.S. Army	2.6	22.6

[a]Aircraft type and model not completely identified in some cases.

*Rates of Sorties hit per casualty can be correlated to individual hits per casualty for most of the casualty sample by merely doubling the sortie rate, since UH-1 sorties were found to receive an average of about two hits per sortie hit.

2.6 Aircraft Missions.

An attempt was made to correlate casualty occurrences with aircraft mission or activity. See Table B-8. Unfortunately, mission was reported too often as "Combat" or "Combat Support"; hence, two-thirds of the sample mission is inadequately specified. However, the reported data does serve as a crude index of the main activities for each aircraft type at the time casualties occurred. For the UH-1, the main missions were combat support (mainly delivering troops to landing zones), armed and unarmed reconnaissance, troop extraction, resupply, and medical evacuation. For the CH-21, the role was similar to the unarmed role of the UH-1, except that the passengers were usually ARVN troops. For the CH-47, the main mission was resupply. For the small OH-13S and OH-23G the role was mainly armed and unarmed reconnaissance. Similar observations for the fixed-wing aircraft were mainly reconnaissance for the O-1 and OV-1, and resupply for the others (CV-2B, U-1A, U-6A, U-8D). The other missions of Army aircraft were mentioned occasionally, (including some non-combat) but in view of the known limitations of the reports on this data, it could be misleading to imply detailed correlations of casualty occurrence with reported mission. Further analysis was abandoned.

2.7 Crew Station.

Does crew station, i.e., personnel location on Army aircraft (when hit), affect chance of casualty? The first attempt to examine this factor is presented in Tables B-8 and B-9 and summarized in Table 2.4 for all aircraft.

There is no physical or operational explanation for the large difference in casualty frequency between pilots and copilots; in practically all the aircraft, the only real difference between them is right-versus-left position. The difference is accountable, however, in terms of the TAG Casualty Reporting System.

TABLE 2.4 (C). CASUALTIES AND FATALITIES BY CREW STATION (U)

Crew Station	Casualties	Fatalities
Pilots	1075	116
Copilots	591	83
Crew Chiefs	773	94
Gunners	839	84
Observers	148	22
Passengers	581	78
Unspecified	58	1
	4065	478

The principal data sources for this analysis were U.S. Army casualty reports as prescribed in AR 600-10 and AR 638-40. These reports (Appendix A) were executed by personnel not necessarily on the scene of the incident, and certainly not with any need to document who was sitting in the right or left front seat. The TAGO casualty reporting system requires that a casualty's "duty military occupational specialty" (MOS) be reported. Since no MOS exists for copilots, many are reported as pilots. In many cases, supplementary reports enabled the data processors (coders) to distinguish between pilot, copilot, aircraft commander, etc., but in the many cases, documented only by casualty report data, pilot MOS established crew station. Fortunately, no similar problem was encountered in distinguishing between crew chiefs and gunners, even though they too operated in analogous right and left gunner positions most of the times when aircraft were hit. For the remainder of this study aircrewmen were separated into three groups, i.e., pilots and copilots in one group, crew chiefs and gunners in a second group, and all others in a third group. The relative hazards of these three position groups are examined in Tables B-10 and B-11 and summarized in Table 2.5.

TABLE 2.5 (C). CASUALTY DISTRIBUTION (PERCENT) BY CREW STATION AND AIRCRAFT TYPE (U)

Aircraft	Crew Station	Casualties	Fatalities
UH-1	Pilot and Copilot	40.7	42.0
	Crew Chief & Gunner	43.3	41.5
	All Others	16.0	16.5
Other Helicopters	Pilot and Copilot	39	37
	Crew Chief & Gunner	29	26
	All Others	32	37
Fixed-Wing	Pilot and Copilot	58	53
	All Others	42	47
All U.S. Army	Pilot and Copilot	41.0	41.6
	Crew Chief & Gunner	39.7	37.2
	All Others	19.3	21.2

For the UH-1's (which represent 84.6 percent of all the data), there is no significant difference in hazard between the cockpit and the door positions. Together the four crewmen received more casualties than the "riders" by a factor of about 4 to 1. To some extent, this reflects the fact that Vietnamese and other non-Army passenger casualties were excluded in this analysis, because complete data were not readily available. To some extent it also reflects the fact that some of the Army aircraft never carry passengers, and all of them frequently fly without passengers. Since pilot, copilot, crew chief, and gunner nearly always flew together on the UH-1's, and no difference in casualty hazard appears, it is strongly suggested, at least for UH-1's, that overall casualty (and fatality) risk is independent of personnel location on the aircraft. Table B-11 tends to confirm this.

The average number of reported casualties per fatality (wounds or injuries) was calculated for all the available combinations of crew station groups and aircraft groups, and these very nearly approach a

constant (8.5), which suggests roughly that everyone aboard any Army aircraft has a nearly equal chance to survive casualty incidents. While large deviations from this constant are observed for several of the aircraft, most of these are not significant because of small sample size or data-collecting philosophy. On the other hand, the four main crewmen suffer more casualties because of more frequent exposure; hence, these stations probably warrant priority over those for riders for those types of protection which do not protect the whole aircraft (e.g., crew armor). These factors are examined in greater detail in the subsequent sections on injuries and wounds in this report.

2.8 Aircraft Type.

Of the total 4065 reported casualties it was previously mentioned that 86.0 percent were non-serious, 2.2 percent were serious, and 11.8 percent were fatal. Further distribution of casualty severity by aircraft type results in the following:

TABLE 2.6 (C). SEVERITY DISTRIBUTION (PERCENT) VERSUS AIRCRAFT TYPE (U)

Aircraft	Non-Serious	Serious	Fatal
UH-1	73.1	1.7	9.7
Other Helicopters	8.5	0.3	1.2
Fixed-Wing	3.7	0.1	0.7
Non-Army	0.6	0.0	0.1

Note for the fixed-wing aircraft that the ratio of fatalities (1 to 5) is higher than that for the rotary-winged aircraft (1 to 8). A detailed Army casualty distribution for all the aircraft involved is presented in Table B-12. For purposes of this analysis it is important to keep in mind that the distribution of aircraft involved in the casualty sample is (1) 99.2 percent Army aircraft, (2) 94.6 percent Army helicopters, and 84.6 percent Army UH-1's.

In turn the UH-1's consisted of at least two major classes: Armed Escorts (gunships) and Transports (slicks). Unfortunately, it was not possible to subdivide these precisely, because the casualty source data frequently did not specify UH-1 model or type. Fortunetely, this lack of specific identification occurred less frequently on the fatal and serious casualty source reports.

This distribution by aircraft of all the sample data is presented in Table A-6 and summarized in Table 2.7 by flying hours, aircraft hit, crashes, and casualty major classifications. Note the differences, e.g., whereas UH-1's flew 60.6 percent of the total Army aircraft hours (in RVN), it received 72.8 percent of the hits, and 85 percent of the casualties. On the other hand, the fixed-wing aircraft flew 26 percent of the hours but accounted for 14.8 percent of the hits and only 5 percent of the casualties. The position of the other (non UH-1) rotary-wing aircraft falls between UH-1 and fixed-wing in this distribution. Note also, in the distribution, the smaller differences between wound and injury type casualties and fatalities.

TABLE 2.7 (C). DISTRIBUTION (PERCENT) BY AIRCRAFT TYPE FOR FLYING HOURS, AIRCRAFT HIT, CRASHES AND CASUALTIES (U)

Distribution of	UH-1	Other R/W	Fixed-Wing
Flying Hours	60.7	13.3	26.0
Aircraft Hit	72.8	12.4	14.8
Crashes	66.3	17.0	16.7
Casualties	85.3	10.1	4.6
Fatalities	83.7	10.4	5.9
Injuries	80.2	12.7	7.1
Fatal Injuries	82.8	10.3	6.9
Wounds	85.6	10.3	4.1
Fatal Wounds	85.6	10.5	3.9

Table B-13 presents the distribution of all casualties by aircraft type versus casualty type, i.e., wound, injury or others; Tables B-14 and B-15 present similar distributions for the fatal and non-fatal casualties respectively. As mentioned earlier, the majority of fatalities were injury type casualties, whereas the majority of non-fatal and total casualties were of the wound type. It is also significant to note that this observation holds for every individual aircraft (except the small samples on the CV-2B and the non-Army fixed-wing aircraft, specifically the C-123). The proportions of wounds and injuries vary from one aircraft to another, but in all cases most non-fatal casualties were the "wound type" while most fatalities were "injury type" casualties. To some extent this may reflect the success of the light-weight armor crew protection program in reducing the number of fatal wounds.

2.9 Other (Combat) Casualties.

Most of the cases analyzed in this report are wound or injury type casualties. However, the sample includes 246 (6.0 percent) Other (Combat) type casualties. All but seven involved effects of the aircraft's own weapons, including twenty shot by guns on board. The remaining casualties were: 113 caused by weapon malfunctions, 30 from weapon ejections, 20 from burns on weapons, and 49 from rocket blast. The full distribution of these Other (Combat) casualties is presented in Table B-16 of Appendix B. By aircraft, all but seven occurred on UH-1's, and probably more than half occurred on Armed UH-1's. By crew station, 183 involved gunners or crew chiefs (who also serve as gunners); 41 involved pilots or copilots; 22 involved observers or passengers or unspecified crew stations. Out of the total 246 cases of Other (Combat) casualties, only three of the weapon malfunction cases were reported as serious. None were fatal. The remaining "true" combat casualties - 2946 wounds and 873 injuries - are analyzed in detail in the following sections of this report.

3. (CONFIDENTIAL) INJURY ANALYSIS

Injury type casualties, by definition, result from ground-fire damage to critical aircraft components and systems causing crashes or "hard" forced landings. For the period analyzed in this study, injuries accounted for only 21.5 percent of the total casualties (4065), but 68.0 percent of the total fatalities (478). Approximately half of the total injuries and over three-fourths of the fatal injuries involved aircraft fires frequently ignited by bullets.

3.1 Severity.

A total of 873 injury type casualties were reported, and by severity, they were distributed as follows:

TABLE 3.1 (C) DISTRIBUTION OF INJURIES BY SEVERITY (U)

Severity	No. of Injuries	Percent
Fatal	325	37.3
Serious	37	4.2
Non-Serious	511	58.5

Correlation of severity with cause or type of crash incident is discussed further in the latter part of this section. The various medical categories of bodily injury are presented in Table C-18. Burns were involved most frequently (22 percent), but other categories included broken bones, internal injuries as well as lacerations and contusions, even drowning and asphyxiation.

3.2 Aircraft Type.

The distribution of injury data by aircraft type is detailed in the tables of Appendix C. A few (20) Army personnel were injured on non-Army aircraft (C-123, U-10 and HH-43); these represented 2.3 percent of all injuries and 1.8 percent of the fatal injuries. However, 98 percent of all injury-type casualties resulted from crashes and forced

landings of Army aircraft. For classification by Army aircraft type, the reported data are summarized in the following table:

TABLE 3.2 (C) PERCENTAGE DISTRIBUTION BY AIRCRAFT TYPE (U)

Distribution of	UH-1	Other R/W (Non UH-1)	Fixed-Wing A/C
Flying Hours	60.6	13.4	26.0
Aircraft Hit	72.9	12.4	14.8
Aircraft Crashes	64.2	17.0	16.7
A/C Incidents with Injuries	72.1	13.8	14.1
A/C Incidents with Fatal Injuries	71.9	14.0	14.0
Personnel Reported Injured	80.2	12.7	7.1
Personnel Fatally Injured	82.8	10.3	6.9

As expected, the UH-1 dominates because it was deployed in large numbers; however, while it flew approximately 61 percent of the total U.S. Army flying hours, it produced 80 percent of the injuries including 83 percent of the fatal injuries. The U.S. Army fixed-wing aircraft flew 26 percent of the hours but produced only 7 percent of the injuries. For the other rotary wing, the percentages of flying hours and injuries approach each other. This distribution probably results from two main influences: relative exposure, and average number of personnel on board. UH-1 appears higher in both respects. Further breakdown of the UH-1's into Armed and Unarmed was handicapped, because some of the source data failed to specify this item. The available data are summarized in Table 3.3.

In Table 3.3 the armed UH-1's, with only 24 percent of the flying hours for all UH-1's, account for approximately 60 percent of the fatal injuries, while the transport UH-1's with 76 percent of the flying hours, account for only 40 percent of the fatal injuries. Note that the aircraft hit, crashes, injury incidents, and total personnel injured are divided about evenly between Armed and Unarmed UH-1's, yet

more injury fatalities occurred aboard "gunships" (UH-1 A/B/C) in spite of the fact that the transports probably averaged more personnel on board. This suggests that not only are the Armed UH-1's hit more often, but also that the crashes are more violent, frequently killing the crew of four. It also suggests that (other factors being equal) "two-man gunships," such as AH-1G Cobra and Cheyenne, should reduce combat casualties and fatalities from such missions. Injury rates are discussed further in later sections.

TABLE 3.3 (C). PERCENTAGE DISTRIBUTION OF UH-1 BY TYPE AND MODEL (U)

Distribution of	Armed A/B/C	Transport B	Transport D/H
Flying Hours	23.9	9.0	67.1
Aircraft Hit	51.0	8.5	40.5
Aircraft Crashes	48 ± 3[a]	5 ± 3[a]	46.6
A/C Incidents with Injuries	50 ± 12[a]	13 ± 12[a]	40 ± 3[a]
A/C Incidents with Fatal Injuries	62 ± 7[a]	7 ± 7[a]	31.7
Personnel Reported Injured	49 ± 9[a]	11 ± 10[a]	42 ± 1[a]
Personnel Fatally Injured	59 ± 5[a]	5 ± 5[a]	34.8

[a]Aircraft model not identified in some cases.

3.3 Crew Station.

Considerable analysis was devoted to determine the relative hazards of the crew stations. See Tables C-9, 10, and 11 of Appendix C, for the distribution of injuries and fatal injuries by crew station for each of the Army aircraft. These data are summarized for the basic aircraft types in Table 3.4. The general conclusion is that any location on these aircraft is equally hazardous. The issue is somewhat clouded, because the number of uninjured passengers was usually not reported, but for the two pairs of crewmen (pilot - copilot, crew chief - gunners) consistently on board most aircraft, nearly equal numbers of personnel were injured or killed.

TABLE 3.4 (C). PERCENTAGE INJURY DISTRIBUTION BY CREW STATION VERSUS AIRCRAFT TYPE (U)

Aircraft	Pilots and Copilots	Crew Chiefs and Gunners	Others
Armed UH-1 A/B/C	49 ± 1	46 ± 1	5 ± 2
Transport UH-1 D/H	33 ± 1	35	32
All UH-1	41.1	41.2	17.7
CH-21 C/37/47	30	41	29
OH-13S/23G/6A	45	-	55
All Helicopters	40.5	39.0	20.5
Fixed-Wing	59	-	41
All U.S. Army	41.9	36.3	21.8

The only exception (not accounted for by too small a sample) is the OV-1 Mohawk which appears to have suffered a preponderance of pilot injuries. However, this anomaly undoubtedly results from the fact that the great majority of Mohawks reported hit were armed A-models or their earlier counterparts, OV-1C's, crewed by a pilot and an observer. These observers were usually Vietnamese or U.S. Air Force personnel, whereas the pilot was always U.S. Army. Since this analysis covers only U.S. Army casualties, the reported distribution of Mohawk injuries (and fatal injuries) is balanced accordingly.

The ratio of Fatal Injuries to All Injuries is practically independent of crew station (see Table C-15), i.e., given an injury the probability of fatality is very nearly the same for all crew stations - 37 percent. While this probability apparently varies among crew stations and among aircraft, from 25 percent to 40 percent, the significance of the variations is marginal. The percentage of fatalities to total injuries appears slightly less for the other (non-UH-1) helicopters, than for the UH-1's or the fixed-wing aircraft mixture.

3.4 Injury Rates.

The relatively large number of injuries to the total number of casualties, and especially to the total fatalities, has already been mentioned. This section analyzes a number of injury rates, i.e., ratios of potential interest in assessing "injury risk." The ratios were investigated and the averages for all Army aircraft are summarized in Table 3.5. Each of these averages was examined by aircraft (or aircraft group) to determine, if possible, the major factors that influenced injuries and fatalities.

TABLE 3.5 (C) INJURY RATES FOR ARMY AIRCRAFT (U)

Average Number of	All Injuries	Fatal Injuries
Flying Hours Per Injury	5200	14000
Aircraft (Sorties) Hit Per Injury	12.5	33.5
Aircraft (Sorties) Hit Per Sortie With Injury	36.8	93.6
Injuries Per Crash	2.96	1.11
Injuries Per Fatal Injury	2.7	-

The average number of flying hours per injury and per fatal injury varied considerably among the aircraft. Data are presented in Table C-6 and summarized in Table 3.6. Note the significant difference between the rotary and fixed-wing aircraft types. Relative exposure to groundfire also shows a strong influence on flying hours per injury.

The average number of aircraft hit for all the Army aircraft was 12.5 per injury and 33.5 per fatal injury. These ratios are presented by aircraft in Table C-8 and summarized in Table 3.7. The numbers in parentheses could be unreliable because of small sample size or unspecified data. However, even excluding these, the ranking is difficult to explain. The aircraft which rank low seem to be those with aggressive roles, but serious exceptions are the Utility/fixed-wing

TABLE 3.6 (C). AVERAGE NUMBER OF FLYING HOURS PER INJURY VERSUS AIRCRAFT TYPE (U)

Aircraft	Hours Per Injury	Hours Per Fatal Injury
OH-13S/23G/6A	6,900	21,000
Transport UH-1	5,600	18,000
CH-47	5,200	17,700
CH-21C	3,300	22,400
Armed UH-1	2,200	5,100
All Rotary-Wing	4,130	11,000
CV-2B	>166,400	>166,400
U-1A/6A/8D/21	48,700	85,300
O-1	14,600	39,600
OV-1A/B/C	5,600	22,200
All Fixed-Wing	18,900	52,300

TABLE 3.7 (C). AVERAGE NUMBER OF AIRCRAFT HIT PER INJURY VERSUS AIRCRAFT TYPE (U)

Aircraft	Aircraft Hit Per Injury	Aircraft Hit Per Fatal Injury
CV-2B	(>223)	(>223)
OV-1A/B/C	(>38.5)	(>135)
CH-21C	18.2	121.3
CH-54	(>14)	(>14)
CH-47	14.3	48.5
O-1	(>12.7)	34.4
UH-1D/H	11.0	34.2
U-1A/6A/8D/21	(>13.7)	24.0
Armed UH-1	12.2	20.5
OH-13S/23G/6A	8.9	27.4

aircraft (U-1A/6A/8D/21) which also rank low, and the OV-1A/B/C which rank high. The ranking correlates roughly with aircraft size, which should be expected on the basis of aircraft hit per injury; however, other factors are obviously exerting influence. Average passenger load which limits the number injured per incident is probably another factor. Finally, it is suggested that the lack of reasonable pattern may be accounted for by the intrinsic vulnerability of the aircraft, which is known to be characteristic of individual aircraft design (and projectile threat) and independent of aircraft size and type. Note that the two types of UH-1's are at about the same level for "aircraft hit per injury," despite their drastically different roles.

Table C-10 presents the average number of sorties hit per sortie with injury, or per sortie with fatal injury. In Table 3.8 aircraft rank changes from the previous table. Aircraft size appears to correlate best, i.e., the larger the aircraft, the more sorties hit per injury. Note the surprising similarity between fixed and rotary-winged aircraft. The closeness of the two averages could be a coincidence of the aircraft mixture, but the rank on this basis appears insensitive to the difference in this basic feature.

TABLE 3.8 (C). AVERAGE NUMBER OF SORTIES HIT PER SORTIE WITH INJURIES VERSUS AIRCRAFT TYPE (U)

Rank	Aircraft	Sorties Hit Per Sortie With	
		Injury	Fatal Injury
1	CV-2B	(>223)	(>223)
2	CH-21C	73	182
3	CH-47	69	162
4	U-1A/6A/8D/21	48	96
5	OV-1A/B/C	45	108
6	UH-1D/H	37.5	121
7	Armed UH-1A/B/C	37.5	80
8	O-1	18	48
9	OH-13S/23G/6A	16.2	43.8
	Total Rotary-Wing	36.5	92.8
	Total Fixed-Wing	38.4	98.4

Still another injury rate consideration is the average number of injuries and/or fatal injuries per crash. For all the aircraft over the entire period, three (2.96) injuries per crash were reported including one (1.11) fatality. These data are presented in Table C-11 and summarized by aircraft type in Table 3.9. On this basis the main influence seems to be average number of personnel on board, except for the UH-1A/B/C gunship for which data reflect its more aggressive role and higher threat.

TABLE 3.9 (C). AVERAGE NUMBER OF INJURIES PER COMBAT CRASH VERSUS AIRCRAFT TYPE (U)

Aircraft	All Injuries	Fatal Injuries
CH-21C/37/47	4.2	1.9
Armed UH-1A/B/C	3.7 ± 0.5	1.6
Transport UH-1D/H	3.2	1.0
OH-13S/23G/6A	1.5	0.5
Army Fixed-Wing	1.3	0.5
All U.S. Army	2.96	1.11

Finally, rate of fatality per injury was also examined (see Table C-16). As mentioned previously (in the crew station injury analysis) for all the injury type casualties, approximately 37 percent were fatal. Table 3.10 summarizes these observations by aircraft type. Note the significant difference between the Armed UH-1A/B/C's and all other U.S. Army aircraft. In view of this observation the need for a crew of four on the obviously more hazardous tasks of the gunships should be examined critically. Use of two-men gunships should reduce overall fatalities.

TABLE 3.10 (C). PERCENTAGE FATALITY RATE PER INJURY VERSUS AIRCRAFT TYPE (U)

Aircraft	Percent
Armed UH-1A/B/C	57 ± 5
Army Fixed-Wing	36
OH-13S/23G/6A	33
Transport UH-1D/H	32
CH-21C/37/47	29
All U.S. Army	37

The same observations appear when the data are categorized to illustrate crash survivability, as in Table C-13 which is condensed in Table 3.11.

TABLE 3.11 (C). CRASH SURVIVABILITY VERSUS AIRCRAFT TYPE (U)
(Sample: 288 Crashes)

Aircraft	Percent Without Injury	Percent Without Fatality	Percent With No Survivors
Armed UH-1A/B/C	<6	45 ± 5	29 ± 4
Armed UH-1D/H	<5	71	12
CH-21C/37/47	14	57	7
OH-13S/23G/6A	32	71	14
Fixed-Wing	25	67	10

Note that for approximately 30 percent of the armed UH-1 crashes, there were no survivors, while on the other aircraft only 7 to 14 percent of the crashes were without survivors. Also, for about half of the armed UH-1 crashes, at least one person was fatally injured, whereas for the other aircraft, no fatalities occurred in 57 to 71 percent

of the crashes. Similarly, very few of the UH-1 (armed or unarmed) crashes failed to injure anyone, whereas 14 to 32 percent of the other aircraft crashes produced no (reported) injuries. Further analysis of the relative violence of crashes is pursued in a later section under the cause classification.

3.5 Time Trends.

Army aircraft deployment began in late 1961 and was still increasing at the end of 1967, which was arbitrarily selected as the end for this analysis. Casualty data are still being collected and hopefully will be analyzed at some future date. In the Appendixes of this report, most of the relevant data are presented by half-year periods. Injuries and fatal injuries increased with time as did the number of sorties flown, flying hours, aircraft hit, etc. In the fall of 1965, however, deployment of the 1st Air Cavalry Division marked a turning point in escalation of U.S. Army operations. Prior to this time, the principal function of U.S. Army aviation was in support of Vietnamese units; afterwards large numbers of U.S. Army personnel became involved. To analyze casualty trends with time, the data were classified into three groups: CY 1962-65, CY 1966, and CY 1967. The data are summarized in Table 3.12.

TABLE 3.12 (C). ARMY AVIATION INJURY TRENDS WITH TIME (1962-1967) (U)

	CY 1962-65	CY 1966	Pct Increase	CY 1967	Pct Increase
Flying Hours	993,720	1,334,875	34	2,093,227	57
Aircraft Sorties Hit	3,026	3,310	9	4,334	31
Crashes	74	88	18	126	43
Reported Injuries	208	241	16	404	68
Fatal Injuries	101	91	-10	127	40

Note that there was more activity in CY 66 than in all prior years together, and in CY 1967 activity increased by approximately

another 50 percent. In 1966, the percentage increases (over previous years) in aircraft hit, crashes, and injuries were less than the corresponding increase in flying hours; in fact fatal injuries actually declined. From 1966 to 1967, flying hours increased by 57 percent, aircraft hit, crashes, and fatal injuries increased at a lower rate, but total injuries increased at a higher rate. Why the percentage increases are not the same cannot be readily explained. One factor might be changes in the Army aircraft fleet, e.g., less fixed-wing flying and more helicopter flying. Another factor might be general lessons learned in combat environment and autorotative landings. If such a hypothesis were true, the same trends would be reflected in the accident (non-combat) crashes. Unfortunately, analysis of accidents is beyond the scope of this study.

Some of the rates of casualty were also examined for time trends, in Tables C-7, C-9, and C-11, and the major findings are summarized in Table 3.13.

TABLE 3.13 (C). INJURY RATES VERSUS TIME (U)

Average Number of	CY 1962-65	CY 1966	CY 1967
Flying Hours Per Injury	4,800	5,500	5,200
Flying Hours Per Fatal Injury	9,800	14,600	16,500
Aircraft Sorties Hit Per Injury	14.5	13.7	10.7
Aircraft Sorties Hit Per Fatal Injury	30.0	26.1	34.1
Injuries Per Crash	2.8	2.7	3.2
Fatal Injuries Per Crash	1.4	1.0	1.0

As a whole, injury rates appear fairly constant from year to year. Flying hours per fatal injury increased steadily, but flying hours per injury did not. For number of aircraft hit (per injury and per fatal injury) the opposite is observed. Number of injuries per

crash rose slightly, but fatal injuries per crash declined slightly. Number of total injuries per fatal injury increased slightly, which represents improvement, but the reason for it is not readily apparent.

3.6 Cause Classification.

For all the injuries - 873 including 325 fatalities - causes were classified as follows:

Crash

- Without Fire (CR)
- With Fire
  - Post Crash
    - Without Explosion (CB)
    - With Explosion (CE)
  - In Flight
    - Without Explosion (CF)
    - With Explosion (CA)

Forced Landing

- On Fire (FF)
- Without Fire (FL)

Miscellaneous

- Ejecting (EJ)
- Parachuting (PA)
- Unspecified Cause (UN)

The cause distributions by severity, crew station, aircraft type, etc., are presented in Appendix C, Tables C-19 through C-26. Twenty injuries, including six fatal injuries, involved U.S. Army personnel aboard U.S. Air Force planes in four separate incidents:

a. A U-10 crash fire killing one Army observer.

b. A C-123 crash fire killing two Army passengers.

c. An HH-43 crash fire killing three Army passengers.

d. A C-123 crash landing with non-serious lacerations to fourteen Army passengers.

These four cases are excluded in the following discussions; classification of 853 injuries including 319 fatalities, which occurred to U.S. Army personnel on U.S. Army aircraft, is summarized in Table 3.14. It is readily apparent that non-crash injuries are of minor numerical significance.

TABLE 3.14 (C). PERCENTAGE INJURY AND FATAL INJURY DISTRIBUTION BY MAJOR CAUSE (U)

Cause	Percent Injury Sorties	Percent Reported Injuries	Percent Fatal Injuries
Crash	80.0	88.6	99.4
Forced Landing	11.7	8.2	0.3
Miscellaneous	8.3	3.2	0.3

The miscellaneous class includes: one fatal and three non-serious injuries resulting from parachuting incidents; three serious and six non-serious injuries in ejecting from the OV-1 Mohawk (the only Army aircraft with ejection seats); 14 non-serious injuries from causes unspecified in the source reports. All (27) of the miscellaneous injuries occurred in 24 separate incidents.

Seventy injuries were reported in 34 separate forced landings, either relatively "hard" or on-fire. One was fatal, and the rest (69) were reported as non-serious. Thirteen non-serious injuries involved fire in flight in which personnel escaped, but the aircraft were usually consumed by fire; the remaining 57 involved no fire and in most cases the aircraft were recovered and repaired. By crew-station, injuries occurred more frequently (32) to the pilots and copilots, probably because of their location (in front); 17 were crew chiefs and gunners, and 21 were other personnel on board. By aircraft type, a significant number (8 out of 70) occurred on fixed-wing aircraft; most (56) occurred

on UH-1's; 5 occurred on the small LOH's (OH-6/13/23), and only 1 was reported on large helicopters.

3.7 Crashes.

The majority (68.6 percent) of injuries and all but two of the fatal injuries (99.4 percent) involved crashes and usually (but not always) total destruction of the aircraft. The crashes represent 80.0 percent of the total 290 incidents reporting injury. Fire was an important factor as shown in Table 3.15.

TABLE 3.15 (C). CRASH INJURIES WITH AND WITHOUT FIRES (U)

Cause	Percent of Totals	
	Injuries	Fatal Injuries
Crash with Fire	50.2	79.0
Crash without Fire	38.4	20.4
Non-Crash Cause	11.4	0.6

Note that crashes with fire caused four times more fatal injuries than crashes without fire. However, crashes without fire accounted for half of the serious (non-fatal) and non-serious injuries. Without fire, the injury-producing crashes averaged about three injured per crash, with one fatality for every five injured. However, a substantial number of crashes without fire reported no injury, such that the average is probably less than 2.5 injured per crash. In most cases, only one or two fatalities occurred per crash without fire (during or after crash). "No survivors" were reported in less than four crashes.

By comparison, crashes involving fires of all types were considerably more severe and caused 79.0 percent of all the fatalities. These averaged 3.3 injured and 2 fatalities per crash. Practically all the "no survivor" crashes involved some type of fire, and analysis of the various types of fire seems essential.

3.8 Fires.

The primary distinction required in aircraft fire analysis is between fires ingiting in-flight and fires resulting from crashes. These two differ not only in their consequences to the aircraft and personnel, but also in the measures required to prevent them (or reduce their occurrence). Injuries for each type of fire are given in Table 3.16.

TABLE 3.16 (C). CRASH INJURIES FROM IN-FLIGHT VERSUS POST-CRASH FIRES (U)

Cause	Percent of Totals	
	Injuries	Fatal Injuries
Crash (or Post-Crash) Fires	33.0	53.0
Crashes from Fires in-Flight	17.2	26.0
Non-Fire Crash Causes	49.8	21.0

Note that post-crash fire is the most frequent killer, with twice as many deaths as those caused by fires in-flight. But note also that crashes from in-flight fires killed more personnel than all non-fire crashes and forced landings. Both types of fires include reported explosions, which are discussed in Section 3.9. The percentages given in Table 3.16 are conservative for both types of fires, because they exclude thirteen non-serious injuries which occurred in on-fire forced landings; they also exclude the injuries when ejecting and parachuting from aircraft on fire. These are included in non-fire crash causes in the same table. The crash fires averaged 2.6 injuries, including 1.8 fatalities per crash; the in-flight fires averaged 3.8 injuries, including 2.1 fatalities per crash. Both types of fires contributed numerous cases with no survivors, especially when explosions occurred.

3.9 Explosions.

In both types of fires - in-flight and post-crash - some cases of "explosion" were reported. It is difficult (if not impossible) to define this term, or even to distinguish "explosion" from other violent rapid fires. Certainly very few were detonations of munitions - enemy shell or on-board ammunition. The crash explosions resulted mainly from fuel cell(s) rupturing upon crash. The seven cases of mid-air explosions or disintegrations lacked information to identify cause; in two cases transmission failure, engine surging, or compressor stall was suspected; in another, exploding ammunition; in three cases, exploding fuel is suspected. Not one of the seven mid-air explosions was clearly initiated inside a fuel cell. In any case all explosions were violent and rapid, and usually the aircraft was destroyed, which made reliable assessment of cause and sequence of events difficult. In all, eighteen known cases of explosion were reported which resulted in 74 deaths and only four known survivors, two of which were considered seriously injured. All of the explosions occurred on UH-1's; approximately 75 percent of them occurred on the Armed UH-1B/C's. The significance of the explosions relative to the other fires and crashes is indicated in Table 3.17.

TABLE 3.17 (C). INJURIES FROM EXPLOSIONS AND OTHER CRASH INCIDENTS (U)

Cause	Percent of Totals	
	All Injuries	Fatal Injuries
Explosions-in-Flight	3.5	9.4
Explosions-on-Crash	5.6	13.8
Fires without Explosions	41.1	56.8
Non-Fire Causes	49.8	21.0

Note that these few explosions accounted for more fatalities than all the non-fire causes (crashes without fire, forced landings, etc.).

The relative severity of the various injury causes is indicated in Table 3.18.

TABLE 3.18 (C). AVERAGE NUMBER OF INJURIES AND FATAL INJURIES PER INCIDENT VERSUS CAUSE (U)

Cause	Average Number per Incident	
	Reported Injuries	Fatal Injuries
Explosion-in-Flight (CA)	4.3	4.3
Fire-in-Flight without Explosion (CF)	3.5	1.6
Crashed and Exploded (CE)	4.4	4.0
Crashed and Burned (CB)	3.0	1.6
Crash-No Fire (CR)	3.0	0.6
Forced Landings and Other Causes	1.8	0.03
All Injury Causes	2.9	1.1

3.10 Injury Reduction.

Essentially, the prevention of combat injuries requires prevention of crashes; the prevention of fatal injuries requires special attention to the prevention of fires. At first sight, reduction of fire occurrence upon crash seems to offer the greatest potential, since 53 percent of the fatal injuries involved crash fires (including explosions). Considering also the additional fatal injuries, which result in crash fires from pure accidents and other hostile causes (without actual hits on aircraft), it is apparent that any and all measures to reduce crash fires should be considered. Basically, these measures consist of better fuel containment upon crash, e.g., improved crash-resistance of fuel cells and fuel cell material, as well as self-closing fittings and lines. For new aircraft, designs should include isolation of fuel from fire-critical systems and personnel.

However, complete elimination of crash and post-crash fires would eliminate less than half of the fatal injuries. Some of the

crashes were undoubtedly non-survivable, even if the fire had not occurred. Forty-seven percent of the fatal injuries involved no fire or they involved fire in-flight (including explosions). Hence, it is equally apparent that measures to prevent crashes (and thereby, post-crash fires) should also be studied. An added incentive to apply crash prevention measures is the savings in aircraft that would result.

Other studies (see Bibliography) indicate that crashes result from the following causes: control failure, certain types of power plant and power train failure, fires in-flight, and (infrequently) from fatal and non-fatal pilot wounds. Seven crashes, including five deaths occurring in two different crashes. are suspected of being caused by wounds to the pilot. However, 98.4 percent of the fatal injuries resulted from projectile damage to aircraft components. The primary control failures were probably the most severe, but, fortunately, the least frequent, because the critical control components present a relatively small vulnerable area. Some power failures were also disastrous, but usually autorotation saved personnel and aircraft. Both of these causes can be eliminated in the design of new aircraft; both can be relatively difficult to correct in existing aircraft.

The fires in-flight (including explosions) contribute the largest number of crashes and 26.0 percent of all the fatal injuries. A few of these fires involve oil, hydraulic fluid, munitions, etc., but the great majority involve a fuel leak. Many of these leaks result from impact by an inert bullet, where the leak is ignited by spark, hot section, or other on-board ignition source; a significant number also result directly from impact by an incendiary (actually API, i.e., armor-piercing-incendiary) bullet. Self-sealing tanks, lines, and coatings can reduce this problem significantly, but unfortunately these are not designed to seal an impact by a functioning incendiary bullet. A number of ignition and/or fire preventive techniques have been developed and demonstrated to be effective. All are extremely lightweight; some are even practical for retrofit on existing aircraft. In the design of new

aircraft, fires in-flight can be reduced without additives. Basically, nearly all the fires ignite in the void cavities within the aircraft near fuel components. To prevent the fires requires the elimination or inerting of these voids, by design and/or additives, e.g., void-filler plastic foam, purge mats, detector-suppressor systems, and other fire prevention or extinguishing techniques (References 2, 3, 4, 5).

Undoubtedly, the occurrence of fire and explosion is related to the type of fuel used, which was mainly JP-4 (for turbine-engine aircraft) and aviation gasoline (for the older aircraft). In this respect, it is noteworthy that not one (of the seven) mid-air explosions clearly initiated inside a fuel cell. This suggests that protection inside the fuel cells of Army aircraft (to date) is apparently not justified by the combat data.

Probability of crash from bullet damage can be reduced significantly by a variety of measures. In the design of new aircraft this can be accomplished without armor (except to prevent wounds to pilots and other personnel).

4. (CONFIDENTIAL) WOUND ANALYSIS

Wound type casualties, by definition, result from direct hits on personnel by projectiles or by debris resulting from missile impact on aircraft structure. A few of these wounds have caused crashes resulting in 1.6 percent of the fatal injuries. Some additional cases involved more than one person wounded by the same projectile, but most wound cases (89 percent) involved single casualties. For the period analyzed in this study, wounds contributed 72.5 percent of all the casualties (4065), and 32.0 percent of the fatalities (478). Basically, this part of the casualty analysis attempts to correlate severity and frequency of the various types of wounds with anatomical location and cause of wound. The significant overall observation is that the fatal and serious wounds resulted almost entirely from bullets in the head, neck, and torso of personnel. However, most wounds were reported as

non-serious; they were distributed over the entire body; they were caused as much by debris emanating from bullet impact upon aircraft material, as they were by direct hit on personnel.

4.1 Severity.

A total of 2946 wounds were reported, and by severity they were distributed as follows:

TABLE 4.1 (C). DISTRIBUTION OF WOUNDS BY SEVERITY (U)

Distribution of	No. of Wounds	Percent
Fatal	153	5.2
Serious	49	1.7
Non-Serious	2744	93.1

For fatal and serious wounds the anatomical locations and the types of wounding projectiles were very similar, but the non-serious wounds differed significantly in both of these factors. Later sections develop these observations in detail. Note that 93.1 percent of all the wounds were reported as "non-serious." As previously defined, however, the non-serious classification includes amputation, loss of sight, etc., as well as mere cuts and bruises.

4.2 Aircraft Type.

The distribution of wounds by aircraft type is detailed in the tables of Appendix D. Thirteen cases or 0.44 of 1 percent of the total (2946) wounded considered in this study occurred on non-Army helicopters (CH-34, CH-37, UH-1F) and non-Army fixed-wing planes (C-123, A-1E, O-2B). None of these were fatal and only one was reported as serious. Hence, 2933 or 99.6 percent of the wounds occurred on Army Aircraft. For classification by type of Army aircraft the reported data are summarized in Table 4.2.

TABLE 4.2 (C). PERCENTAGE DISTRIBUTION BY AIRCRAFT TYPE (U)

Distribution of	UH-1	Other R/W (Non UH-1)	Fixed-Wing Aircraft
Flying Hours	60.6	13.4	26.0
Aircraft Hit	72.8	12.4	14.8
A/C Incidents with Wounds	85.4	10.1	4.5
Personnel Wounded	85.6	10.3	4.1
Personnel Fatally Wounded	85.6	10.5	3.9

As observed for the distribution of injuries, the UH-1 again dominates the wound sample. However, note that the UH-1 proportion of wounds significantly exceeds its proportions of both flying hours and aircraft hit. Conversely, the proportion of wounds occurring on fixed-wing planes was significantly smaller than the corresponding proportions of either flying hours or aircraft hit. For helicopters other than the UH-1's, the proportion of wounds is slightly less than but similar to that of flying hours and aircraft hit. This distribution pattern suggests that, not only is the UH-1 exposed to hits more frequently than the fixed-wing planes, but also that personnel aboard are more likely to be hit when the UH-1 is hit. In other words, personnel density is apparently higher for UH-1's than for the other aircraft. Note that, for the three groups of aircraft, the distributions of total wounds and fatal wounds are virtually the same. Further breakdown of the UH-1's into armed and unarmed is shown in Table 4.3.

TABLE 4.3 (C). PERCENTAGE DISTRIBUTION BY UH-1 TYPE (U)

	Armed A/B/C	Unknown If Armed	Transport B/D/H
Flying Hours	23.9	-	76.1
Aircraft Hit	51.0	-	49.0
A/C Incidents with Wounds	24.7	43.6	31.7
Personnel Wounded	24.8	41.2	34.0
Personnel Fatally Wounded	22.1	19.9	58.0

In over 40 percent of the reported wound cases, the source data did not specify model and type of UH-1. For the fatal wounds, reporting was more complete. Note that, for the transports, the proportion of fatal wounds is significantly greater than the proportion of aircraft hit, even without pro-rating any of the cases of unspecified UH-1's. The effect of "personnel density" is again suggested since the transport models of this aircraft are otherwise similar to the armed models. It also implies that for the new "two-man" gunships, i.e., Cobra and Cheyenne, the wound rate should be lower than for the existing "four-man" Huey gunships.

4.3 Crew Station.

The distribution of wounds by crew station is analyzed in detail in Tables D-9 through D-21 of Appendix D. As explained in the analysis of injuries, crew stations were grouped into three classes: pilots and copilots, crew chiefs and gunners, and all others (including observers, passengers, and a few unspecified). By crew station the total reported wounds (2946) and the 153 fatal wounds were distributed as shown in Table 4.4.

TABLE 4.4 (C). PERCENTAGE DISTRIBUTION OF TOTAL AND FATAL WOUNDS BY CREW STATION (U)

Crew Station	All Wounds	Fatal Wounds
Pilot - Copilot	43.0	39.9
Crew Chief and Gunner	38.0	41.2
All Others	19.0	18.9

Note that the "pilot-copilot" group suffered nearly the same proportion of wounds as the "crew chief and gunner" group, which suggests equal risk of wound for either crew station group. Equal risk for these two groups was also observed for injuries, as discussed previously.

Deviations, if any, from this general observation among the various aircraft types appear in Table 4.5.

TABLE 4.5 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY CREW STATION AND AIRCRAFT TYPE (U)

Aircraft	Pilots and Copilots	Crew Chiefs and Gunners	Others
Armed UH-1A/B/C	46 ± 11	46 ± 12	8 ± 4
Transport UH-1D/H	41 ± 10	37 ± 9	22 ± 6
All UH-1	42.9	40.8	16.3
CH-21C/37/47	36.5	43.2	20.3
OH-13S/23G/6A	46	-	54
All Helicopters	42.6	39.4	18.0
Fixed-Wing	58	-	42

For each of the aircraft groups in Table 4.5, and for the aircraft in Table D-10, there is no significant difference in wound risk among regular crew stations. The OV-1 anomaly of apparent imbalance (as also observed for injury risk) can be accounted for by the fact that it was frequently flown with an ARVN or USAF observer (and a U.S. Army pilot). For fatal wounds, the distribution by crew station is not significantly different from that of all wounds (see Tables D-9 and D-10). Given a wound, this suggests equal risk of fatal wound for all crewman.

Table D-11 of Appendix D presents the percentage of the total reported wounds that were fatal, which averages 5.2 percent. It is interesting to note that this probability was very nearly a constant for all the significant groups of crew stations and aircraft types. In other words, given a wound, the probability that it is fatal appears practically independent of the carrier aircraft or the location of the man on the aircraft. Conversely, everyone aboard was about equally "armored." This observation is analyzed in greater detail by studying the distributions of wounds by anatomical location.

4.4 Wound Rates.

From an operational point of view, the number of flying hours per wound and per fatality are useful ratios. However, from a vulnerability (or protection) point of view, the average number of aircraft hit (or individual hits) per wound is more meaningful. Previous studies (see Bibliography) of aircraft combat damage have identified personnel wounds as the major cause of mission aborts in Vietnam. The above ratios are examined in Tables D-4 and D-5 of Appendix D and are condensed in Table 4.6.

TABLE 4.6 (C). WOUND RATES FOR U.S. ARMY AIRCRAFT IN RVN (U)

Average Number of	Total Wounds	Fatal
Flying Hours Per Wound	1500	29,000
Aircraft (Sorties) Hit Per Wound	3.6	70
Aircraft (Sorties) Hit Per Sortie w/Wound	4.1	72
Wounds Per Sortie With Wound	1.13	0.06
Wounds Per Fatal Wound	19.2	-

Note that most sorties with wounds involved only one casualty (also, see Tables D-3 and D-27). Note also that only 1 fatality occurred for every 19 wounds (or as mentioned previously, 5.2 percent of the wounds were fatal). Since some of the above rates should vary with aircraft type, they were compared in Tables D-4 and D-5 of Appendix D and summarized in Tables 4.7, 4.8, and 4.9.

TABLE 4.7 (C). AVERAGE NUMBER OF FLYING HOURS PER WOUND VERSUS ARMY AIRCRAFT TYPE (U)

Aircraft	Hours Per Reported Wound	Hours Per Fatal Wound
Armed UH-1A/B/C	620 ± 280	14,800 ± 4,600
CH-21C	850	9,600
Transport UH-1D/H	1,500 ± 400	21,000
CH-47	1,500	44,000
OH-13S/23G/6A	3,100	68,000
All Rotary-Wing	1,160	22,250
OV-1A/B/C	3,400	(>89,000)
O-1	8,500	185,000
CV-2B	9,800	83,000
U-1A/6A/8D/21	28,000	341,000
All Fixed-Wing	9,510	192,000

Note that the difference between the rotary and fixed-wing aircraft is an order of magnitude in flying hours per wound and per fatal wound. Generally the more aggressive aircraft rank more hazardous on the list, but the exceptions are of interest. For instance the high rank for CH-21 may reflect the fact that it was the first to be deployed and perhaps its crew was not as well "armored" as the crews of later helicopters. The reason for the low rank of the light observation helicopters is not readily apparent. For the fixed-wing aircraft, flying hours per fatal wound fail to fit a pattern, but the reason is small sample size: only six fatal wounds were reported on these aircraft during the 6-year period analyzed. For total reported wounds (mainly non-fatal), however, the pattern reflects the relative aggressiveness (exposure) of the various aircraft missions.

Table 4.8 compares the aircraft on the basis of average number of aircraft (sorties) hit per wound and per fatal wound.

TABLE 4.8 (C). AVERAGE NUMBER OF AIRCRAFT HIT PER WOUND VERSUS AIRCRAFT TYPE (U)

Aircraft	A/C Hit Per Reported Wound	A/C Hit Per Fatal Wound
Transport UH-1D/H	3.0 ± 0.8	42
OH-13S/23G/6A	4.0	88
Armed UH-1A/B/C	4.4 ± 2.0	104 ± 32
CH-47	4.5	121
CH-21C	4.6	52
All Helicopters	3.2	62
Army Fixed-Wing	13	263

On this basis note that the UH-1 transports and the OH's rank above the armed UH-1's. The rank generally correlates with "personnel density" for the various aircraft except for the CH-21C. This anomaly may be accounted for by the fact that most of these wounds occurred before the present personnel armor was deployed. Note also the order of magnitude difference between the helicopters and fixed-wings, which also supports the correlation with personnel density.

Finally, in Table 4.9 a third ratio was analyzed, i.e., the average number of reported wounds per fatal wound, which should provide an index of the relative personnel protection (including armor) provided by each aircraft. The reciprocal form of this ratio is also presented in Table D-11.

An average of 19 wounds was reported per fatal wound with very little variation among all the aircraft (those with significant samples). Most of the extremes can be explained. The fatalities on the CV-2B's and the utility aircraft were passengers not provided with armor; many of the CH-21C fatalities occurred early in the war before armor was available for gunners; the OV-1 anomaly results from the fact that fatal wounds to the non-Army observers were not included in the source data. The ratio of 19 wounds per fatality (or its reciprocal 5.2 percent)

reflects the body presented areas which can cause death from projectile penetration. Mainly these are the head, neck and unarmored torso.

TABLE 4.9 (C). AVERAGE NUMBER OF REPORTED WOUNDS PER FATAL WOUND VERSUS AIRCRAFT TYPE (U)

Aircraft	Wounds/Fatalities
CV-2B	9*
CH-21C	11
U-1A/6A/8D	12*
Transport UH-1D/H	15 ± 4
OH-23G	20*
OH-13S	21
C-1	22
Unarmed UH-1B	22 ± 2
Armed UH-1A/B/C	26 ± 4
CH-47	27
OV-1A/B/C	>26*
All UH-1	19.2
All U.S. Army	19.3

*Small samples, less than 50 reported wounds.

4.5 Time Trends.

For CY 1962, 31 wounds were reported, including 4 fatalities; for CY 1967, reported wounds had risen to 1314, including 63 killed. Data for half-year periods are presented in Appendix D, Tables D-1, D-2, and D-6, which were specifically assembled to detect any influence of personnel armor (including crew seats) on casualty rates.

"Tipping-plate" and Doron protection was designed in late 1962 primarily for pilots and copilots. Later this was replaced by the new ceramic-plastic armors for all crewmen. The armor kits were applied to various groups of aircraft in RVN beginning in early 1963. The armor was undoubtedly successful since very few wound reports mentioned its failure. Unfortunately, no casualty report was required when a

wound was prevented by the armor; hence, a direct count of armor successes was not available. An attempt was made to assess armor effectiveness indirectly, but this was complicated by many other effects.

The number of reported wounds (per half-year) rose with time, but neither linearly nor smoothly. At least two significant "jumps" appear: one for the second half of 1963, and a larger one for the first half of 1966; the latter reflects the increased activity of U.S. forces.

The number of fatal wounds (per half-year) seems o decline from 1962 to 1964, then rise until 1966 and tends to level off at the end of the period. More significant, however, is the fact that the increase of fatal wounds vs time was much slower than that of other casualty data.

The average number of flying hours per reported wound was 1510 for the whole period but this rate fluctuated between 800 and 2000. The average number of flying hours per fatal wound was 28,900 but it fluctuated between 10,000 and 50,000. Similar but smaller fluctuations are also apparent on the basis of number of aircraft hit per wound and per fatal wound.

The percentage of various wound types also was examined for trends with time. It is noteworthy that while the numbers of total wounds and fatal wounds increased, the percentage of fatal wounds generally declined from about 15 percent to 5 percent. This suggests a savings of approximately 300 lives. However, factors other than armor may have also contributed to the reduction of fatalities. When torso and non-torso wound fatalities are studied separately, both show a significant decline. The armor kits provided torso protection primarily, and it is not apparent how the armor could have significantly reduced non-torso (e.g., head and neck) fatal wounds. Fatal torso wounds declined from about 6 percent to 2 percent, which suggests a savings of approximately 125 lives. This decline is reflected most by the crew-chief - gunner station, i.e., 4 percent to 1 percent. For pilots and copilots, the decline is not as noticeable, since armor efforts were

made from the beginning (1962 and 1963). For the "Others" (i.e., observers, passengers, etc.) no particular trend is indicated, possibly because no official attempt was made to provide them with armor. On the other hand, the crew chiefs and gunners had no official armor in the beginning, but significant measures were taken to provide them torso armor; hence, the decline in torso fatal wounds suggests a savings of approximately 60 crew-chief - gunner lives. From this it seems reasonable to imply that at least as many pilot-copilot lives were also saved since they were (at least) equally protected during the same period.

In summary, from the data through 1967, it is not possible to estimate precisely how many lives were saved by armor kits because too many complex factors interplay. A conservative estimate of lives saved is approximately 125, but it could be as many as 300.

4.6 Anatomical Location.

The strongest influence on the severity of wounds proved to be anatomical location. Appendix Tables D-12 through D-30 analyze this parameter in detail, and gross distribution is summarized in Table 4.10.

TABLE 4.10 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY ANATOMICAL LOCATION VERSUS SEVERITY (U)

Anatomical Location	Total	Fatal	Serious	Non-Serious
Head and Neck	14.2	53.0	32.6	11.7
Torso	7.1	40.5	36.8	4.7
Legs	22.8	3.9	20.4	23.9
Arms	19.7	0.0	0.0	21.1
Numerous or Unknown	36.2	2.6	10.2	38.6

Note that 93.5 percent of the fatal wounds and 69.4 percent of the serious wounds occurred in the head, neck, and torso areas, even though these areas accounted for only 21.3 percent of all the wounds. Conversely, most of the non-serious wounds were in the extremeties although a high percentage (38.6) of the reports on non-serious wounds failed to specify location. The legs contributed a few fatalities and

a significant number of serious wounds, but none of the arm wounds were reported as serious. It must be remembered, however, that 93.1 percent of all the wounds were non-serious, and only 5.2 percent were fatal. Table 4.11 presents the distribution of wound severities for each of the gross anatomical locations.

TABLE 4.11 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY SEVERITY VERSUS ANATOMICAL LOCATION (U)

Anatomical Location	Fatal	Serious	Non-Serious
Head and Neck	19.3	3.8	76.9
Torso	29.5	8.6	61.9
Legs	0.9	1.5	97.6
Arms	0.0	0.0	100.0
Numerous or Unknown	0.4	0.5	99.1
Total	5.2	1.7	93.1

Table 4.11 further emphasizes the non-serious classification of the extremity wounds. It also points up the fact that not all the head, neck, and torso wounds were fatal or serious. In fact, a majority of the wounds in these critical areas were classified non-serious.

The above distributions do not differ drastically for each of the main crew-station groups as shown in Tables 4.12 and 4.13 for all wounds and fatal wounds, respectively.

TABLE 4.12 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY ANATOMICAL LOCATION VERSUS CREW STATION (U)

Anatomical Location	All Stations	Pilot & Copilot	Crew Chief & Gunner	Others
Head and Neck	14.2	17.0	11.5	13.3
Torso	7.1	5.7	8.0	8.4
Legs	22.8	22.6	27.0	14.8
Arms	19.7	21.6	20.5	13.7
Numerous or Unknown	36.2	33.1	33.0	49.8

TABLE 4.13 (C). PERCENTAGE DISTRIBUTION OF FATAL WOUNDS BY ANATOMICAL LOCATION VERSUS CREW STATION (U)

Anatomical Location	All Stations	Pilot & Copilot	Crew Chief & Gunner	Others
Head and Neck	53.0	55.8	47.6	58.6
Torso	40.5	39.3	41.3	41.4
Legs	3.9	4.9	4.8	0.0
Arms	0.0	0.0	0.0	0.0
Numerous or Unknown	2.6	0.0	6.3	0.0

The previous distributions of anatomical location represent the entire wound sample including those occurring on board all the aircraft, but the trends are dominated by the UH-1 helicopters which represent 85.6 percent of the wound data. In Tables 4.14 and 4.15 the data are segregated to present anatomical location of wounds suffered aboard other major aircraft types.

TABLE 4.14 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY ANATOMICAL LOCATION VERSUS AIRCRAFT TYPE (U)

Anatomical Location	All A/C	UH-1	Other R/W	Fixed Wing
Head and Neck	14.2	13.5	17.3	20.3
Torso	7.1	6.9	8.5	7.8
Legs	22.8	22.4	27.1	22.7
Arms	19.7	19.3	19.0	28.1
Numerous or Unknown	36.2	37.9	28.1	21.1

TABLE 4.15 (C). PERCENTAGE DISTRIBUTION OF FATAL WOUNDS BY ANATOMICAL LOCATION VERSUS AIRCRAFT TYPE (U)

Anatomical Location	All A/C	UH-1	Other R/W	Fixed Wing
Head and Neck	53.0	52.7	56	50
Torso	40.5	39.7	44	50
Legs	3.9	4.6	0	0
Arms	0.0	0.0	0	0
Numerous or Unknown	2.6	3.0	0	0

4.7 Cause.

The 2946 reported wounds were classified into eight cause codes: bullet, shrapnel, fragment, missile, land mine, booby trap, aircraft metal debris, and plexiglas debris. These causes, defined previously, fall into three main classes: first, bullets; second, other projectiles or pieces of projectile; and third, aircraft debris resulting from projectile impact on the aircraft. The data on wound cause are presented in Tables D-22 through D-26 of Appendix D and relative severity is summarized in Tables 4.16 and 4.17.

TABLE 4.16 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY CAUSE VERSUS SEVERITY (U)

Cause	Total	Fatal	Serious	Non-Serious
BULLET:	34.1	91.5	77.5	30.1
OTHER PROJECTILES:				
Shrapnel	10.4	2.0	4.1	11.0
Fragment	4.3	1.3	4.1	4.4
Missile	4.6	2.0	8.2	4.7
Land Mine	1.3	3.2	0.0	1.2
Booby Trap	0.3	0.0	0.0	0.4
Sub-Total:	20.9	8.5	16.4	21.7
DEBRIS:				
Metal	36.4	0.0	4.1	39.0
Plexiglas	8.6	0.0	2.0	9.2
All Debris:	45.0	0.0	6.1	48.2

TABLE 4.17 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY SEVERITY VERSUS CAUSE (U)

Cause	Fatal	Serious	Non-Serious
Bullet	13.9	3.8	82.3
Other	2.1	1.3	96.6
Debris	0.0	0.2	99.8
Total	5.2	1.7	93.1

One significant observation is that "impact debris" caused almost half (45.0 percent) of all the reported wounds; however, none of these wounds were fatal and only three cases were reported serious. Conversely, all fatal wounds (and nearly all serious wounds) were caused by enemy projectiles or pieces thereof. "Bullet" was identified as cause for 34.1 percent of the total wounds, 91.5 percent of the fatalities, and more than 75 percent of the serious wounds. The other pieces of projectile appear less hazardous than the bullets but more hazardous than the aircraft material debris. Note that practically all the fatal and serious wounds were caused by bullets, yet a majority (82.3 percent) of the bullet wounds were non-serious. It is known (from other data) that most of the bullets were small caliber types, but a few were 12.7mm (Caliber .50). The term "shrapnel" was used in the casualty source data mainly to describe pieces of bullets. Shrapnel, fragments, and missiles together accounted for eight fatalities and eight serious wounds; they usually caused non-serious wounds. Booby traps received much attention in recent years, but for the period analyzed herein the data show only ten wounds resulting from this threat, all non-serious. Similarly land mines accounted for only 39 wounds, including five fatalities.

In the previous discussion of anatomical locations of wounds, it became apparent that non-serious wounds occurred on all parts of the body, but the fatal and serious wounds were located on the head, neck, and unarmored torso. In Table 4.18, cause of wound is related to anatomical site for the 153 fatalities and the 49 serious wounds.

TABLE 4.18 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY CAUSE VERSUS ANATOMICAL LOCATION (U)

(Fatal and Serious Wounds Only-202 Cases)

Anatomical Location	Bullets	Other Projectiles	Aircraft Debris	All Causes
Head and Neck	40.1	6.4	1.5	48.0
Torso	37.6	2.0	0.0	39.6
Legs	6.9	1.0	0.0	7.9
Numerous and Unknown	3.5	1.0	0.0	4.5
Total	88.1	10.4	1.5	100.0

Note that 88.1 percent of these (fatal and serious) wounds were caused by bullets. Of the remaining 11.9 percent, caused by other projectiles and debris, 7.9 percent occurred in the head and neck region. The general wound locations in Table 4.18 were further subdivided for more detailed analysis in the following sections of this report.

In Section 4.3 it was brought out that wounds were fairly evenly distributed among crew stations. However, when the wounds are separated by cause, some differences become apparent among the crew stations, as brought out in summary Table 4.19.

TABLE 4.19 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY CAUSE VERSUS CREW STATION (U)

Cause	Pilot & Copilot	Crew Chief & Gunner	Others
Bullet	13.8	13.1	7.1
Shrapnel	4.5	4.5	1.4
Fragment, Missile, Mine, and Booby Trap	3.0	4.9	2.6
Debris, Metal	14.9	14.7	6.8
Debris, Plexiglas	6.9	0.8	1.0
All Causes, All Wounds	43.1	38.0	18.9
All Causes, Fatal and Serious	2.8	2.8	1.4

Note first the equal proportions of wounds to the pilot - co-pilot group and the crew-chief - gunner group in most cause classes, i.e., bullet, shrapnel, metal debris. Wounds from plexiglas were preponderantly in the cockpit; but the other crew stations suffered a majority of the wounds from fragments, missiles, mines, and booby traps. But, none of these differences significantly influenced the distribution of the fatal and serious wounds. The only plexiglas wound that was serious (non-fatal) was an eye wound to a pilot.

The number of plexiglas wounds seems relatively high (253 out of 2946 total wounds), considering how thin (0.1 inch) the glazing is in most Army aircraft, especially UH-1's. However, the early protection kits included fairly thick (0.4 inch) stretched plexiglas plates to induce bullet tipping to make it possible to stop bullets with armor materials available at that time. Unfortunately, while preventing fatal and serious gunshot wounds, hits on the transparent tipping plates produced additional non-serious wounds. When the new lightweight ceramic-plastic armor became available, the plexiglas tipping plates were no longer needed, but in many cases these plates were kept in the aircraft because pilots had developed confidence in them. To observe this influence on the number of casualties produced, Table 4.20 scans plexiglas wounds by year.

TABLE 4.20 (C). PLEXIGLAS WOUNDS VERSUS CALENDAR YEAR (U)

Calendar Year	All Locations		Face Only	
	Number	Percent*	Number	Percent*
1962	2	6.4	1	3.2
1963	11	8.3	5	3.8
1964	25	10.5	6	2.5
1965	35	10.3	7	2.0
1966	85	9.6	9	1.0
1967	95	7.2	18	1.3
Total	253	8.58	46	1.5

*Percent of total wounds for each year.

Note that the percentage of these wounds increased until 1964 and then steadily decreased. The CH-21's were prime users of tipping plates and then were phased out of RVN in 1964. On the UH-1's, tipping protection was replaced by ceramic armor from 1964 to 1966.

Finally, in Table 4.21 wound causes are examined to determine differences among aircraft types.

TABLE 4.21 (C). PERCENTAGE DISTRIBUTION OF WOUNDS BY CAUSE VERSUS AIRCRAFT TYPE (U)

Cause	UH-1	Other R/W	Fixed Wing
Bullet	86.4	10.8	2.8
Shrapnel, Fragment, Missile, Land Mine, Booby Trap	86.4	10.8	2.8
Debris	91.4	2.4	6.2
All Causes	85.3	10.4	4.3

Apparently, wound causes are similar for the principal aircraft groups. Debris appears slightly more significant to UH-1's and to the fixed-wing aircraft group, but slightly less significant to the other rotary wing aircraft.

4.8 Arm Wounds.

In discussing the anatomical location of wounds, it was shown that gross location (i.e., head, torso, legs, arms) was specified for 97.4 percent of the fatal wounds and 64 percent of all wounds. In the source reports for 83 percent of the fatal wounds and 48 percent of all wounds, anatomical location was further specified as to which part of the head, torso, leg, arm suffered the wound. The following sections of this report analyze the detailed subdivisions of wound locations. Tables 4.22 and 4.23 summarize the distributions of arm wounds by cause versus location and by crew stations versus aircraft type. None of the arm wounds were fatal or serious.

TABLE 4.22 (C). PERCENTAGE DISTRIBUTION OF ARM WOUNDS BY CAUSE VERSUS ANATOMICAL LOCATION (U)

Anatomical Location	Bullet	Other Proj.	Aircraft Debris	All Causes
Shoulder and Upper Arm	10.3	8.6	11.0	29.9
Elbow and Lower Arm	5.5	8.6	22.2	36.3
Wrist and Hand	6.9	10.0	16.9	33.8
All (Excluding Unknown)	22.7	27.2	50.1	100.0
All (Including Unknown)	22.4	26.6	51.0	100.0

Note that the arm wounds from all causes are almost evenly distributed among the three parts of the arm. Table D-23 of Appendix D further indicates that about one-fourth of the arm wounds were reported on the "joints," i.e., shoulder, elbow, and wrist. Half of the wounds were caused by debris, and half by bullets and other projectiles. More bullet wounds were reported on the shoulder and upper arm, while more debris wounds were reported from the elbow to the hand, which reflects slightly better protection for the shoulder and upper arm. There was no report of an arm wound seriously interfering with aircraft control; at least no crash cause was reported as a wound to the arm or hand. The following table summarizes distribution of arm wounds by crew station and aircraft type, which is similar to the distribution of all the wounds.

TABLE 4.23 (C). PERCENTAGE DISTRIBUTION OF ARM WOUNDS BY CREW STATION VERSUS AIRCRAFT TYPE (U)

Crew Station	All Aircraft	UH-1 Only	Other R/W	Fixed Wing
Pilot and Copilot	47.3	39.9	3.6	3.8
Crew Chief and Gunner	39.3	34.8	4.5	-
Others	13.4	9.1	1.9	2.4
All Stations	100.0	83.8	10.0	6.2

4.9 Leg Wounds.

A total of 671 leg wounds were reported, which was more than for any other part of the body. Six of these were fatal bullet wounds in the upper leg of crewman. In at least four cases, cause of death was loss of blood from a severed artery. Ten serious wounds were reported, but these were more widely dispersed on the leg; eight were caused by bullets, two by missiles and none by debris.

The distribution of all the leg wounds is given in Tables 4.24 and 4.25.

TABLE 4.24 (C). PERCENTAGE DISTRIBUTION OF LEG WOUNDS BY CAUSE VERSUS ANATOMICAL LOCATION (U)

Anatomical Location	Bullets	Other Proj.	Debris	All Causes
Upper Leg	13.7	8.6	6.0	28.3
Knee and Lower Leg	16.4	14.4	13.4	44.2
Ankle and Foot	15.5	7.4	4.6	27.5
All (Excluding Unknown)	45.6	30.4	24.0	100.0
All (Including Unknown)	42.3	30.0	27.7	100.0

TABLE 4.25 (C). PERCENTAGE DISTRIBUTION OF LEG WOUNDS BY CREW STATION VERSUS AIRCRAFT TYPE (U)

Crew Station	All Aircraft	UH-1 Only	Other R/W	Fixed Wing
Pilot and Copilot	42.8	35.2	5.4	2.2
Crew Chief and Gunner	44.0	39.8	4.2	-
Others	13.2	8.3	2.8	2.1
All Stations	100.0	83.3	12.4	4.3

While the bullet wounds are distributed evenly to all three parts of the legs, the wounds from other causes are not evenly distributed. Note also that only about one-fourth of the leg wounds were

caused by debris (as opposed to one-half for the arm wounds). Crew chiefs and gunners received slightly more leg wounds than other personnel. Crewmen and passengers aboard fixed-wing aircraft received a very small number of leg wounds.

4.10 Torso Wounds.

Whereas the extremities received over 1200 wounds with only 16 of them fatal or serious, the torso received only 210 wounds, but 62 of them were fatal and 18 were serious. The armor kits were designed to protect crew torsos but unfortunately these kits could not provide complete coverage. By crew station and aircraft the distribution of all wounds is given in Tables 4.26 and 4.27.

TABLE 4.26 (C). PERCENTAGE DISTRIBUTION OF TORSO WOUNDS BY CREW STATION VERSUS AIRCRAFT TYPE (U)

Crew Station	All Aircraft	UH-1 Only	Other R/W	Fixed Wing
All Severities				
Pilot and Copilot	34.7	30.4	3.3	1.0
Crew Chief and Gunner	42.4	38.1	4.3	-
Others	22.9	14.3	4.8	3.8
All Stations	100.0	82.8	12.4	4.8
Fatal and Serious Only				
Pilot and Copilot	40	34	5	1
Crew Chief and Gunner	40	34	6	-
Others	20	14	2	4
All Stations	100	82	13	5

For all personnel, more than 60 percent of all the torso wounds were caused by bullets, mostly in the upper torso.

None of the fatal and serious wounds of the torso were caused by debris; nearly all (95 percent) were caused by bullets. Over

TABLE 4.27 (C). PERCENTAGE DISTRIBUTION OF TORSO WOUNDS BY CAUSE VERSUS ANATOMICAL LOCATION (U)

Anatomical Location	Bullets	Other Proj.	Aircraft Debris	All Causes
All Severities				
Chest	25.9	6.6	3.0	35.5
Abdomen	10.2	3.0	1.5	14.7
Back (including Spine and Lumbar)	11.1	5.6	3.6	20.3
Lower Torso (including Hip, Buttocks, Groin)	16.8	8.1	4.6	29.5
All Torso (excluding Unknown)	64.0	23.3	12.7	100.0
All Torso (including Unknown)	61.9	22.9	15.2	100.0
Fatal and Serious Only				
Chest	48.7	3.8	0.0	52.5
Abdomen	20.0	1.2	0.0	21.2
Back (including Spine and Lumbar)	17.5	0.0	0.0	17.5
Lower Torso (including Hip, Buttocks, Groin)	6.3	0.0	0.0	6.3
Torso, Unknown	2.5	0.0	0.0	2.5
All Torso	95.0	5.0	0.0	100.0

80 percent were in the upper torso including more than 50 percent of them in the chest. However, 20 percent occurred on "Others" (observers, passengers, etc.), most of whom were probably not protected by armor kits. The remaining 80 percent were evenly distributed among the regular crew members (pilot and copilot, crew chief, and gunner). It is known that some of the wounds occurred before armor kits were made available. None of the armor kits could be designed for complete torso coverage, and some, e.g., those for CH-47 pilots, offered more coverage

than others, such as those for O-1 pilots or UH-1 gunners. However, no case of armor failure was reported with any of the fatal or serious cases of torso wounds. From the casualty data sources it is not possible to determine precisely how many lives were saved by the armor. However, it is significant that fewer (fatal, serious, and non-serious) wounds were reported in the torso than in the head and neck area, which is a much smaller area but is not armored.

4.11 Head and Neck Wounds.

By crew station and aircraft type the distribution of wounds on the head and neck area is similar to that on other areas of the body and is summarized in Table 4.28.

TABLE 4.28 (C). PERCENTAGE DISTRIBUTION OF HEAD AND NECK WOUNDS BY CREW STATION VERSUS AIRCRAFT TYPE (U)

Crew Station	All Aircraft	UH-1 Only	Other R/W	Fixed Wing
All Severities				
Pilot and Copilot	51.6	41.1	6.2	4.3
Crew Chief and Gunner	30.3	27.0	3.3	-
Others	18.1	13.1	3.1	1.9
All Stations	100.0	81.2	12.6	6.2
Fatal and Serious Only				
Pilot and Copilot	43.3	36.1	5.1	2.1
Crew Chief and Gunner	35.1	33.0	2.1	-
Others	21.6	18.5	2.1	1.0
All Stations	100.0	87.6	9.3	3.1

The pilot-copilot group incurred the most head and neck wounds on all aircraft. When only the fatal and serious wounds in this area were considered, the number declined.

For coding purposes the head and neck area was subdivided into eight classes: forehead, skull, face, eye, ear (mastoid), head top, head unknown, and neck. (See Figure A-1, Appendix A.) To simplify discussion however, the eight classes were combined as follows: (1) face, including eye; (2) neck; (3) helmet area, including all other codes, except (4) unknown. Considerable controversy has arisen concerning the desirability of a ballistic helmet, possibly bullet-resistant. The "helmet area" herein is approximately the area covered by the present (APH-) flyer's helmet, which is not considered a ballistic helmet. Distribution of the wounds which occurred are summarized in Table 4.29.

TABLE 4.29 (C). PERCENTAGE DISTRIBUTION OF HEAD AND NECK WOUNDS BY CAUSE VERSUS LOCATION (U)

	Bullets	Other Proj.	Aircraft Debris	Other Causes
All Severities				
Helmet Area	10.0	2.2	3.1	15.3
Head (Unspecified)	6.4	2.2	1.4	10.0
Face (Including Eye)	6.0	16.7	34.1	56.8
Neck	4.7	3.3	9.9	17.9
Total Head and Neck	27.1	24.4	48.5	100.0
Fatal and Serious				
Helmet Area	34.0	2.1	0.0	36.1
Head (Unspecified)	22.7	3.1	0.0	25.8
Face (Including Eye)	15.5	7.2	2.1	24.8
Neck	11.3	1.0	1.0	13.3
Total Head and Neck	83.5	13.4	3.1	100.0

While debris caused most of the head and neck wounds, it is practically negligible as a cause of fatal and serious wounds, most of which resulted from bullets. Face and neck wounds accounted for 74.7 percent of the total wounds. However, the remainder of the head

accounted for most (61.9 percent) of the fatal and serious wounds. This observation by itself tends to support the desirability of a "ballistic" helmet, but other factors must also be considered. It presumes that all unspecified head wounds occurred in the helmet area, and it presumes maximum armor coverage for the head, i.e., the ideal helmet from the armor viewpoint disregarding other complex problems such as weight and the many other functions of the aviator helmet.

Some discussion is also warranted by the large proportion (almost half) of wounds caused by debris, which were mainly non-serious wounds to the faces and necks of pilots and copilots. Almost half of these were caused by plexiglas. Also included are 30 eye wounds (or 7 percent of head and neck wounds), which represent a significant proportion considering the relatively small presented area of the eyes. This may suggest that the helmet visors are not being utilized to full advantage, since they should stop most debris, especially plexiglas.

4.12 Wounds Prevented.

From the previous discussion in this report, it is apparent that many fatal and non-fatal wounds to the torso were prevented by the timely application of crew-seat and body armor kits. Unfortunately, equivalent protection was not feasible for the head, neck, and limbs.

To assess how many wounds were prevented or how many lives were saved requires a means of estimating the number of hits, wounds, and fatal wounds that should have been expected without the torso protection kits.

Previous studies of Vietnam combat damage (References 1, 6 through 15) have demonstrated that projectile hits on aircraft are uniformly distributed; hence probability of hit on any aircraft section (including personnel) is proportional to its average presented area. This provides a means of predicting expected hits of any type per body or per body section.

However, not every hit necessarily causes wounds or fatal wounds, because not every part of the body is equally unprotected. Part of the face and (sometimes) the hands are bare; arms and legs are covered by clothing alone; feet and head are protected by flight helmet and shoes; some torso area is protected by fragmentation vest and some is protected by crew-seat armor or body armor. Only the armor can stop bullets, but other materials can stop varying degrees of other projectiles and impact debris. In practice, it becomes difficult to predict the heterogeneous mixture of wounds that might have occurred.

To compare expected with observed, a further difficulty is encountered. For the non-serious wounds that occurred most frequently, documentation, e.g., anatomical location, were frequently lacking. On the other hand, the source reports on the fatal and serious cases are believed to be complete and reliable.

By measurement of photographs of a pilot body model it was determined that the average presented area of the torso is 2.57 times that of the head and neck. Since the head and neck were essentially unprotected, it is reasonable to select the number of observed fatal and serious wounds as equivalent to the expected number of such wounds (to the head and neck). From this it follows that the expected number of similar wounds in the unarmored torso would be greater by a factor of 2.57. This estimate is detailed in Table 4.30.

This estimate suggests that 249 fatal and serious wounds should have been expected on the torsos of personnel, without protection kits and other natural aircraft protection. Actually only 80 occurred, hence possibly 169 were prevented, 75.7 percent or 128 of which would have been fatal.

Unfortunately, there is no regulation to report armor "successes," hence no reliable source for direct count. In the absence of such objective data, the above estimate suggests that about 128 lives were saved by crew-seat and body armor from 1962 through 1967.

TABLE 4.30 (C). ESTIMATE OF FATAL AND SERIOUS WOUNDS PREVENTED BY ARMOR (U)
(All Aircraft 1962 - 1967)

	All Crew Stations				All Causes		
	All Causes	Bullets	Other Proj.	Aircraft Debris	Pilot & Copilot	Crew Chief & Gunner	Others
Observed Fatal and Serious Wounds							
Total Number	202	178	21	3	81	81	40
Unspecified Location	9	7	2	0	2	5	2
Total Specified	193	171	19	3	79	76	38
Leg	16	14	2	0	5	10	1
Head and Neck	97	81	13	3	42	34	21
Torso	80	76	4	0	32	32	16
Expected Torso Wounds[a]	249	208	33	8	108	87	54
Estimated Number of Wounds							
Fatal and Serious Prevented[b]	169	132	29	8	76	55	38
Fatal Only Prevented[c]	128	100	22	6	57	42	29

[a] Head and neck wounds x 2.57, which is the ratio of the average presented areas of the pilot torso to the head and neck.

[b] Expected less observed torso wounds.

[c] Wounds prevented x 75.7 percent (observed percent fatal).

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This represents a significant proportion (84 percent) when one considers that 153 actually died from fatal wounds. It also represents 27 percent of the (478) total fatalities, when fatal injuries are included. The significance increases when projected for 1968 and 1969.

In addition the armor kits also prevented serious and non-serious wounds (to the torso). The above estimate implies 39 serious wounds were prevented, and similarly about 200 non-serious wounds of varying significance were probably also prevented.

4.13 Further Wound Reduction.

In principle, further reduction in fatal and serious wounds seems possible by increasing the body armor coverage of the lower torso and the armored seats on some of the aircraft. In practicality, significant further reduction is not probable in existing aircraft.

Since head and neck area accounted for a majority of the fatal wounds, protection in this area suggests significant reduction potential. Previous discussion indicated an "ideal ballistic helmet" could reduce these wounds by as much as 62 percent, representing a reduction of 50 wounds or 33 percent of all fatal wounds, or 10 percent of all combat fatalities in this study. Unfortunately, the weight of the ballistic helmet would increase the hazard of broken necks in crashes. From the crash injury data in this report (which excludes pure accidents), it is estimated that over 500 Army personnel survived crashes without serious injury. If only 10 percent of these were endangered by the extra weight on the head, then the net savings in lives by a ballistic helmet would be canceled. Considering an average of five men aboard per crash a critical rise in fatal neck injury for only 2 percent of the crashes would be equivalent to all the potential fatal head wounds prevented by a ballistic helmet.

An alternative approach (already introduced in Vietnam) is to mount head protection on the back of the seat instead of the man's head. However, this is only applicable for pilots (and copilots), who received

40 percent of the fatal head wounds. Furthermore, such protection is limited to the rear and sides, such that expected net reduction would be less than 20 percent of fatal head wounds, representing 10 percent reduction in total fatal wounds and 3 percent reduction in total combat fatalities. This approach involves no weight addition to pilots' heads, but significant weight penalty to aircraft.

Six fatalities (4 percent of fatal wounds or 1.3 percent of combat fatalities) resulted from bullet wounds in the upper leg. Only a minimal net improvement can be achieved in this direction. Leg armor for door gunners was designed and tried in RVN; however, the casualty data indicate others aboard are equally susceptible to serious and fatal leg wounds.

Besides armor, the only other approach to prevent fatal wounds is to reduce the crew. Sixty-three of the fatally wounded were crew chiefs and gunners. Between 13 and 26 of these were killed while on armed UH-1's. It is difficult to assess the value of (or the need for) these men to the mission performed or to assess the number of lives saved by their suppressive fire. However, crew chiefs and gunners definitely account for about 13 percent of the fatal wounds and about 28 percent of the total fatalities (injuries and wounds). In this respect the deployment of the new two-man gunships should reduce casualty rates.

Taking this approach to its extreme, why not have single-pilot aircraft, to further reduce the casualty rate? In the gunship role this might reduce fatalities, but it would mean loss of aircraft for every serious pilot wound, and it would seriously (perhaps critically) degrade mission effectiveness. For transport helicopters and other aircraft, this approach is inconceivable. In effect, any serious wound to the pilot, and any non-serious wound which affects his ability to control and land the aircraft, would jeopardize the lives of all the passengers, not to mention the aircraft and mission.

Observers, passengers, and other U.S. Army personnel contributed 29 fatal wounds, with more than half of these on UH-1 transports. Additional armoring for these personnel is difficult on existing aircraft, but should be examined critically in designing new aircraft.

Most wounds, 2744 or 93 percent, were not reported as serious, but they represent the main cause of mission aborts in Vietnam. For this reason, as well as for improved morale, reduction of such non-serious casualties deserves some attention. Since half of these (1323) were caused by metal and plexiglas debris (from bullet impact on the aircraft), significant reduction should be technically feasible and relatively easy. Improvement of the face visor and even increased use of the existing visor (or safety sun glasses) have already been mentioned. Certainly the obsolete plexiglas "bullet tipping plates" should be removed, if any remain. Additional measures for suppression of spall may be warranted, especially on the cockpit consoles, e.g., instruments and their glass and metal.

The front spall covers on existing armor appear adequate. It is suspected that some of the non-serious wounds from debris and shrapnel actually were caused by pieces of ceramic from impacted armor; however, practically none of these were specified in the source reports.

The relative ease of preventing debris wounds is demonstrated by comparing the numbers of such wounds suffered on various anatomical locations. For instance, 64 debris wounds were reported on hands which were covered by gloves at most, whereas only 14 were reported on feet which were covered by boots; the face received 143 debris wounds, while the remainder of the head covered by the helmet received only 13 such wounds. Hence, most debris wounds can be prevented by lightweight non-armor materials.

Some wounds were caused by a variety of fragmenting munitions; grenades, mortar shell, landmines, booby traps, and bullets breaking upon impact (shrapnel). However, these accounted for only 21.7 percent of all the wounds and only 10 percent of the fatal and serious wounds.

Certainly the small-bullet armor is adequate to prevent such wounds; on the torso, even the infantryman's fragmentation vest should be effective. For the extremities (arms and legs), small bullet armor is difficult to justify, but limited protection from debris and fragments is feasible and desirable.

With regard to protection from larger projectiles, lightweight armor against 12.7mm (Caliber .50) armor-piercing bullets is now considered practical. In South Vietnam to date, such bullets have been encountered mainly by the gunships, but they accounted for very few wounds. Except for these aircraft, and of course single-pilot aircraft, the penalties in extra weight, cost and mounting problems appear to outweigh the benefits of such armor. Certainly against 14.5mm and larger projectiles, other techniques of casualty reduction offer more promise than armoring of personnel.

Finally, to keep wound prevention in proper perspective, one must remember that personnel wounds are not the major cause of combat fatalities on aircraft. With the armor provided, wounds accounted for 32 percent of the fatalities; without the armor it is estimated that wounds might have accounted for 46 percent of the fatal casualties from hits on aircraft. Hence, armoring personnel has a definite limit in casualty reduction. Maximum casualty reduction also requires serious attention to aircraft design and all measures of reducing crashes and/or crash injuries and burns.

5. (CONFIDENTIAL) SUMMARY

5.1 General.

U.S. Army Combat Casualties reported aboard aircraft in RVN from CY 1962 through CY 1967 numbered 4065. These casualties included three types: injuries (resulting from crash or hard landing caused by projectile damage to the aircraft), wounds (caused directly by a projectile or impact debris), and other casualty incidents aboard aircraft. Crewmen and passenger casualties were included, but source data

excluded non-U.S. Army personnel. The aircraft included a few USAF and USMC planes, but 99 percent of the Army casualties were aboard U.S. Army aircraft, 95 percent of which were helicopters, primarily UH-1's (85 percent). From December 1961, the Army aircraft inventory in RVN rose from about 25 (CH-21's and O-1's) to 3536 aircraft of various types at the end of CY 1967. A total of 4,422,000 hours were flown; over 10,500 sorties were reported hit, and 288 crashed from projectile damage. From the beginning a serious effort was made by the Army to develop and apply lightweight armor for crew-seats and torso body protectors to prevent fatal wounds. As a result, a significant number of lives were saved. By comparison, the total application of aircraft protection to prevent crash and/or crash injuries was nominal. For the period analyzed, 11.8 percent of the reported casualties or a total of 478 were KIA.

5.2 Major Findings.

(1) The number of fatal crash injury casualties (excluding pure accidents) was more than twice the number of fatal wound casualties; i.e., 325 or 68 percent injuries versus 153 or 32 percent wounds.

(2) Seventy-nine percent of the fatal crash injuries (or 53 percent of all the fatalities) involved aircraft fires.

(3) In descending order of frequency, the major causes of fatalities were:

a.	Crash Fires	169 or 35%
b.	Fires In-Flight (and crash)	83 or 17%
c.	Head and Neck Wounds	81 or 17%
d.	Crashes Without Fire	65 or 14%
e.	Torso Wounds	62 or 13%
f.	Miscellaneous Other Wounds	10 or 2%
g.	Miscellaneous Other Injuries	8 or 2%

(4) Of the 4065 total casualties, 89 or 2.2 percent were reported as 'serious." Their causes were analogous to the causes of fatal casualties.

(5) Most (3498 or 86 percent) of the casualties were reported as "non-serious." Their causes were distributed differently than the causes of the fatal and/or serious casualties. Most (78 percent) were wounds, or five times the total injuries. Most of the wounds (48 percent) were caused by debris (aircraft metal, plexiglas, etc.) rather than by bullets or other projectiles and pieces or projectile, and wounds from all causes were mostly (45 percent) in the extremities (arms and legs)

(6) . position group, most of the casualty types e generally distributed 2:2:1, i.e.,: 40 percent were pilots or copilots, 40 percent were crew chiefs or gunners, and the remaining 20 percent were observers. passengers, and others. This suggests that casualty risk is the same for the four main crew positions.

(7) Casualty (and fatality) risk varied among aircraft but the average number of flying hours for all the Army aircraft in RVN was 1100 per combat casualty and 9400 per fatality. The average number of aircraft sorties hit was 2.6 per casualty and 22.6 per fatality.

(8) As time went on, number of casualties escalated as did flying hours, sorties hit, etc., but "rates" either fluctuated about a constant or else declined. From the early years to 1967, flying-hour risk (for Army aircraft combined) improved only slightly per casualty but significantly per fatality (i.e., 7200 to 11,000). However, the number of aircraft sorties hit per casualty and per fatality did not change significantly with time. Injury risk declined slightly with time; wound risk (especially torso wounds) also declined with time.

(9) By aircraft type, casualty risk ranked as follows: armed UH-1's, transport UH-1's, other helicopters, and fixed-wing aircraft. The same rank is obtained in nearly all cases, based on flying hours or aircraft sorties hit, for fatal or total casualties, injuries or wounds. (One notable exception is Armed UH-1 sorties hit per fatal wound, which reflects crew protection.) In general casualty and fatality rates

correlate with "personnel density." Since the Armed UH-1's accounted for so many fatalities, the rate should decrease with the deployment of two-men gunships.

(10) Data were not available to obtain a direct count of lives saved by armor (and other protection). However, based on the average presented area ratio of head and neck to torso, and the observed number of fatal wounds from each anatomical location, it is estimated that approximately 128 fatal torso wounds were prevented through CY 1967. A total of 153 fatal wounds actually occurred, with more than half in the head and neck. Some serious and non-serious wounds were also prevented.

5.3 Other Observations.

(1) The main threat was small bullets, but some casualties were also caused by larger bullets (12.7mm), booby traps, land mines, and other fragmenting munitions. Mines and traps have received a lot of attention, but through CY 1967 they accounted for only five fatal wounds, eleven non-serious wounds, and no injury-type casualties.

(2) Mission (or task) type undoubtedly has a strong influence on casualty rate. The data demonstrate this indirectly; the "aggressive" aircraft, e.g., Armed UH-1's, account for many casualties. Unfortunately "mission" was not precisely specified for most aircraft in the casualty data sources.

(3) In addition to wounds and injuries, 246 (6 percent) "other" combat casualties also occurred. These involved a variety of burns on hot barrels, weapon malfunctions, and other such occurrences in hostile actions. None were fatal, and only three were serious. Hence, these were not very significant to the overall casualty analysis.

(4) Thirty-seven percent of the injuries were fatal; only 5 percent of the wounds were fatal. Injuries also caused a slightly higher percent of serious casualties than did wounds.

(5) Eighty-nine percent of the injuries and 99 percent of the fatal injuries resulted from aircraft crashes. Other injury causes, e.g., hard landing, ejection, parachuting, etc., were not significant in the overall casualty analysis. A number of forced landings were made "on fire" and the aircraft was usually consumed, but only thirteen non-serious injuries (and burns) resulted from these.

(6) Crashes without fire accounted for 38 percent of the fatal injuries and 20 percent of the total injuries.

(7) Crash and/or (post crash) fires accounted for 73 percent of the fatal injuries and 33 percent of the total injuries.

(8) Crashes from fires in-flight accounted for 26 percent of the fatal injuries and 17 percent of the total injuries.

(9) Reported "explosions" accompanied fires in 18 (or 8 percent) of the crashes, but these accounted for 23 percent of the fatal injuries including most of the crashes with no survivors. The average number of fatal injuries per crash was >4 for these cases, compared with 1.6 for fires without "explosion" and 0.6 for crashes without fire. Most of these "explosions" resulted from fuel cell rupture upon crash, but seven (out of eighteen) occurred in mid-air. Fuel is suspected as a cause factor in three of these, but not one clearly initiated inside the fuel cell. All of these cases occurred on UH-1's, nearly all of which were armed.

(10) Less than 2 percent of the fatal crash injuries were caused by wounds to the pilot(s); 98 percent were caused by projectile damage to the aircraft.

(11) Injury risk varied with aircraft type. For the Armed UH-1's approximately 57 percent of the injuries were fatal; for the other Army aircraft approximately 33 percent were fatal. Average number of fatal injuries per combat crash ranged from 0.5 (for the LOH's and fixed-wing aircraft) to 2 (for the large helicopters). Average number of sorties hit per fatal injury ranged from about 40 to 200. Average

number of flying hours per fatal injury ranged from 5100 for the Armed UH-1 to about 20,000 for the other helicopters, and higher for the fixed-wing aircraft. With time, injuries declined, slightly but steadily.

(12) Wound risk varied with aircraft type as follows. Approximately 5 percent of the wounds were fatal for nearly all the aircraft types (with sufficient sample size of wounds). Average number of sorties hit per wound ranged from 42 (for Transport UH-1's) to 263 (for fixed-wing aircraft) apparently depending on "personnel density." Average number of flying hours per fatal wound varied from 10,000 to 70,000 for the helicopters and from 80,000 to 350,000 for the fixed-wing aircraft, reflecting differences in threat, exposure, and utilization. As the armor kits were deployed, wound risk to crewmen declined with time, especially for the torso fatal wounds. For non-crewmen, however, the wound risk increased because of another factor. In 1966, the expansion of the UH-1D Troop Transport operations exposed an increasing number of U.S. Army passengers to wounds aboard helicopters. The infantryman's protection, i.e., helmet and fragmentation vest, are not designed to stop bullets. The net result of these two opposing trends is that the overall trend in wound risk to all personnel (crew and non-crew) does not reflect a sharp decline, throughout the period analyzed.

(13) Seventy-three percent of the casualties (fatal and non-fatal) were wounds, but sixty-eight percent of the fatalities were from injuries.

(14) The most influential factor on wound severity was anatomical location of wound. Head, neck, and torso accounted for less than half of the total wounds, but 93.5 percent of the fatal wounds, and approximately 75 percent of the "serious" wounds. Arms and legs accounted for about half of the total wounds, but less than 30 percent of the serious wounds and less than 6.5 percent of the fatal wounds.

(15) The distribution of wounds and fatal wounds by anatomical location did not vary significantly among aircraft types.

(16) Most (91.5 percent) of the fatal wounds and most (77.5 percent) of the serious wounds were caused by bullets. A significant number of these, 8.5 percent of fatal, 16.4 percent of serious, were caused by a variety of projectile "fragments." No fatal wounds and very few serious wounds resulted from impact debris, i.e., aircraft material. However, such debris accounted for 48 percent of the non-serious wounds, and 45 percent of the total wounds.

(17) In total wounds and wounds caused by bullets, the pilot-copilot position and the gunner - crew-chief position received equal percentages. However the pilot group suffered more wounds from plexiglas debris, whereas the gunner group suffered more "fragment" wounds. This difference affected non-serious wounds only.

(18) None of the arm wounds were fatal or serious; however, of the leg wounds a few were fatal and a significant number were serious. The wounds caused by bullets were evenly distributed on the arms and legs, but the wounds caused by "fragments" and debris were not evenly distributed, suggesting that varying degrees of partial protection existed for the arms and legs. No reports mentioned extremity wounds as cause of crash or loss of control of the aircraft.

(19) Fewer wounds (fatal, serious, and non-serious) were reported in the torso than in the head and neck area, which is a much smaller area but is not armored. Most (63 percent) of these torso wounds were caused by bullets, including 95 percent of the fatal and serious torso wounds. Of these, the majority occurred in the upper torso, primarily in the chest. Since no chest protector failures were reported, these involved personnel without chest protectors, e.g., crewmen before armor was available, and non-crewmen (especially on UH-1D's). However, 68 percent of the torso wounds (fatal or non-fatal) did involve UH-1 crewmen who should have had access to torso protection.

(20) Head and neck wounds accounted for 53 percent of the fatal wounds, 33 percent of the serious and 12 percent of the non-serious wounds. No major differences appear among position groups or aircraft types. Most (83.5 percent) of the fatal and serious wounds were caused by bullets; most of the non-serious were caused by debris; "fragments" caused a small but significant percentage of fatal, serious, and non-serious wounds.

(21) Because of the relatively large number of fatal and serious wounds in the head and neck area, an attempt was made to subdivide these into helmet and non-helmet categories. If all the unspecified head wounds were included, the helmet category could include a maximum of 62 percent of all the fatal and serious wounds to the head and neck, which represented 33 percent of all fatal wounds and 10 percent of all combat fatalities.

5.4 Lessons Learned for Casualty Reduction.

(1) Crash prevention offers the greatest potential in reducing combat fatalities. Crashes with and without fires, caused by projectile hits on aircraft and/or personnel aboard, accounted for 68 percent of the fatalities. This involves general vulnerability reduction of all aircraft systems, but especially reduction of fires in-flight which by itself accounted for 17 percent of all fatalities. Many techniques (e.g., plastic foam, purge-mats, coatings, suppressors, extinguishers, firewalls, etc.) are available to the designers of new aircraft, but some are equally practical for retrofit of existing aircraft, by kit and/or Engineering Change Proposal (ECP). Vulnerability reduction should also include redesign of critical control system and drive train components, prevention of oil starvation to critical high-speed bearings, and in some cases judicious application of lightweight armors, all of which are feasible within the present state-of-the-art. Requirements for new aircraft, e.g., Utility Tactical Transport Aircraft System (UTTAS), should include complete redundancy and separation of systems (and/or components) required to prevent crash, including power

plant, flight controls and pilot. Methods of vulnerability reduction should emphasize basic design, fire-prevention, and other techniques which do not require armor, and which are not sensitive to threat. Crash (and forced landing) prevention has the bonus advantage of saving aircraft.

(2) Crash fire prevention approaches should receive at least second priority in fatality reduction. Crash (and/or post-crash) fires accounted for 35 percent of the combat fatalities; this percentage probably ignores an equal number (or more) of crash fire victims in pure accidents in hostile and non-hostile areas. Basically this involves techniques of fuel containment under crash conditions. Specifically, new crash-resistant (and bullet-sealing) fuel cell materials and self-closing fittings are now available to reduce this hazard.

(3) Prevention of fatal wounds requires bullet armor. The application of new lightweight armors in crew-seats and body armor has already saved many lives by preventing fatal torso wounds. For the whole period analyzed, torso wounds accounted for 13 percent of all fatalities; for the last half of 1967 this had decreased to 8.5 percent, half of which were non-crewmen. The main disadvantage of armor is that it requires significant weight to protect each individual, but its practicality against 7.62mm (.30 Cal.) bullets has been demonstrated in RVN. Armor also has the intangible benefit of improving crew confidence and morale. The weight of existing armor required to protect against 12.7mm (.50 Cal.) is justifiable in some cases, e.g., gunships, but impractical (if not unreasonable) to stop any larger threat. To date, no (official) armor has been provided for troops and other passengers, and the data for this report indicate only 2.6 percent of the total fatalities were fatal torso wounds to non-crewmen. However, 14 percent of all casualties were wounded non-crewmen. While most wounds were non-serious they would probably incapacitate a man for infantry operation. Such casualty prevention would be desirable in troop transports. In summary, further improvements in torso (and other) armor

protection are possible, but most of the casualty reduction potential for this approach has already been achieved.

(4) A major cause of combat fatality (17 percent) was fatal wound to the head and neck, which suggests the desirability of a ballistic helmet for aviators. Actually potential reduction is less than 10 percent since the helmet cannot cover the whole head and neck. However, to approach this potential saving, a helmet will require significant weight on a man's head. This adds to the hazard of broken neck for a very large number, who would otherwise survive combat crashes and accident crashes in hostile areas. The net gain (if any) in lives saved is questionable. Its precise determination requires detailed analysis of crash survival, beyond the scope of this study.

(5) Gunners and crew chiefs on UH-1 gunships accounted for 28 percent of all the combat fatalities in RVN. The period analyzed in this report ends with 1967, when the Cobras were introduced. Other factors being equal, it seems reasonable that crew reduction from four in UH-1C's, to two in AH-1G's (and future gunships), should reduce casualties significantly. Generally, minimum crew for any mission (not less than two pilots) is another means of reducing casualties.

(6) Finally, the prevention of non-serious wounds deserves some attention because these occurred so frequently (78 percent of all combat casualties). Such wounds caused the greatest number of combat mission aborts. Most of these wounds were caused by aircraft metal and plexiglas debris, which is relatively easy to prevent or stop.

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(CONFIDENTIAL) APPENDIX A (General Background)

Table

Figure

SAMPLE SOURCE REPORTS

Form 1300 - Report of Casualty

DD Form 173 - Joint Message Form (CASUALTY)

AGPZ Form 67 - Wounded - Report of Casualties Resulting from Hostile Action Vietnam

DA Form 10-249 - Certificate of Death

DD Form 893 - Record of Identification (PROCESSING)

DA Form 2773 - Statement of Identification

DA Form 2775 - Record of Preparation and Disposition of Remains

DA Form 8-275-3 - Clinical Record Cover Sheet

USARV Form 232 - Abbreviated Aircraft Accident/Combat Damage Report Form for Combat Area

Sample Crash Facts Message Report

JSIDR - Joint Services Anti-Aircraft Fire Incident and Damage Report - MACV Dir 381-34

Table A-1 (C). Aircraft Types with Reported Army Combat Casualties

Vietnam 1962 - 1967 (U)

Service and Type	Designation	Manufacturer	Popular Name	General Mission	Gross Weight (lbs)	Cruise Speed (Knots)	Crew	Passengers	Date in SVN	Date Out of SVN	Number of Casualties Reported	
ARMY												
	UH-1A	Bell	Huey/Iroquois	Armed & Unarmed	----	----	4	0-1	Jul 62	Spring 63	4	
	UH-1B	Bell	Huey/Iroquois	Armed & Unarmed	8,500	90	4	0-3	Nov 62	----	1375	
Rotary	UH-1C	Bell	Huey/Iroquois	Gunship	9,500	110	4	0-3	1965	----	288	
	UH-1D	Bell	Huey/Iroquois	Transport	9,500	115	4	0-12	Spring 65	----	1046	3438
Wing	UH-1H	Bell	Huey/Iroquois	Transport	9,500	115	4	0-12	Jun 67	----	88	
	UH-1	Bell	Huey/Iroquois	Unspecified	9,500	----	4	----	----	----	536	
	AH-1G	Bell	Hueycobra	Gunship	9,500	155	2	0	Nov 67	----	0	
	R/W	Unspecified	----------	----------	-----	----	-	----	----	----	101	
	CH-21	Vertol	Shawnee	Transport	13,000	85	3	0-19	Dec 61	Fall 64	99	
	CH-37	Sikorsky	Mojave	Recovery	31,000	100	3	0-27	Fall 63	Spring 66	11	251
	CH-47	Boeing Vertol	Chinook	Transport	30,000	130	4	0-33	Sept 65	----	141	
	CH-54	Sikorsky	Flying Crane	Cargo/Recovery	42,000	95	3	----	Sept 65	----	0	
	O-13S	Bell	Sioux	Light Observation	2,850	80	2	0-1	Spring 65	Spring 69	115	
	OH-23G	Hiller	Raven	Armed & Unarmed	2,800	80	2	0-1	Fall 65	Spring 69	32	158
	OH-6A	Hughes	Cayuse	Armed & Unarmed	2,400	120	2	0-3	Nov 67	----	11	
Fixed	O-1	Cessna	Bird Dog	Observation	2,400	90	2	0	Dec 61	----	103	147
	OV-1	Grumman	Mohawk	Reconnaissance	12,500	180	2	0	Spring 62	----	44	
Wing	CV-2B	DeHavilland	Caribou	Cargo/Transport	21,000	140	3	0-30	Summer 62	1967	19	
	U-1A	DeHavilland	Otter	Utility	8,000	110	2	7	Spring 62	----	14	
	U-6A	DeHavilland	Beaver	Utility	5,100	110	2	3	Spring 62	----	4	38
	U-8D	Beech	Seminole	Utility	7,300	160	2	4	Summer 62	----	1	
	U-21	Beech	Ute	Utility/Staff	9,600	170	2	0-10	Aug 67	----	0	
NON-ARMY												
R/W	CH-34	Sikorsky	Choctaw (VNAF)	Transport	13,000	90	3	0-17	1962	----	4	
	CH-37	Sikorsky	Mojave (USMC)	Transport	31,000	100	3	0-27	1965	----	1	9
	HH-43	Kaman	Huskie (USAF)	Rescue	4,600	95	4	5	1962	----	3	
	UH-1F	Bell	Huey (USAF)	Transport	9,000	90	4	0-9	1964	----	1	
F/W	A-1E	Douglas	Skyraider (USAF)	Attack	20,000	250	2	0	1962	----	2	24
	C-123	Fairchild	Provider (USAF)	Resupply/Transport	40,000	205	3	0-60	1962	----	20	
	U-10	Helio	Courier (USAF)	Observation/Utility	3,600	135	2	2	1962	----	1	
	0-2B	Cessna	------- (USAF)	Observation	3,800	160	2	0	1967	----	1	
TOTAL											4065	

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Table A-2 (C). Vietnam Inventory of U.S. Army Aircraft (U)

Aircraft Type vs Date

Year	1962		1963		1964		1965		1966		1967		1968
Month	Jan (Approx)	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan	Jul	Jan
Aircraft Type													
Armed UH-1A/B/C	0	(Unknown Distribution Between Armed & Unarmed)							277	347	361	452	603
UH-1B Transport	0	(Unknown Distribution Between Armed & Unarmed)							204	184	162	113	105
UH-1D/H Transport	0	0	0	0	0	0	0	78	412	611	810	1194	1539
AH-1G (Cobra)	0	0	0	0	0	0	0	0	0	0	0	0	24
TOTAL UH-1	0	1*	40	111	162	217	309	402	893	1142	1333	1759	2271
CH-21C	(20)	66	98	95	71	43	0	0	0	0	0	0	0
CH-37	0	0	0	0	4	6	10	10	9	0	0	0	0
CH-47 (incl. armed)	0	0	0	0	0	0	0	0	76	108	133	179	241
CH-54A	0	0	0	0	0	0	0	0	3	4	3	6	15
OH-13S (incl. armed)	0	8	0	0	0	0	0	10	180	190	179	140	142
OH-23G (incl. armed)	0	0	0	0	0	0	0	0	7	31	89	156	171
OH-6A (incl. armed)	0	0	0	0	0	0	0	0	0	0	0	2	88
SUB TOTAL	(20)	74	98	95	75	49	10	20	275	333	404	483	657
TOTAL HELICOPTERS	(20)	87	138	206	237	266	319	422	1168	1475	1737	2242	2928
O-1	(?)	12	19	56	54	51	61	69	159	185	193	220	306
OV-1A/B/C	0	5	8	6	6	9	13	14	28	36	41	47	95
CV-2B	0	1	36	36	27	24	43	45	91	108	97	(to USAF)	
U-1A	(?)	20	21	29	27	27	29	38	38	38	38	36	36
U-6A	0	8	10	17	16	18	31	31	42	59	66	64	80
U-8D	0	5	4	4	8	9	9	12	22	48	62	66	53
U-21	0	0	0	0	0	0	0	0	0	0	0	13 (Aug)	38
TOTAL FIXED WING	(?)	51	98	148	138	138	186	209	380	474	497	446	608
TOTAL ARMY AIRCRAFT	(25)	138	236	354	375	404	505	631	1548	1949	2234	2688	3536

Sources: (1) For UH-1 from Jan 1966 on: Monthly Summaries of Army Aviation Losses and Performance (compiled from OPREP5).

(2) For other aircraft from Jan 1967 on: Army Aircraft Inventory Status and Flying Time. RCS: AHCAV-101

(3) For all other data: Miscellaneous ACTIV & USARV sources.

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Table A-3 (C). U.S. Army Aircraft Total Flying Hours in RVN per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		Total
Half	I	II	I	II	I	II	I	II	I	II	I	II	(1962 - 1967)
Aircraft Type	(Approximated)												
Armed UH-1A/B/C/G	---	(Unknown Distribution Between Armed & Unarmed)					74,173	96,137	121,849	109,002	161,730		562,891
UH-1B Transport	---	(Unknown Distribution Between Armed & Unarmed)					54,672	52,433	41,060	43,727	20,825		212,717
UH-1D/H Transport	---	---	---	---	---	---	(10,000)	70,036	200,794	294,616	437,833	578,268	1,591,547
TOTAL UH-1	0	4,200	12,900	37,490	50,434	86,027	127,267	204,670	349,364	457,525	590,562	760,823	2,681,262
CH-21C	12,251	13,000	19,300	14,299	8,058	(400)	---	---	---	---	---	---	67,308
CH-37	---	---	---	141	337	715	1,090	759	96	---	---	---	3,138
CH-47 (incl. armed)	---	---	---	---	---	---	---	6,899	18,752	26,585	44,816	79,627	176,677
CH-54A	---	---	---	---	---	---	---	500	576	779	1,080	1,888	4,823
OH-13S (incl. armed)	---	---	---	---	---	---	---	(5,000)	46,275	50,572	53,123	56,581	(211,551)
OH-23G (incl. armed)	---	---	---	---	---	---	---	(800)	5,034	19,191	42,246	52,576	(119,847)
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	---	---	---	6,728	6,728
SUB TOTAL	12,251	13,000	19,300	14,440	8,395	(1,115)	1,090	(13,958)	70,733	97,125	141,265	197,450	(590,072)
TOTAL HELICOPTERS	12,251	17,200	32,200	51,930	58,829	(87,142)	128,357	(218,628)	420,097	554,650	731,827	958,223	(3,271,334)
O-1	(1,200)	2,700	4,300	21,648	16,402	25,060	25,612	57,101	73,739	85,485	92,408	148,388	(554,043)
OV-1A/B/C	(300)	927	3,395	2,651	1,920	2,105	4,551	6,701	11,481	15,677	15,974	23,301	(88,983)
CV-2B	---	(6,000)	11,491	9,474	6,359	10,286	16,173	23,245	42,385	40,980	---	---	(166,393)
U-1A	2,523	7,400	7,800	10,521	9,131	8,700	10,960	10,501	13,049	14,464	15,007	15,599	125,655
U-6A	(800)	2,300	2,900	3,935	4,106	5,643	8,886	10,846	15,342	17,852	17,048	16,108	(106,066)
U-8D	(500)	1,100	1,400	2,064	2,468	3,368	4,365	5,365	11,660	18,014	26,444	27,341	(104,089
U-21	---	---	---	---	---	---	---	---	---	---	---	5,259	5,259
TOTAL FIXED WING	(5,323)	(20,427)	(31,286)	50,293	40,386	55,162	70,547	(13,759	167,656	192,472	166,881	236,296	(1,150,488)
TOTAL ARMY AIRCRAFT	(17,574)	(37,627)	(63,486)	102,223	99,215	(142,304)	198,904	(332,387)	587,753	747,122	898,708	1,194,519	(4,421,822)

Sources: (1) For UH-1 from Jan 1966 on: Monthly Summaries of Army Aviation Losses and Performance (compiled from OPREP5).

(2) For other aircraft from Jan 1967 on: Army Aircraft Inventory Status and Flying Time. RCS: AMCAV-101

(3) For all other data: Miscellaneous ACTIV & USARV sources.

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Table A-4 (C). Number of U.S. Army Aircraft (Sorties)Hit in Vietnam per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		Total
Half	I	II	I	II	I	II	I	II	I	II	I	II	
Aircraft Type	Hit Reports Reaching USAMSAA[1]						Total Recorded on Monthly Summaries[2]						
Armed UH-1B/C	---	4	34	205	230	270	330	325	698	541	626	702	3965
UH-1B Transport	---	3	12	23	26	42	86	144	69	26	128	103	662
UH-1D/H Transport	---	---	---	---	---	---	14	235	556	503	943	897	3148
AH-1G (Cobra)	---	---	---	---	---	---	---	---	---	---	---	7	7
TOTAL UH-1	---	7	46	228	256	312	430	704	1323	1070	1697	1709	7782
CH-21C	53	79	96	87	49	0	---	---	---	---	---	---	364
CH-37	---	---	---	10	3	4	2	0	0	---	---	---	19
CH-47 (incl. armed)	---	---	---	---	---	---	---	26	96	68	145	150	485
CH-54A	---	---	---	---	---	---	---	0	2	2	6	4	14
OH-13S & OH23G (incl. armed)	---	---	---	---	---	---	---	3	76	105	121	110	415
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	---	---	0	23	23
SUB TOTAL	53	79	96	97	52	4	2	29	174	175	272	287	1320
TOTAL HELICOPTERS	53	86	142	325	308	316	432	733	1497	1245	1969	1996	9102
O-1	0	1	3	21	22	37	22	45	53	61	80	136	481
OV-1A/B/C	---	2	30	69	44	38	33	73	92	63	48	48	540
CV-2B	---	0	1	21	19	27	26	37	41	51	---	---	223
U-1A	1	1	5	9	6	9	8	5	3	11	5	2	65
U-6A	0	0	0	0	1	9	4	2	1	3	4	5	29
U-8D	---	0	0	0	0	0	0	0	0	0	2	0	2
U-21	---	---	---	---	---	---	---	---	---	---	---	0	0
Unspecified F/W	---	---	---	---	---	---	---	---	102	87	46	---	235
TOTAL FIXED WING	1	4	39	120	92	120	93	162	292	276	185	191	1575
TOTAL ARMY AIRCRAFT	54	90	181	445	400	436	525	895	1789	1521	2154	2187	10677

(1) Not all aircraft hits individually reported; not all hit reports reach USAMSAA.

(2) Monthly Summaries of Army Aviation Losses & Performance (Official counts from OPREP 5).

(3) Code: 0 entry denotes flying hours but no hits recorded; --- entry denotes no flying hours recorded.

Table A-5 (C). U.S. Army Aircraft Combat Crashes per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		
Half / Aircraft Type	I	II	I	II	I	II	I	II	I	II	I	II	Total
Armed UH-1B/C	---	0	1	1	7	4	12	8	10	15	13	15	86
UH-1B Transport	---	0	0	0	1	2	0	0	0	0	0	0	3
UH-1B (Unk. if armed)	---	---	---	---	1	0	2	2	6	2	---	---	13
UH-1D/H Transport	---	---	---	---	---	---	1	2	18	12	22	34	89
AH-1B (Cobra)	---	---	---	---	---	---	---	---	---	---	---	0	0
TOT UH-1	---	0	1	1	9	6	15	12	34	29	35	49	191
CH-21C	1	1	1	3	0	---	---	---	---	---	---	---	6
CH-37	---	--	---	1	0	0	0	---	---	---	---	---	1
CH-47 (incl. armed)	---	---	---	---	---	---	---	0	1	0	3	3	7
CH-54A	---	---	---	---	---	---	---	---	0	0	0	0	0
OH-13S (incl. armed)	---	---	---	---	---	---	---	2	3	5	7	7	24
OH-23G (incl. armed)	---	---	---	---	---	---	---	0	0	1	3	4	8
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	---	---	---	3	3
SUB TOTAL	1	1	1	4	0	0	0	2	4	6	13	17	49
TOTAL HELICOPTERS	1	1	2	5	9	6	15	14	38	35	48	66	240
O-1	---	0	0	0	2	1	3	2	3	3	6	5	25
OV-1A/B/C	---	0	2	3	1	1	0	4	4	4	0	0	19
CV-2B	---	---	0	0	0	0	0	0	0	1	---	---	1
U-1A	0	0	0	0	0	0	0	0	0	0	0	1	1
U-6A	---	---	---	---	0	0	1	1	0	0	0	0	2
U-8D	---	---	---	---	---	---	---	---	---	---	0	---	0
U-21	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL FIXED WING	0	0	2	3	3	2	4	7	7	8	6	6	48
TOTAL ARMY AIRCRAFT	1	1	4	8	12	8	19	21	45	43	54	72	288

CODE: 0 entry denotes aircraft hits but no crash recorded; --- entry denotes no hits recorded.

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Table A-6 (C). Distributions (%) by Aircraft Type for Flying Hours, Aircraft Hit, Crashes, Casualties, and Fatalities (U) - (1962-1967)

Aircraft Type	Flying Hours	Aircraft Hit	Combat Crashes	Casualties				Fatalities		
				Total	Wounds	Injuries	Others	Total	Wounds	Injuries
Armed UH-1A/B/C	12.7*	37.21*	29.86	24.97	21.18	31.61	46.75	35.98	18.95	44.00
UH-1B Transport	4.8	6.20	1.04	1.01	0.81	0.69	4.47	0.21	0.65	0
UH-1B (Unknown if Armed)	---	---	4.52	15.03	16.02	12.37	12.60	11.09	15.69	8.92
UH-1D/H Transport	36.0	29.48	30.90	27.90	28.14	31.73	11.38	34.94	49.02	28.31
UH-1 (Unspecified Model)	---	---	---	15.67	19.08	1.95	23.58	0.42	1.31	0
TOTAL UH-1	60.7	72.89	66.32	84.58	85.23	78.35	98.78	82.64	85.62	81.23
CH-21C	1.52	3.41	2.08	2.43	2.68	2.29	0	2.09	4.59	.93
CH-37	.07	.18	.35	0.27	0.20	.57	0	.84	0	1.23
CH-47 (Incl. Armed)	4.00	4.54	2.43	3.47	3.63	3.90	0	2.93	2.61	3.08
CH-54A	.11	.13	0	0	---	---	---	---	---	---
SUB TOTAL	5.70	8.26	4.86	6.17	6.51	6.76	0	5.85	7.20	5.24
OH-13S (Incl. Armed)	4.75)	3.89	8.33	2.83	2.81	3.67	0	3.35	2.61	3.69
OH-23G (Incl. Armed)	2.70)		2.78	0.79	0.70	1.37	0	1.04	0.65	1.23
OH-6A (Incl. Armed)	15	.21	1.04	0.27	0.20	.57	0	---	0.00	---
SUB TOTAL	7.60	4.10	12.15	3.89	3.71	5.61	0.0	4.40	3.26	4.92
TOTAL HELICOPTERS	74.0	85.25	83.33	94.64	95.45	90.72	98.78	92.89	96.08	91.39
O-1	12.5	4.50	8.68	2.54	2.21	4.36	0	3.54	1.96	4.31
OV-1A/B/C	2.0	5.06	6.60	1.08	0.89	1.83	0.81	0.84	0.0	1.23
CV-2B	3.8	2.09	.35	0.47	0.61	0	0.41	0.42	1.31	0
U-1A	2.8	.61	.35	0.34	0.34	0.46	0	0.84	0.0	1.23
U-6A	2.4	.27	.69	0.10	0.03	0.34	0	0.21	0.65	0.0
U-8D	2.5**	.02	0	0.02	0.03	0	0	---	0.0	0.0
Unspecified F/W	---	2.20	---	---	---	---	---	---	---	---
TOTAL FIXED WING	26.0	14.75	16.67	4.55	4.11	6.99	1.22	5.85	3.92	6.77
TOTAL ARMY AIRCRAFT	100.0	100.0	100.0	99.19	99.56	97.71	100.0	98.74	100.0	98.16
NON-ARMY HELICOPTERS	---	---	---	0.22	0.20	1.95	---	0.63	0	0.92
NON-ARMY FIXED WING	---	---	---	0.59	0.24	0.34	---	0.63	0	0.92
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Incl. Cobra
** Incl. U-21 (0.1%)

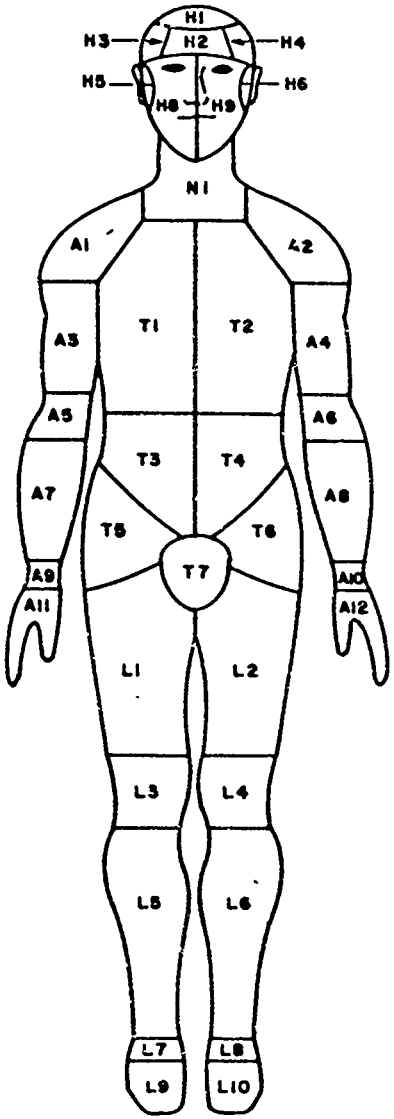
SOURCES: Tables A-3, A-4, A-5, B-1, B-2, C-1, C-2, D-1, D-2, & B-16.

Table A-7 (C). Number of Casualties Reported vs Report Source (U)

Source Code	Source Report	Non Fatal Number	Non Fatal Percent	Fatal Number	Fatal Percent
A	Form 1300	N/A	N/A	455	95.2
B	Casualty Report (Teletype, Other)	1,277	35.6	338	70.9
C	Log Sheet (TAGO)	1,994	55.6	24	5.0
D	Mortuary Reports	N/A	N/A	427	89.3
E	Abreviated Aircraft Accident Reports (Forms 48 or 232)	980	27.3	182	38.1
F	Aircraft Company Tech. Rep. Reports	90	2.5	8	1.7
J	Joint Service Incident & Damage Report (JSIDR)	719	20.0	119	24.9
K	Crash Facts Message	425	11.8	225	47.3
L	Dynalectron (Field Damage Survey Team)	11	0.3	13	2.7
	TOTAL REPORTS	5,515	---	1,792	---
	A, B, C, or D (Without E, F, J, K, or L)	1,827	50.7	11	2.3
	E, F, J, K, or L (Without A, B, C, or D)	507	14.2	3	0.6

Table A-8 (C). Number of Casualties Reported vs Multiple of Sources

Source Multiple Reporting	Non Fatal Number	Non Fatal Percent	Fatal Number	Fatal Percent
1	2,090	58.3	18	3.8
2	1,171	32.6	39	8.2
3	255	7.1	139	29.1
4	58	1.6	162	33.9
5	11	0.3	91	19.0
6	2	0.1	27	5.6
7	0	0.0	2	0.4
8	0	0.0	0	0.0
TOTAL CASUALTIES	3,587	100.0	478	100.0



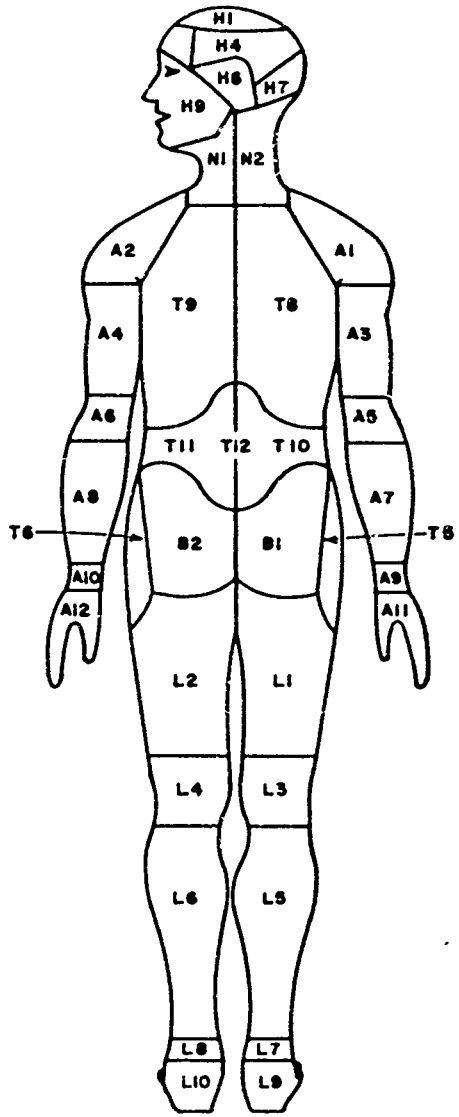
FRONT VIEW

LOCATION	SIDE	SYMBOLS
HEAD & NECK		
TOP	N/A	H1
FOREHEAD	N/A	H2
SKULL (1)	RIGHT, LEFT, BACK	H3, H4, H7
MASTOID	RIGHT, LEFT	H5, H6
FACE	RIGHT, LEFT	H8, H9
NECK (2)	FRONT, BACK	N1, N2
TORSO (FRONT)		
CHEST	RIGHT, LEFT	T1, T2
ABDOMEN	RIGHT, LEFT	T3, T4
HIP	RIGHT, LEFT	T5, T6
GROIN	N/A	T7
TORSO (REAR)		
HIP	RIGHT, LEFT	T5, T6
BACK	RIGHT, LEFT	T8, T9
LUMBAR	RIGHT, LEFT	T10, T11
SPINE (1)	N/A	T12
BUTTOCKS	RIGHT, LEFT	B1, B2
ARM		
SHOULDER	RIGHT, LEFT	A1, A2
UPPER	RIGHT, LEFT	A3, A4
ELBOW	RIGHT, LEFT	A5, A6
LOWER	RIGHT, LEFT	A7, A8
WRIST	RIGHT, LEFT	A9, A10
HAND	RIGHT, LEFT	A11, A12
LEG		
UPPER	RIGHT, LEFT	L1, L2
KNEE	RIGHT, LEFT	L3, L4
LOWER	RIGHT, LEFT	L5, L6
ANKLE	RIGHT, LEFT	L7, L8
FOOT (INCL HEEL)	RIGHT, LEFT	L9, L10

NOTES:

1 - NO FRONT SIDE FOR SKULL OR SPINE
2 - NO LEFT OR RIGHT SIDE FOR NECK, SPINE OR FOREHEAD.

Figure A-1 Anatomical Location Code



REAR VIEW

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE ADJUTANT GENERAL
WASHINGTON, D. C., 20315

REPORT OF CASUALTY	REPORT NUMBER AND TYPE	DATE PREPARED

1. SERVICE IDENTIFICATION *(Name, Service Number, Grade or Rate, Component, Branch and Organization)*

2. CASUALTY STATUS ☐ BATTLE ☐ NON-BATTLE

3. DATE AND PLACE OF BIRTH, RACE, RELIGIOUS PREFERENCE

4. DATE AND PLACE OF LAST ENTRY ON ACTIVE DUTY IN CURRENT STATUS AND HOME OF RECORD AT TIME

5. SOCIAL SECURITY NUMBER, PAY GRADE, LENGTH OF SERVICE FOR PAY, BASIC PAY, INCENTIVE PAY — CHECK IF APPLICABLE ☐ CREW ☐ NON-CREW

6. DUTY STATUS

7. INTERESTED PERSONS *(Name, Address, Relationship)*

8. REPORT FOR VA TO FOLLOW ☐ YES ☐ NO

9. REPORTING COMMAND AND DATE REPORT RECEIVED IN DEPARTMENT

10. SELECTIVE SERVICE NUMBER, LOCAL BOARD, AND LOCATION *(If unknown, enter date and place of first entry in Armed Services)*

11. PRIOR SERVICE DATA ☐ YES ☐ NO

12. REMARKS

FOOTNOTES:
1 Adult next of kin.
2 Beneficiary for gratuity pay in event there is no surviving wife or child as designated on record of emergency data.
3 Beneficiary for unpaid pay and allowances—as designated on record of emergency data.

13. DISTRIBUTION

14. BY ORDER OF THE SECRETARY OF THE ARMY:

Adjutant General

DD FORM 1 MAR 60 1300 REPLACES DA FORM 52-1, WHICH IS OBSOLETE.

JOINT MESSAGEFORM

RESERVED FOR COMMUNICATION CENTER

SECURITY CLASSIFICATION: UNCLAS EFTO FOUO

TYPE MSG	BOOK	MULTI	SINGLE
		M	

PRECEDENCE

ACTION: IMMEDIATE

INFO: PRIORITY

DTG

SPECIAL INSTRUCTIONS

FROM: (REPORTING AGENCY)

TO: CHIEF CASUALTY BR TAGO DA WASH DC

INFO: (Info addressees as required by reporting command)

UNCLAS EFTO FOUO For

Protective marking automatically removed in accordance with paragraph 19b (2), AR 360-5.

Casualty Report Nr

A. NAME:

B. SERVICE NUMBER:

C. GRADE:

D. DATE AND HOUR OF INCIDENT:

E. CIRCUMSTANCES:

F. RACE:

G. ORGANIZATION AND ADDRESS:

H. NAME AND ADDRESS OF NEXT OF KIN:

I. AMOUNT OF BASIC PAY, TYPE OF ADDITIONAL PAY, BASIC PAY ENTRY DATE, AND SGLI INFORMATION:

J. CAUSE OF DEATH:

K. STATUS OF REMAINS:

L. DATE TOUR IN AREA OF HOSTILE ACTION COMMENCED:

M. DUTY MOS:

N. LINE OF DUTY STATUS:

O. RELIGION:

(SAMPLE REPORT FROM AR 600-10)

DATE	TIME
MONTH	YEAR
PAGE NO. 1	NO. OF PAGES 1

DRAFTER — TYPED NAME AND TITLE | PHONE

RELEASER — SIGNATURE

TYPED (or stamped) NAME AND TITLE

SECURITY CLASSIFICATION: UNCLAS EFTO FOUO

REGRADING INSTRUCTIONS

DD FORM 1 NOV 68 173

REPLACES EDITION OF 1 MAY 68 WHICH WILL BE USED.

WOUNDED - REPORT OF CASUALTIES RESULTING FROM HOSTILE ACTION
VIETNAM

FROM	TO
0600,	0600

NEXT MASTER CASUALTY NUMBER	NEXT MISCELLANEOUS CASUALTY REPORT NO	MISCELLANEOUS CASUALTY REPORTS OVERDUE

DO NOT REPT	CASUALTY REPORT NO.	MASTER CASUALTY NO. (1-6)	• NAME (7-20)	• GRADE (33-36)	• SN (36-47)	• ORG (48)	• CAUSE	OFF ONLY BRANCH (50-51)	DATE OF CASUALTY (52-58)	DMOS (59-63)	STATE (64-67)	STA OF WND (68)	TYPE OF WND (69-70)	ACFT TYPE (73)	DUTY POS (73)	NOK NOTIF (74)

102

AGPE FORM 67, 1 Mar 66

PAGE _____ OF _____ PAGES

CERTIFICATE OF DEATH (OVERSEAS)

(AR 638-40)

NAME OF DECEASED (Last, First, Middle)	GRADE	BRANCH OF SERVICE	SERVICE NUMBER

ORGANIZATION	DATE OF BIRTH	SEX
		☐ MALE ☐ FEMALE

COLOR OR RACE	MARITAL STATUS	RELIGION
☐ WHITE	☐ SINGLE	☐ DIVORCED	☐ PROTESTANT	☐ OTHER (Specify)
☐ NEGRO	☐ MARRIED	☐ SEPARATED	☐ CATHOLIC	
☐ OTHER (Specify)	☐ WIDOWED		☐ JEWISH	

NAME OF NEXT OF KIN	RELATIONSHIP TO DECEASED

STREET ADDRESS	CITY OR TOWN AND STATE

MEDICAL STATEMENT

CAUSE OF DEATH (Enter only one cause per line)		INTERVAL BETWEEN ONSET AND DEATH
DISEASE OR CONDITION DIRECTLY LEADING TO DEATH [1]		
ANTECEDENT CAUSES — MORBID CONDITION, IF ANY, LEADING TO PRIMARY CAUSE		
ANTECEDENT CAUSES — UNDERLYING CAUSE, IF ANY, GIVING RISE TO PRIMARY CAUSE		
OTHER SIGNIFICANT CONDITIONS [2]		

MODE OF DEATH	AUTOPSY PERFORMED	MAJOR FINDINGS OF AUTOPSY	CIRCUMSTANCES SURROUNDING DEATH DUE TO EXTERNAL CAUSES
☐ NATURAL	☐ YES		
☐ ACCIDENT	☐ NO		
☐ SUICIDE			
☐ HOMICIDE			

DATE OF DEATH (Hour, day, month, year)	PLACE OF DEATH

I HAVE VIEWED THE REMAINS OF THE DECEASED AND DEATH OCCURRED AT THE TIME INDICATED AND FROM THE CAUSES AS STATED ABOVE.

NAME OF MEDICAL OFFICER			TITLE OR DEGREE
GRADE	SERVICE NUMBER	INSTALLATION OR ADDRESS	
DATE		SIGNATURE	

DISPOSITION OF REMAINS

NAME OF MORTICIAN PREPARING REMAINS	GRADE	LICENSE NUMBER	STATE	OTHER
INSTALLATION OR ADDRESS	DATE	SIGNATURE		

NAME OF CEMETERY OR CREMATORY	LOCATION OF CEMETERY OR CREMATORY

TYPE OF DISPOSITION	DATE OF DISPOSITION
☐ BURIAL ☐ CREMATION ☐ REMOVAL (Specify)	

REGISTRATION OF VITAL STATISTICS

REGISTER (Town and County)	DATE REGISTERED	FILE NUMBER	STATE	OTHER

NAME OF FUNERAL DIRECTOR	ADDRESS

SIGNATURE OF AUTHORIZED INDIVIDUAL

[1] State disease, injury or complication which caused death, but not mode of dying such as heart failure, etc.

[2] State conditions contributing to the death, but not related to the disease or condition causing death.

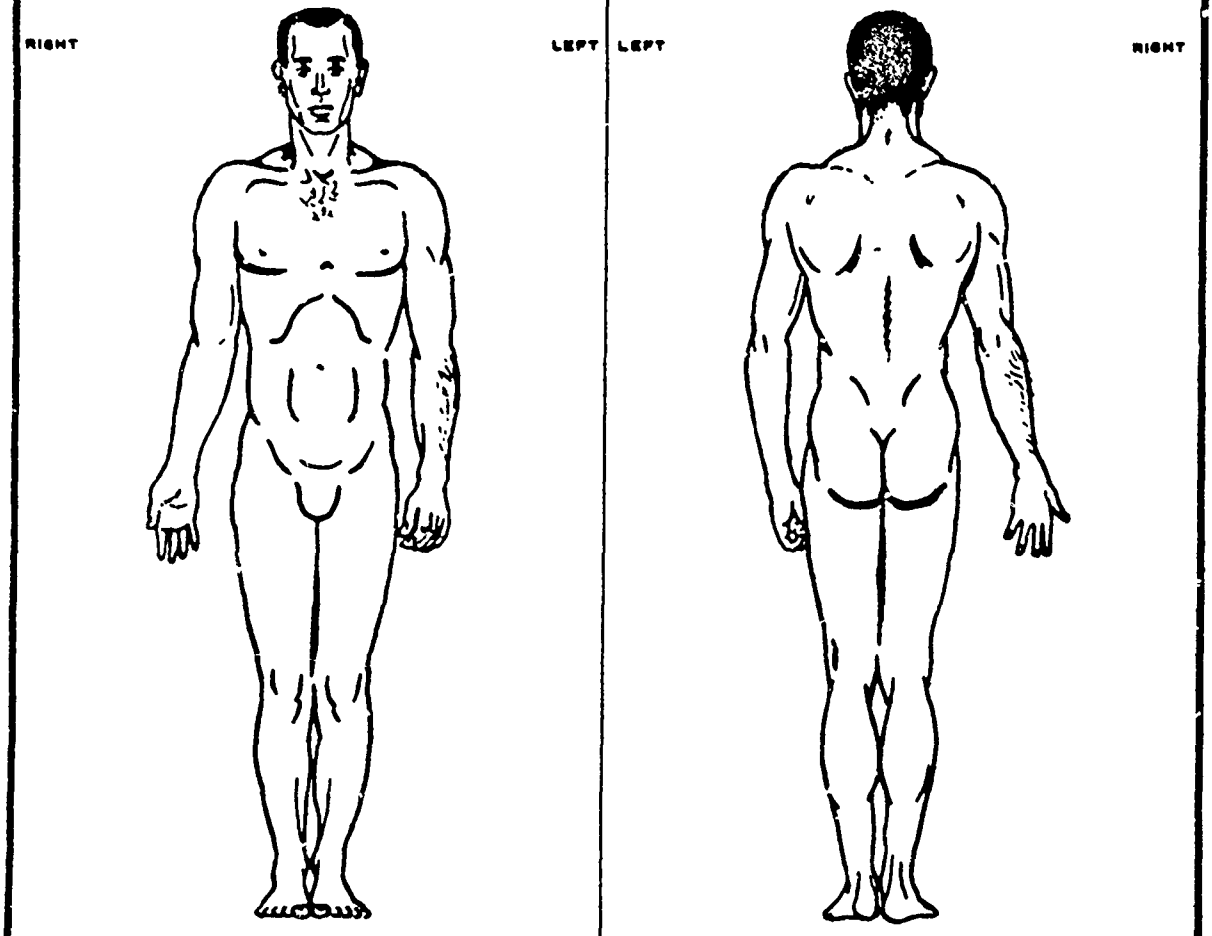
DA FORM 1 APR 55 10-249

RECORD OF IDENTIFICATION PROCESSING
ANATOMICAL CHART

LAST NAME - FIRST NAME - MIDDLE INITIAL (or unknown number)		GRADE	SERVICE NUMBER

NAME OF CEMETERY, EVACUATION NUMBER, OR SEARCH AND RECOVERY NO.	PLOT	ROW	GRAVE	ESTIMATED AGE (Yrs)	ESTIMATED HEIGHT

BLACK OUT PORTIONS NOT RECOVERED



CONDITION OF REMAINS (Check pertinent blocks) ☐ INTACT ☐ DECOMPOSED ☐ SEMI-SKELETAL ☐ FLESH COVERED ☐ BURNED (Degree: ☐ 1st ☐ 2d ☐ 3d)

REMARKS (Continue on reverse if additional space is required)

NAME OF PREPARING OFFICIAL (Print or type)	SIGNATURE

DD FORM 1 FEB 84 893

U. S. GOVERNMENT PRINTING OFFICE : 1984 O - 371965

STATEMENT OF IDENTIFICATION

(AR 638-40)

INSTRUCTIONS

1. Prepare in triplicate and distribute as follows:
   a. Original to OCofSptS. Attn: Memorial Division
   b. Copy to Army Command
   c. Copy retained at preparing installation

2. This statement will be supplemented by signed copies of appropriate Records of Identification Processing *(DD Forms 890 through 894).*

NAME OF DECEASED *(Last, First, Middle)*	GRADE	SERVICE NUMBER	BRANCH OF SERVICE

ORGANIZATION AND BASE	DATE OF DEATH	PLACE OF DEATH

CONDITION OF REMAINS *(Describe briefly in Remarks)*

☐	RECOGNIZABLE	☐	NOT RECOGNIZABLE	☐	COMMINGLED
☐	EVIDENCE OF DECOMPOSITION	☐	MANGLED OR MUTILATED	☐	EVIDENCE OF BURNS

MEANS OF IDENTIFICATION

(Check all appropriate boxes and indicate appropriate inclosures. Specify supporting data in Remarks.)

☐	IDENTIFICATION TAGS		INCLOSURES
☐	PERSONAL EFFECTS	☐	DD FORM 890
☐	DENTAL COMPARISON	☐	DD FORM 891 AND SF FORM 603
☐	SKELETAL AND ANATOMICAL COMPARISON	☐	DD FORM 892 AND/OR DD FORM 893
☐	FINGERPRINTS	☐	DD FORM 894
☐	VISUAL RECOGNITION	☐	
☐	OTHER *(Specify in Remarks)*	☐	

REMARKS

TO THE BEST OF MY KNOWLEDGE AND BELIEF, THE STATEMENTS MADE HEREIN ARE CORRECT AND TRUE.

TYPED NAME, GRADE, AND TITLE OF IDENTIFYING OFFICER	NAME AND ADDRESS OF INSTALLATION

DATE	SIGNATURE OF IDENTIFYING OFFICER

DA FORM 1 FEB 64 2773

REPL 105 1 FORM 10-248, 1 APR 59, WHICH IS OBSOLETE.

GPO 806-999

RECORD OF PREPARATION AND DISPOSITION OF REMAINS

(Deaths Occurring Overseas)
(AR 638-40)

REPORTS CONTROL SYMBOL SPTS-15(R1)

REPORT NUMBER

DECEDENT DATA

1. REMAINS OF *(Last Name - First Name - Middle Initial)* | 2. GRADE | 3. SERVICE NUMBER

4. BRANCH OF SERVICE
☐ ARMY ☐ NAVY ☐ AIR FORCE ☐ MARINE CORPS
☐ OTHER *(Specify)*

5. CAUSE OF DEATH | 6. PLACE OF DEATH

7. DATE OF DEATH | 8. HOW IDENTIFIED

MORTUARY DATA

9. REMAINS RECEIVED AT MORTUARY		10. EMBALMING STARTED		11. EMBALMING COMPLETED	
DATE	HOUR	DATE	HOUR	DATE	HOUR

12. CONDITION OF REMAINS PRIOR TO EMBALMING

13. TYPE OF CASE
☐ NORMAL ☐ AUTOPSIED
☐ MUTILATED

14. PRE-EMBALMING PROCEDURES COMPLETED *(Items 36a thru 36l)*
☐ YES ☐ NO *(Explain)*

15. TOTAL OZ. CONC FLUID USED

ARTERIAL	CAVITY

16. NAME POINTS OF INJECTION

17. TOTAL HARDENING COMPOUND USED *(lb)*

18. AREAS HYPODERMICALLY EMBALMED

19. POST EMBALMING PROCEDURES COMPLETED *(Items 36j thru 36l)*
☐ YES ☐ NO *(Explain)*

20. SUBSEQUENT TREATMENT

21. LOCATION OF PREPARING MORTUARY *(City and Country)*

22. TYPED NAME OF PREPARING EMBALMER | SIGNATURE | 23. LICENSE NUMBER & STATE

SHIPMENT DATA

24. SHIPPING PROCEDURES COMPLETED *(Items 36a thru 36d)*
☐ YES ☐ NO *(Explain)*

25. METHOD OF SHIPMENT
☐ AIR ☐ WATER
☐ OVERLAND

26. DATE SHIPPED FROM PREPARING MORTUARY | 27. POE DESTINATION *(Place of final destination if not to a U.S. Port)*

28. DATE DEPARTURE FROM OR RELEASE IN COMMAND | 29. CHECK ONE IF RELEASED IN COMMAND *(Remains will be fully dressed and cosmetized)*
☐ PRIVATE COMMERCIAL SHIPMENT ☐ LOCAL INTERMENT *(Indicate City, Town and Country)*

REIMBURSEMENT DATA

30. TOTAL AMOUNT OF REIMBURSEMENT | 31. SPONSOR

32. DATE REIMBURSEMENT EFFECTED *(Or action taken to obtain reimbursement)*

33. TYPED NAME OF MORTUARY OFFICER OR OTHER RESPONSIBLE PERSON | SIGNATURE

DA FORM 1 FEB 67 2775 REPLACES PREVIOUS EDITION, WHICH IS OBSOLETE. CHIEF OF SUPPORT SERVICES 1

CLINICAL RECORD COVER SHEET

(AR 40-400)

1. ADMISSION NOTES	2. WARD	3. TYPE OF CASE ☐ DIS ☐ INJ ☐ EC	4. LAST NAME–FIRST NAME–MIDDLE INITIAL		
	5. SEX / 6. RELIGION	7. PREV. ADM. ☐ YES ☐ NO	8. REGISTER NO.	9. SERVICE NO.	10. GRADE
	11. RATING OR DEGR	12. DEPARTMENT	13. ORGANIZATION AND BRANCH OF SERVICE		14. FLYING STATUS
	15. NAME AND ADDRESS OF EMERGENCY ADDRESSEE		16. AGE / 17. RACE / 18. LENGTH OF SERVICE		19. DATE OF ADMISSION
			20. SOURCE OF ADMISSION		
			NOTE: Enter flying status for AF Military Personnel only. For Civilians, etc., show type *(Dep. of EM, etc.)* in space 13.		
	21. ADMITTING OFFICER		22. CONTINUATION OF ITEMS 13 AND 20		

23. DIAGNOSES *(See instructions for recording as shown on reverse side. Include all required related data)*

24. OPERATIONS AND SPECIAL THERAPEUTIC PROCEDURES *(Show date for each; show anesthetic for each operation)*

25. SELECTED ADMINISTRATIVE DATA *(Show nature of and dates for board proceedings; show fact of and dates for leave, AWOL, subsisting elsewhere, detached service, etc.)*

26. **PHYSICAL PROFILE**

TYPE	SERIAL						SUFFIX					☐ PROFILE IS UNCHANGED
	P	U	L	H	E	S	R	T	D	O	X	
PREVIOUS												
REVISED												

27. DAYS DURATION THIS FACILITY

ALL_____IN HOSPITAL OR INFIRMARY_____SUBSISTING ELSEWHERE_____QUARTERS OR DISPENSARY_____LEAVE_____OTHER_____

28. NATURE OF DISPOSITION	29. DATE OF DISPOSITION

30. SIGNATURE OF ATTENDING PHYSICIAN	31. SIGNATURE OF REGISTRAR OR MEDICAL RECORDS OFFICER

32. NAME AND LOCATION OF MEDICAL TREATMENT FACILITY	33. REGISTER NUMBER

DA FORM 1 JUL 62 8-275-3 *(4 PART)* REPLACES DD FORM 461-2, 1 SEP 62, EXISTING SUPPLIES OF WHICH WILL BE ISSUED AND USED UNTIL 1 JUL 63 UNLESS SOONER EXHAUSTED. 1

ABBREVIATED AIRCRAFT ACCIDENT/COMBAT DAMAGE REPORT FORM FOR COMBAT AREA

REPORTS CONTROL SYMBOL

THRU:	TO:	FROM:

SECTION A - LOCATION AND TIME

1 DATE OF ACCIDENT	2 TIME	3 PLACE OF ACCIDENT

SECTION B - AIRCRAFT

1 AIRCRAFT SERIAL NUMBER	2 TYPE MODEL AND SERIES	3 UNIT ASSIGNED

SECTION C - DAMAGE CLASSIFICATION

1 COMBAT LOSS OR DAMAGE *(as a direct result of hostile action)*	2 ACCIDENT *(Major or Minor as defined by AR 385-40)*

SECTION D - OPERATOR AND/OR OPERATORS

PERSONNEL AT CONTROLS AT THE TIME OF THE ACCIDENT ☐ PILOT ☐ INSTRUCTOR PILOT ☐ COPILOT ☐ ACFT COMMANDER

1 LAST NAME FIRST NAME MIDDLE INITIAL	2 GRADE	3 SERVICE NUMBER	4A. HRS ON DUTY

4 AGE	5 SERVICE *(Army, Air Force, Navy)*	6 ORGANIZATION TO WHICH ASSIGNED

7 PRESENT AERONAUTICAL RATING	8 DATE RECEIVED	9 DUTY STATUS AT TIME OF ACDT

10 LAST NAME - FIRST NAME - MIDDLE INITIAL	11 GRADE	12 SERVICE NUMBER	13A. HRS ON DUTY

13 AGE	14 SERVICE *(Army, Air Force, Navy)*	15 ORGANIZATION TO WHICH ASSIGNED

16 PRESENT AERONAUTICAL RATING	17 DATE RECEIVED	18 DUTY STATUS AT TIME OF ACDT

SECTION E - INJURIES

DUTY AT TIME OF ACCIDENT	NUMBER FATAL	NUMBER INJURED	NR NOT INJURED	LOCATION OF INJURY	CAUSE OF INJURY
1 PILOT					
2 COPILOT					
3 ACFT COMDR					
4 INST PILOT					
5 CE					
6 GUNNER					
7 OBSERVER					
8 PASSENGERS					

SECTION F - CREW EXPERIENCE

1 HOURS FLYING TIME	TOTAL TIME	TOTAL FIXED WING			TOTAL ROTARY WING			TOTAL THIS TYPE ACFT	2 INST QUAL		3 TOTAL TIME PRESENT TOUR	
		IP	P	CP	IP	P	CP		FW	RW	MONTHS	FLYING TIME
PILOT												
COPILOT												
ACFT COMDR												
INST PILOT												

SECTION G - CAUSE FACTORS

1 CREW ERROR	☐ ESTABLISHED	☐ SUSPECTED	☐ NONE	☐ UNKNOWN
2 MATERIEL FAILURE	☐ ESTABLISHED	☐ SUSPECTED	☐ NONE	☐ UNKNOWN
3 EIR CONTROL NUMBER:		DATE SUBMITTED:		
4 MAINTENANCE ERROR	☐ ESTABLISHED	☐ SUSPECTED	☐ NONE	☐ UNKNOWN

SECTION H - DAMAGE

1 EXTENT OF DAMAGE ☐ TOTAL LOSS ☐ REPARABLE	2 AMOUNT OF DAMAGE *(Dollars)*	3. MAN HRS. TO REPAIR

SECTION I - WEATHER

1 WEATHER CONDITION	2 PRESSURE ALT	3 DENSITY ALT

SECTION J - DESCRIPTION OF MISHAP *(continue on page 2)*

To include details of mission, flight maneuvers, operators' actions/error, maintenance deficiency, material failure and supervisory error.

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ABBREVIATED AIRCRAFT ACCIDENT/COMBAT DAMAGE REPORT FORM FOR COMBAT AREA

SECTION J - DESCRIPTION OF MISHAP (continued)

SECTION K - FINDINGS

List all established and contributing cause factors. (Identify units or activity responsible for cause factors.)

Recommendations to prevent recurrence

1 INVESTIGATING OFFICER	2 RANK	3 BRANCH	4 AERONAUTICAL RATING

SECTION L - STATEMENT OF APPOINTING AUTHORITY/UNIT COMMANDER

Statement of concurrence or nonconcurrence of appointing authority/unit commander and actions taken to prevent recurrence.

1 DATE	2 SIGNATURE

SECTION M - APPROVAL BLOCK

1 APPROVED

2 DATE	3. SIGNATURE

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PAGE 2

DD FORM 66 126 JAN 66] PREVIOUS USARV EDITIONS ARE OBSOLETE

ABBREVIATED AIRCRAFT ACCIDENT/COMBAT DAMAGE REPORT FORM FOR COMBAT AREA

SECTION H - AIRCRAFT COMBAT DAMAGE

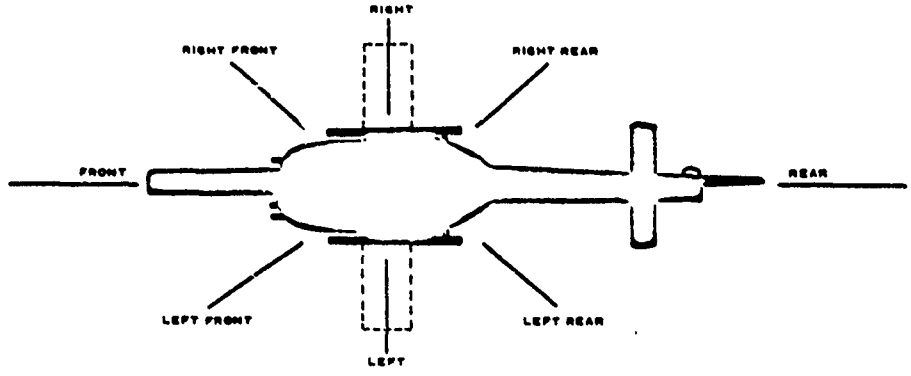
NUMBER HITS ON AIRCRAFT	
1 TOTAL	
2 RIFLE	
3 MG	
4 UNKNOWN	
5 OTHER	

6 MISSION (purpose of flight):

7 NUMBER ACFT ON MISSION

8 ALTITUDE (feet above ground)

9 LOCATION WHERE HITS FROM ENEMY FIRE WERE RECEIVED ON THE AIRCRAFT (Check applicable box)



☐ FRONT	☐ LEFT REAR
☐ RIGHT FRONT	☐ LEFT SIDE
☐ RIGHT SIDE	☐ LEFT FRONT
☐ RIGHT REAR	☐ TOP
☐ REAR	☐ BOTTOM

10 FLIGHT CONDITION	CHECK APPLICABLE ITEM	REMARKS
NORMAL CRUISE (en route)		
LANDING		
TAKING OFF		
HOVERING		
SLOW CRUISE		

11 FLIGHT ATTITUDE	CHECK APPLICABLE ITEM	REMARKS
STRAIGHT AND LEVEL		
NOSE UP		
NOSE DOWN		
TURNING RIGHT		
TURNING LEFT		

12 WAS CRASH LANDING REQUIRED ☐ YES ☐ NO

13 DAMAGE TO COMPONENTS OR SYSTEMS WHICH PREVENTED FURTHER FLIGHT (check applicable items)

☐ CONTROL SYSTEM	☐ EMPENNAGE	☐ FUEL SYSTEM	☐ POWER TRANSMISSION SYSTEM
☐ RC [illegible] SYSTEM	☐ ELECTRICAL SYSTEM	☐ OIL SYSTEM	☐ PROPELLER(S)
☐ WING(S)	☐ HYDRAULIC SYSTEM	☐ ENGINE	

14 EXTENT OF DAMAGE ☐ TOTAL LOSS ☒ REPARABLE

15 AMOUNT OF DAMAGE (Dollars)

SAMPLE CRASH FACTS MESSAGE REPORT

Subject: Army Aircraft Accident Crash Facts Message Report, RCS CSGPA-459(*)

1. 13 June 68, 1555C,Day.
2. 3 nautical miles (NM) north of Ft. Bayonet, Ga.
3. OH-13H, 56-7281.
4. 175th Avn Co, Ft Bayonet, Ga.
5. Major accident, skids and cross tubes broken, bubble broken, tail rotor damaged.
6. Pilot: Jones, Robert M., 078261, SSAN 424-54-3473, 1LT, 175th Avn Co, Ft. Bayonet, Ga.; no injuries.
7. None.
8. Passenger: Smith, Donald R., 055652, SSAN 610-43-9971, CPT, 35th Engr Bn, Ft Bayonet, Ga., small cut above left eye, glass fragments from broken bubble.
9. Service; VFR; Municipal Airport, Columbia, Ga., 0+05.
10. Takeoff (climb-out).
11. Engine failed at 300 ft after takeoff; pilot attempted to autorotate into a small clearing, but struck a ditch bank on landing. The aircraft remained in an upright position.
12. Weather not a factor.
13. None.
14. Engine failure; EIR Nr 46783; O-435-23B; L-563-31; total time 534:00; time since overhaul, 134; overhaul facility ARADMAC; date of last overhaul, 21 Feb 68; previous storage history, new; cause of failure, unknown pending analysis; power setting, 25,3100 RPM, lost oil pressure, manifold pressure, and engine RPM.
15. None. Insignificant damage to peanut field.
16. Additional information:
    a. 13 Jun 68.
    b. None.
    c. N/A.
    d. Aircraft to be slinglifted by CH-54 to Ft Bayonet, Ga, on 15 Jun 68 for further investigation and repair.
17. For additional information, contact Major John Q. Doe, 175th Aviation Co, Ft Bayonet, Ga., Extension 877-2384.

" CONFIDENTIAL" WHEN COMPLETED

JOINT SERVICES ANTI-AIRCRAFT FIRE INCIDENT AND DAMAGE REPORT

To: Air Operations Center (TSN) FROM:
APO 143, US Forces
Phone # 2203

I. Spot Report:

1. Date, time, group: _____
(Time of incident or hit in local time)

2. Type of aircraft: _____

3. Aircraft activity at time of incident or hit (check one):
( ) a. On Ground ( ) b. Taking Off
( ) c. En Route ( ) d. Landing
( ) e. Target Attack ( ) f. Other Activity: _____
(Describe,i.e., low reconnaissance, etc.)

4. U. T. M. coordinates of A-A fire: _____

5. Aircraft's absolute altitude: _____

6. a. Intensity of fire (check one):
( ) (1) LT (Light) ; ( ) (2) MOD (Moderate) ; ( ) (3) INT(Intense)

b. Type of fire (check one):
( ) (1) SA (Small Arms); ( ) (2) AW(Automatic Wpns);( ) (3).50 Cal.
( ) (4) 20mm ; ( ) (5) Other (explain):_____

7. Number of individual hits:_____

8. Aircraft reaction: (Check one or more)
(1) ( ) CRashed (2) ( ) Forced to Land, Destroyed
(3) ( ) Forced to Land, Recovered (4) ( ) Mission Not Completed
(5) ( ) Continued to Fly

9. Casualties (N/A if none):
US: KIA ____, WIA ____, VN: KIA ____, WIA ____

10. Advisory Information (i.e., this is third hit in two days from this area).
(Delete if not applicable):_____

NOTE: The SPOT REPORT by itself is not classified, but is "For Official Use Only". It is to be phoned or delivered by the fastest means available.

Missing od unknown information from sequence should be indicated by inserting UNK in appropriate space.

C-L-A-S-S-I-F-I-C-A-T-I-O-N-

ASV-2 "CONFIDENTIAL" WHEN COMPLETED

II. Supplementary Information (For Hits Only):

11. Mission Number: _____

12. Type Task (s): _____
(Medical Evacuation, escort, etc.)

13. Airspeed in Knots when hit: _____

14. Pilots Name & Rank: _____

15. Heading in Degrees: _____

16. Ceiling, visibility, WX conditions: _____

17. Type of formation: _____
(Trail, echelon, vee, right or left echelon, other)

18. Position number _____ in formation of _____ aircraft.

19. This was _____ pass through area this mission for this aircraft.

20. Was helicopter or fixed wing armed-escort present? Yes ( ) No ( )

21. Was source of ground fire (AAA) observed? Yes ( ) No ( )

22. Direction of source: From _____ O'clock.

23. Estimated range of source: _____ meters.

24. Estimated number of rounds observed: _____. Tracer: Yes ( ) No ( )

25. Aircraft damage _____

26. Name, rank SN of casualties and extent of injury: _____

_____

27. Was aircraft hit in protected area, self-sealing tank, armor plate, and if so describe effectiveness of device or kit. _____

_____

28. Damage to property or equipment other than U.S. agencies. Yes ( ) No ( ) (If Yes, explain below)

29. Remarks: _____
(Include any recommended changes in tactics that might

_____
prevent similar battle damage)

_____

(CONFIDENTIAL) APPENDIX B (Casualties)

Table

Table B-1 (C). Reported Combat Casualties to U.S. Army Personnel Aboard Aircraft (Including Fatalities) per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		
Half / Aircraft Type	I	II	I	II	I	II	I	II	I	II	I	II	Total
Armed UH-1B/C	---	4(UH-1A)	10	56	105	84	100	86	92	148	136	194	1015
UH-1B Transport	---	0	1	6	2	11	0	14	0	0	7	0	41
UH-1B (Unk. if armed)	---	---	2	8	26	59	124	108	127	34	45	78	611
UH-1D/H Transport	---	---	---	---	---	---	14	18	175	159	333	435	1134
UH-1 (Unspecified)	---	---	---	---	---	---	---	3	125	197	211	101	537
AH-1G (Cobra)	---	---	---	---	---	---	---	---	---	---	---	0	0
TOTAL UH-1	---	4	13	70	133	154	238	229	519	538	732	808	3438
CH-21C	8	24	33	20	15	---	---	---	---	---	---	---	99
CH-37	---	---	---	8	0	1	2	---	---	---	---	---	11
CH-47 (incl. armed)	---	---	---	---	---	---	---	2	31	18	46	44	141
CH-54A	---	---	---	---	---	---	---	---	---	---	---	---	0
OH-13S (incl. armed)	---	---	---	---	---	---	---	5	15	25	37	33	115
OH-23G (incl. armed)	---	---	---	---	---	---	---	---	---	6	8	18	32
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	---	---	---	11	11
SUB TOTAL	8	24	33	28	14	1	2	7	46	49	91	106	409
TOTAL HELICOPTERS	8	28	46	98	147	155	240	236	565	587	823	914	3847
O-1	---	2	0	2	9	5	9	8	14	14	18	22	103
CV-1A/B/C	---	0	5	5	1	4	1	7	9	6	1	5	44
CV-2B	---	---	1	3	3	3	1	3	2	3	---	---	19
U-1A	0	0	0	6	3	1	2	0	1	0	1	0	14
U-6A	---	---	---	---	0	0	1	3	0	0	0	0	4
U-8D	---	---	---	---	---	---	---	---	---	---	1	---	1
U-21	---	---	---	---	---	---	---	---	---	---	---	---	0
TOTAL FIXED WING	0	2	6	16	16	13	14	21	26	23	21	27	185
TOTAL ARMY AIRCRAFT	8	30	52	114	163	168	254	257	591	610	844	941	4032
NON ARMY HELICOPTER	0	0	0	0	1(CH34)	0	0	0	2(CH34)	3(H43)	1(UH1F)	2(CH34,37)	9
NON ARMY FIXED WING	0	1(U10)	0	1(C123)	0	2(C123)	0	2(A1&C123)	0	15(C123)	1(C123)	2(02,A1)	24
TOTAL	8	31	52	115	164	170	254	259	593	628	846	945	4065

CODE: 0 entry denotes aircraft hits but no casualties recorded; --- entry denotes no aircraft hits recorded.

Table B-2 (C). Combat Fatalities to U.S. Army Personnel Aboard Aircraft per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		
Half / Aircraft Type	I	II	I	II	I	II	I	II	I	II	I	II	Total
Armed UH-1B/C	---	1 (UH-1A)	1	2	13	12	20	22	6	38	32	25	172
UH-1B Transport	---	---	---	---	---	1	---	---	---	---	---	---	1
UH-1B (Unk. if armed)	---	---	1	0	6	2	10	11	12	6	5	---	53
UH-1D/H Transport	---	---	---	---	---	---	4	3	37	26	38	59	167
UH-1 (Unspecified)	---	---	---	---	---	---	---	0	0	1	1	0	2
TOTAL UH-1	---	1	2	2	19	15	34	36	55	71	76	84	395
CH-21C	0	4	2	2	2	---	---	---	---	---	---	---	10
CH-37	---	---	---	4	---	0	0	---	---	---	---	---	4
CH-47 (incl. armed)	---	---	---	---	---	---	---	1	2	1	10	0	14
CH-54A	---	---	---	---	---	---	---	---	---	---	---	---	---
OH-13S (incl. armed)	---	---	---	---	---	---	---	1	4	1	6	4	16
OH-23G (incl. armed)	---	---	---	---	---	---	---	---	---	0	2	3	5
OH-6A (incl.armed)	---	---	---	---	---	---	---	---	---	---	---	0	0
SUB TOTAL	0	4	2	6	2	0	0	2	6	2	18	7	49
TOTAL HELICOPTERS	0	5	4	8	21	15	34	38	61	73	94	91	444
O-1	---	0	---	0	3	0	1	0	3	5	2	3	17
OV-1A/B/C	---	---	1	1	0	0	0	1	0	1	0	0	4
CV-2B	---	---	1	0	0	0	0	0	1	0	---	---	2
U-1A	---	---	---	4	0	0	0	---	0	---	0	---	4
U-6A	---	---	---	---	---	---	1	0	---	---	---	---	1
U-8D	---	---	---	---	---	---	---	---	---	---	0	---	0
U-21	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL FIXED WING	---	0	2	5	3	0	2	1	4	6	2	3	28
TOTAL ARMY AIRCRAFT	0	5	6	13	24	15	36	39	65	79	96	94	472
NON ARMY AIRCRAFT	---	1(U10)	---	0	0	2(C123)	---	0	0	3(H43)	0	0	6
TOTAL	0	6	6	13	24	17	36	39	65	82	96	94	478

CODE: 0 entry denotes casualty but no fatal casualty recorded; --- entry denotes no casualty recorded.

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Table B-3 (C). Average Number of Flying Hours per Casualty & per Fatality vs Aircraft Type (1962-1967) (U)

Aircraft Type	Flying Hours (1000)	Casualties	Fatalities	Flying Hours per Casualty	Flying Hours per Fatality
Armed UH-1B/C	563.	1,015-2,263	172-227	5,546-2,487	3,273-2,480
Unarmed UH-1B	213.	41-1,289	1-56	*	*
Unarmed UH-1D/H	1,592.	1,134-1,771	167-169	1,403- 899	9,530-9,417
UH-1**	2,681.	3,438	395	780	6,788
CH-21C	67.	99	10	680	6,731
CH-37	3.	11	4	285	784
CH-47	177.	141	14	1,253	12,620.
CH-54A	5.	0	0	>4,823	>4,823
SUB TOTAL	252.	251	28	1,003	8,968
OH-13S/23G/6A	338.	158	21	2,140	16,101
TOTAL HELICOPTERS	3,271.	3,847	444	850	7,368.
O-1	554.	103	17	5,379	32,591.
OV-1A/B/C	89.	44	4	2,022	22,246.
CV-2B	166.	19	2	8,758	83,196.
U-1A/6A/8D/21	341.	19	5	17,951	68,214.
TOTAL FIXED WING	1,150.	185	28	6,219	41,089
TOTAL ARMY AIRCRAFT	4,421.	4,032	472	1,097	9,368

* Data inadequate.
** Includes unspecified type or model.

Table B-4 (C). Average Number of Flying Hours per Casualty & per Fatality vs Time (U)

Aircraft Type	Period (CY)	Flying Hours (1000)	Casualties	Fatalities	Flying Hours per Casualty	Flying Hours per Fatality
Armed UH-1A/B/C	62-65	---	*	71-101	---	---
	66	218.	*	44-63	---	4,954-3,469
	67	271.	*	57-63	---	4,750-4,297
Unarmed UH-1B	62-65	---	*	1-31	---	---
	66	93.	*	0-19	---	5,194
	67	64.	*	5-6	---	10,758-12,910
Unarmed UH-1D/H	62-65	---	*	7	---	---
	66	495.	*	63-64	---	7,864-7,741
	67	1,016.	*	97-98	---	10,475-10,368
UH-1	62-65	523.	841	109	622	4,798.
	66	807.	1,057	126	763	6,404
	67	1,351.	1,540	160	878	8,446.
Other Rotary Wing	62-65	84.	117	16	718	5,250
	66	168.	95	8	1,768	21,000
	67	339.	197	25	1,720	13,560
Total Rotary Wing	62-65	606.	958	125	633	4,852
	66	975.	1,152	134	846	7,274
	67	1,690.	1,737	185	973	9,135
Fixed Wing	62-65	387.	88	13	4,400	29,783
	66	360.	49	10	7,350	36,013
	67	403.	48	5	8,400	80,635
All Army Aircraft	62-65	994.	1,046	138	950	7,200
	66	1,335.	1,201	144	1,111	9,270
	67	2,093.	1,785	190	1,173	11,017

*Data inadequate to separate UH-1's into Armed, Unarmed, and Models.

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Table B-5 (C). Average Number of Aircraft Sorties Hit per Casualty & per Fatality vs Aircraft Type (1962-1967) (U)

Aircraft Type	Aircraft Hit	Casualties	Fatalities	Aircraft Sorties Hit per Casualty	Aircraft Sorties Hit per Fatality
Armed UH-1A/B/C	3,272	1,015-2,263	172-227	3.9-1.8	23.1-17.7
Unarmed UH-1B	662	41-1,289	1-56	**	**
Unarmed UH-1D/H	3,148	1,134-1,771	167-169	2.8-1.8	18.9-18.6
TOTAL UH-1	7,782	3,428	395	2.3	19.7
CH-21C	364	99	10	3.7	36.
CH-37	19	11	4	(Small Sample)	
CH-47	485	141	14	3.4	34.6
CH-54A	14	0	0	(Small Sample)	
SUB TOTAL	882	251	28	3.3	31.5
OH-13S/23G	415	147	21	2.8	19.8
OH-6A	23	11	0	(Small Sample)	
TOTAL HELICOPTERS	9,102	3,847	444	2.4	20.5
O-1	481	103	17	5-7	28-42
OV-1A/B/C	540	44	4	12-18	135-194
CV-2B	223	19	2	12-24	112-229
U-1A/6A/8D/21	96	19	5	5-17	19-66
TOTAL FIXED WING	1,575*	185	28	8.5	56.3
TOTAL ARMY AIRCRAFT	10,677	4,032	472	2.6	22.6

* Includes 235 sorties hit on unspecified fixed wing aircraft
** Inadequate data.

Table B-6 (C). Average Number of Aircraft Sorties Hit per Casualty & per Fatality vs Time (U)

Aircraft Type	Period (CY)	Aircraft Hit	Casualties	Fatalities	Aircraft Sorties Hit per Casualty	Aircraft Sorties Hit per Fatality
Armed UH-1A/B/C	62-65	1,398	*	71-101	---	19-14
	66	1,239	*	44-63	---	28-20
	67	1,335	*	57-63	---	23-21
Unarmed UH-1B	62-65	336	*	1-31	---	---
	66	95	*	0-19	---	---
	67	231	*	5-6	---	46-37
Unarmed UH-1D/H	62-65	249	*	7	---	35.7
	66	1,059	*	63-64	---	16.7
	67	1,840	*	97-98	---	13.9
Total UH-1	62-65	1,983	841	109	2.4	18.2
	66	2,393	1,057	126	2.3	19.0
	67	3,406	1,540	160	2.2	21.3
Other Rotary Wing	62-65	412	117	16	3.5	25.8
	66	349	95	8	3.7	43.6
	67	559	197	25	2.8	22.4
Total Rotary Wing	62-65	2,395	958	125	2.5	19.2
	66	2,742	1,152	134	2.4	20.5
	67	3,965	1,737	185	2.3	21.4
Fixed Wing	62-65	631	88	13	7.2	48.5
	66	568	49	10	11.6	56.8
	67	376	48	5	7.8	75.2
Total Army Aircraft	62-65	3,026	1,046	138	2.9	21.9
	66	3,310	1,201	144	2.8	23.0
	67	4,341	1,785	190	2.4	22.8

* Type and model frequently unspecified in available data.

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Table B-7 (C). Number of Casualties (Incl. Fatal) by Reported Mission Type vs Aircraft Type (U)

Aircraft Type / Mission Type	UH-1	CH-21	CH-47	OH-13/23	Other R/W	Rotary Wing	O-1	OV-1	Other F/W	Fixed Wing	Total
Combat Support	2,283	86	32	19	4	2,424	12	14	13	39	2,462
Escort & Screening	95	0	3	4	0	102	0	0	0	0	102
Recon. & Surveillance	346	0	2	109	12	469	85	21	7	113	582
Troop Extraction	87	0	16	2	0	105	0	0	0	0	105
Med. Evac.	244	1	2	0	3	250	0	0	0	0	250
Recovery	17	5	7	0	8	37	0	0	0	0	37
Resupply	174	4	60	0	0	238	1	0	25	26	264
Admin. Trng. Psych. Etc.	24	3	4	1	0	32	3	0	3	6	38
Unknown	169	0	15	12	3	199	2	9	14	25	224
TOTAL	3,439	99	141	147	30	3,856	105	44	62	209	4,065

Table B-8 (C). Army Casualties (Incl. Fatal) by Crew Station vs Aircraft Type(1962-1967)(U)

Aircraft Type	Pilot	Copilot	Crew Chief	Gunner	Observer	Passenger	Unknown	Total
Armed UH-1A/B/C	270	189	245	261	6	39	5	1,015
Unarmed UH-1B	12	5	5	13	0	4	2	41
UH-1B (Unk. if Armed)	163	82	125	158	10	68	5	611
Unarmed UH-1D/H	238	196	221	207	12	243	17	1,134
UH-1 (Unspecified)	179	65	95	158	14	99	27	637
TOTAL UH-1	862	537	691	797	42	453	56	3,438
CH-21C	26	19	29	15	0	10	0	99
CH-37	2	1	4	2	0	2	0	11
CH-47 (Incl. Armed)	17	23	36	21	0	42	2	141
CH-54A	0	0	0	0	0	0	0	0
OH-13S (Incl. Armed)	54	1	4	3	38	15	0	115
OH-23G (Incl. Armed)	13	0	1	0	8	10	0	32
OH-6A (Incl. Armed)	3	1	3	1	3	0	0	11
SUB TOTAL	115	45	77	42	49	79	2	409
TOTAL HELICOPTER	977	582	768	839	91	532	58	3,847
O-1	53	0	---	---	42	8	0	103
OV-1A/B/C	32	3	---	---	8	1	0	44
CV-2B	5	1	4	---	0	9	0	19
U-1A	7	3	1	---	0	3	0	14
U-6A	1	1	0	---	2	0	0	4
U-8D	0	1	0	---	0	0	0	1
TOTAL FIXED WING	98	9	5	---	52	21	0	185
TOTAL ARMY AIRCRAFT	1,075	591	773	839	143	553	58	4,032
NON ARMY HELICOPTERS	---	---	---	---	1	8	0	9
NON ARMY FIXED WING	---	---	---	---	4	20	0	24
TOTAL	1,075	591	773	839	148	581	58	4,065

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Table B-9 (C). Army Fatalities by Crew Station vs Aircraft Type (1962 - 1967) (U)

Aircraft Type	Pilot	Copilot	Crew Chief	Gunner	Observer	Passenger	Unknown	Total
Armed UH-1A/B/C	42	42	42	37	1	8	0	172
Unarmed UH-1B	1	0	0	0	0	0	0	1
UH-1B (Unk. if Armed)	13	10	14	10	0	6	0	53
Unarmed UH-1D/H	32	26	29	31	0	48	1	167
UH-1 (Unspecified)	0	0	0	1	0	1	0	2
TOTAL UH-1	88	78	85	79	1	63	1	395
CH-21C	3	1	3	3	0	0	0	10
CH-37	1	1	1	1	0	0	0	4
CH-47 (Incl. Armed)	2	2	3	1	0	6	0	14
OH-13S (Incl. Armed)	6	0	1	0	9	0	0	16
OH-23G (Incl. Armed)	2	0	0	0	3	0	0	5
SUB TOTAL	14	4	8	5	12	6	0	49
TOTAL HELICOPTER	102	82	93	84	13	69	1	444
O-1	9	0	---	---	7	1	0	17
OV-1A/B/C	4	0	---	---	0	0	0	4
CV-2B	0	0	0	---	0	2	0	2
U-1A	1	1	1	---	0	1	0	4
U-6A	0	0	0	---	1	0	0	1
TOTAL FIXED WING	14	1	1	---	8	4	0	28
TOTAL ARMY AIRCRAFT	116	83	94	84	21	73	1	472
NON-ARMY HELICOPTER	---	---	---	---	---	3	0	3
NON-ARMY FIXED WING	---	---	---	---	1	2	0	3
TOTAL	116	83	94	84	22	78	1	478

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Table B-10 (C). Casualty Distribution (%) by Crew Station vs Aircraft Type (U)

Aircraft Type	Number			Percent		
	Pilot & Copilot	Crew Chief & Gunner	Others	Pilot & Copilot	Crew Chief & Gunner	Others
	Casualties (Incl. Fatalities)					
Armed UH-1A/B/C	459-950	506-1053	50-275	45-42	50-46	5-12
Unarmed UH-1B	17-506	18-554	6-229	41-39	44-43	15-18
Unarmed UH-1D/H	434-678	428-681	272-412	38	38	24
TOTAL UH-1	1,399	1,488	551	40.7	43.3	16.0
CH-21C & CH-37	48	50	12	44.	45.	11.
CH-47 (Incl. Armed)	40	57	44	28.	41	31.
OH-13S/23G/6A (Incl Armed)	72	12	74	45.	8.	47.
SUB TOTAL	160	119	130	39.	29.	32.
TOTAL HELICOPTER	1,559	1,607	681	40.5	41.8	17.7
O-1	53	---	50	52.	---	48.
OV-1A/B/C	35	---	9	80.	---	20.
CV-2B	6	4	9	32.	21.	47.
U-1A/6A/8D	13	1	5	69.	5.	26.
TOTAL FIXED WING	107	5	73	58.	3.	39.
TOTAL ARMY AIRCRAFT	1,666	1,612	754	41.3	40.0	18.7
NON-ARMY AIRCRAFT	---	---	33	---	---	100.
TOTAL	1,666	1,612	787	41.0	39.7	19.3
	Fatalities Only					
Armed UH-1A/B/C	84-107	79-104	9-16	49-47	46	5-7
Unarmed UH-1B	1-24	0-25	0-7	-43	-45	-12
Unarmed UH-1D/H	58	60-61	49-50	35-34	36	29-30
TOTAL UH-1	166	164	65	42.0	41.5	16.5
CH-21C & CH-37	6	8	0	43.	57.	0.
CH-47 (Incl. Armed)	4	4	6	29.	29.	42.
OH-13S/23G/6A (Incl Armed)	8	1	12	38.	5.	57.
SUB TOTAL	18	13	18	37.	26.	37.
TOTAL HELICOPTER	184	177	83	41.4	39.9	18.7
O-1	9	---	8	53.	---	47.
OV-1A/B/C	4	---	0	100.	---	0.
CV-2B	0	0	2	0.	0.	100.
U-1A/6A/8D	2	1	2	40.	20.	40.
TOTAL FIXED WING	15	1	12	53.	4.	43.
TOTAL ARMY AIRCRAFT	199	178	95	42.2	37.7	20.1
NON-ARMY AIRCRAFT	---	---	6	---	---	100.
TOTAL	199	178	101	41.6	37.2	21.2

Table B-11 (C). U.S. Army Casualties per Fatality by Crew Station vs Aircraft Type (U)

Aircraft Type	Pilot & Copilot	Crew Chief & Gunner	All Others	All Stations
Armed UH-1A/B/C	6-9	6-11	6-17	6-10
Unarmed UH-1D/H	8-12	7-11	6-8	7-10
UH-1 (All Models)	8.4	9.1	8.5	8.7
CH-21C & CH-37	8.	6.	>12.	7.9
CH-47 (Incl. Armed)	10.	14.	7.	10.0
OH-13S/23G/6A (Incl.Armed)	9.	12.	6.	7.5
SUB TOTAL	8.9	9.2	7.2	8.3
TOTAL HELICOPTERS	8.5	9.1	8.2	8.7
O-1	6.	---	6.	6.1
OV-1A/B/C	9.	---	>9.	11.
CV-2B	>6.	---	6.	10.
U-1A/6A/8D	3.	---	2.	4.
TOTAL FIXED WING	7.1	---	6.0	6.6
TOTAL ARMY AIRCRAFT	8.3	9.1	7.9	8.5
NON-ARMY AIRCRAFT	---	---	6.	6.
TOTAL	8.3	9.1	7.8	8.5

Table B-12 (C). Distribution of Total Army Casualties (%) by Severity vs Aircraft Type (U)

Aircraft Type	Number				Percent			
	Non-Serious	Serious	Fatal	Total	Non-Serious	Serious	Fatal	Total
Armed UH-1A/B/C	816-1,995	27-41	172-227	1,015-2,263	20-49	0.6-1.0	4.2-5.6	25-56
Unarmed UH-1B	40-1,219	0-14	1-56	41-1,289	1-30	0.0-0.3	0.02-1.4	1-32
Unarmed UH-1D/H	938-1,559	29-43	167-169	1,134-1,771	23-38	0.7-1.1	4.1-4.2	28-44
TOTAL UH-1	2,973	70	395	3,438	73.14	1.722	9.717	84.58
CH-21C	85	4	10	99	2.09	0.098	0.246	2.43
CH-37	7	0	4	11	0.17	0.000	0.098	0.27
CH-47 (Incl. Armed)	125	2	14	141	3.08	0.049	0.344	3.47
CH-54A	---	---	---	0	---	---	---	0.00
OH-13S (Incl. Armed)	92	7	16	115	2.26	0.172	0.394	2.83
OH-23G (Incl. Armed)	27	0	5	32	0.66	0.000	0.123	0.79
OH-6A (Incl. Armed)	11	0	0	11	0.27	0.000	0.000	0.27
SUB TOTAL	347	13	49	409	8.54	0.320	1.205	10.06
TOTAL HELICOPTERS	3,320	83	444	3,847	81.67	2.042	10.922	94.64
O-1	85	1	17	103	2.09	0.025	0.418	2.53
OV-1A/B/C	37	3	4	44	0.91	0.074	0.098	1.08
CV-2B	16	1	2	19	0.39	0.025	0.049	0.47
U-1A	10	0	4	14	0.25	0.000	0.098	0.34
U-6A	3	0	1	4	0.73	0.000	0.025	0.10
U-8D	1	0	0	1	0.02	0.000	0.000	0.02
TOTAL FIXED WING	152	5	28	185	3.74	0.123	0.689	4.55
TOTAL ARMY AIRCRAFT	3,472	88	472	4,032	85.41	2.165	11.611	99.19
NON-ARMY HELICOPTER	6	0	3	9	0.15	0.000	0.074	0.22
NON-ARMY FIXED WING	20	1	3	24	0.49	0.025	0.074	0.59
TOTAL	3,498	89	478	4,065	86.05	2.189	11.759	100.00

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Table B-13 (C). Distribution of Total Army Casualties (%) by Casualty Type vs Aircraft Type (U)

Aircraft Type	Number Wounds	Number Injuries	Number Other	Percent Wounds	Percent Injuries	Percent Other
Armed UH-1A/B/C	624-1,658	276-401	115-204	62-73	27-12	11-9
Unarmed UH-1B	24-1,058	6-131	11-100	59-82	15-12	27-8
Unarmed UH-1D/H	829-1,391	277-294	28-86	73-78	24-16	2-5
TOTAL UH-1	2,511	684	243	73.0	19.9	7.1
CH-21C	79	20	0	80.	20.	0.
CH-37	6	5	0	54.	46.	0.
CH-47 (Incl. Armed)	107	34	0	76.	24.	0.
CH-54A	0	0	0	0.	0.	0.
OH-13S (Incl. Armed)	83	32	0	72.	28.	0.
OH-23G (Incl. Armed)	20	12	0	62.	38.	0.
OH-6A (Incl. Armed)	6	5	0	54.	46.	0.
SUB TOTAL	301	108	0	73.6	26.4	0.
TOTAL HELICOPTERS	2,812	792	243	73.1	20.6	6.3
O-1	65	38	0	63.	37.	0.
OV-1A/B/C	26	16	2	59.	36.	5.
CV-2B	18	0	1	95.	0.	5.
U-1A	10	4	0			
U-6A	1	3	0	63.	37.	0.
U-8D	1	0	0			
TOTAL FIXED WING	121	61	3	65.4	33.0	1.6
TOTAL ARMY AIRCRAFT	2,933	853	246	72.7	21.2	6.1
NON-ARMY HELICOPTER	6	3	0	67.	33.	0.
NON-ARMY FIXED WING	7	17	0	29.	71.	0.
TOTAL	2,946	873	246	72.5	21.5	6.0

Table B-14 (C). Distribution of Fatal Casualties (%) by Casualty Type* vs Aircraft Type (U)

Aircraft Type	Number		Percent	
	Wounds	Injuries	Wounds	Injuries
Armed UH-1A/B/C	29-55	143-172	17-24	83-76
Unarmed UH-1B	1-27	0-29	**	**
Unarmed UH-1D/H	75-77	92	45-46	55-54
TOTAL UH-1	131	264	33.2	66.8
CH-21C	7	3	70.	30.
CH-37	0	4	0.	100.
CH-47 (Incl. Armed)	4	10	29.	71.
CH-54A	0	0	0.	0.
OH-13S (Incl. Armed)	4	12	25.	25.
OH-23G (Incl. Armed)	1	4	20.	80.
OH-6A (Incl. Armed)	0	0	0.	0.
SUB TOTAL	16	33	32.7	67.3
TOTAL HELICOPTERS	147	297	33.1	66.9
O-1	3	14	18.	82.
OV-1A/B/C	0	4	0.	100.
CV-2B	2	0	100.	0.
U-1A	0	4		
U-6A	1	0	20.	80.
U-8D	0	0		
TOTAL FIXED WING	6	22	21.	79.
TOTAL ARMY AIRCRAFT	153	319	32.4	67.6
NON-ARMY HELICOPTER	0	3	0.	100.
NON-ARMY FIXED WING	0	3	0.	100.
TOTAL	153	325	32.0	68.0

* No fatal "Other" (Combat casualties.
** Data inadequate.

Table B-15 (C). Distribution of Non-Fatal Casualties (%) by Casualty Type vs Aircraft Type (U)

Aircraft Type	Number			Percent		
	Wounds	Injuries	Others	Wounds	Injuries	Others
Armed UH-1A/B/C	595-1,603	133-229	115-204	70-78	16-11	14-10
Unarmed UH-1B	23-1,031	6-102	11-100	58-84	15-8	28-8
Unarmed UH-1D/H	754-1,314	185-202	28-86	78-82	19-13	3-5
TOTAL UH-1	2,380	420	243	78.2	13.8	8.0
CH-21C	72	17	0	81.	19.	0.
CH-37	6	1	0	86.	14.	0.
CH-47 (Incl. Armed)	103	24	0	81.	19.	0.
CH-54A	0	0	0	0.	0.	0.
OH-13S	79	20	0	80.	20.	0.
OH-23G	19	8	0	70.	30.	0.
OH-6A	6	5	0	54.	46.	0.
SUB TOTAL	285	75	0	79.2	20.8	0.0
TOTAL HELICOPTERS	2,665	495	243	78.3	14.6	7.1
O-1	62	24	0	72.	28.	0.
OV-1A/B/C	26	12	2	65.	30.	5.
CV-2B	16	0	1	94.	0.	6.
U-1A	10	0	0			
U-6A	0	3	0	79.	21.	0.
U-8D	1	0	0			
TOTAL FIXED WING	115	39	3	73.3	24.8	1.9
TOTAL ARMY AIRCRAFT	2,780	534	246	78.1	15.0	6.9
NON-ARMY HELICOPTER	6	0	0	100.	0.	0.
NON-ARMY FIXED WING	7	14	0	33.	67.	0.
TOTAL	2,793	548	246	77.9	15.3	6.8

Table B-16(C). "Other" Combat Casualties Aboard Army Aircraft (1962 through 1967) (U)

Aircraft Type	Station	Weapon Malfunction	Rocket Blast	Weapon Ejection	Shot by Own Gun	Burned on Weapon	Misc. Other	Total
UH-1 A/B/C	Pilot	7	4	5	8	0	1	25
	Copilot	7	1	1	3	2	0	14
	Crew Chief	33	15	11	6	4	0	69
	Gunner	52*	19	11	3	10	0	95
	Obs., Pas., Unk.	5	5	0	1	0	1	12
	TOTAL	104	44	28	21	16	2	215
UH-1 D/H	Pilot	0	1	0	1	0	0	2
	Copilot	0	0	0	0	0	0	0
	Crew Chief	1*	0	0	2	1	0	4
	Gunner	4	4	2	1	3	1	15
	Obs., Pas., Unk.	3	0	0	2	0	2	7
	TOTAL	8	5	2	6	4	3	28
OV-1	Pilot	0	0	0	0	0	1	1
	Observer	0	0	0	0	0	1	1
CV-2	Passenger	1*	0	0	0	0	0	1
	TOTAL Non UH-1	1	0	0	0	0	2	3
All Army Aircraft	Pilot	7	4	5	9	0	2	27
	Copilot	7	1	1	3	2	0	14
	Crew Chief	34	15	11	8	5	0	73
	Gunner	56	23	13	4	13	1	110
	Others	9	6	0	3	0	4	22
	TOTAL	113	49	30	27	20	7	246
TOTAL SERIOUS		3	0	0	0	0	0	3

* Includes one serious case each.

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(CONFIDENTIAL) APPENDIX C (Injuries)

Table

C-19 Injury Cause vs Severity

C-20 Distribution of Injuries by Cause & Severity vs Aircraft Type

C-21 Distribution of Injuries by Cause & Severity vs Crew Station (All Army Aircraft)

C-22 Distribution of Fatal Injuries by Cause vs Aircraft Type & Crew Station

C-23 Distribution of Serious Injuries by Cause vs Aircraft Type & Crew Station

C-24 Distribution of Non-Serious Injuries by Cause vs Aircraft Type & Crew Station

C-25 Distribution of Injuries (All Severities) by Cause vs Aircraft Type & Crew Station

C-26 Number of Injury Sorties per Multiple of Personnel Injured vs Cause-All Aircraft

Table C-1 (C). Reported Injuries (Incl. Fatal) to U.S. Army Personnel in Aircraft Combat Crashes & Hard Landings per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		
Half	I	II	I	II	I	II	I	II	I	II	I	II	Total
Armed UH-1B/C	---	3 (UH-1A)	1	---	19	12	24	31	21	57	58	50	275
UH-1B Transport	---	---	---	---	---	6	---	---	---	---	---	---	6
UH-1B (Unk. if armed)	---	---	---	2	9	9	18	15	28	8	4	15	108
UH-1D/H Transport	---	---	---	---	---	---	4	4	15	32	78	114	277
UH-1 (Unspecified)	---	---	---	---	---	---	---	---	2	6	5	4	17
TOTAL UH-1	---	3	1	2	28	27	46	50	96	103	145	183	684
CH-21C	0	4	11	5	---	---	---	---	---	--	---	---	20
CH-37	---	--	---	5	---	---	---	---	---	---	---	---	5
CH-47 (incl. armed)	---	---	---	---	---	---	---	---	10	1	17	6	34
CH-54A	---	---	---	---	---	---	---	---	---	---	---	---	---
OH-13S (incl. armed)	---	---	---	---	---	---	---	1	4	8	10	9	32
OH-23G (incl. armed)	---	---	---	---	---	---	---	---	---	2	4	6	12
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	---	---	---	5	5
SUB TOTAL	0	4	11	10	0	0	0	1	14	11	31	26	108
TOTAL HELICOPTERS	0	7	12	12	28	27	46	51	110	114	176	209	792
O-1	---	---	---	---	3	1	3	1	8	3	10	9	38
OV-1A/B/C	---	---	2	3	1	1	---	3	4	2	---	---	16
CV-2B	---	---	---	---	---	---	---	---	---	0	---	---	0
U-1A	---	---	---	4	---	---	---	---	---	---	---	0	4
U-6A	---	---	---	---	---	---	0	3	---	--	---	---	3
U-8D	---	---	---	---	---	---	---	---	---	---	---	- -	---
TOTAL FIXED WING	---	---	2	7	4	2	3	7	12	5	10	9	61
TOTAL ARMY AIRCRAFT	---	7	14	19	32	29	49	58	122	119	186	218	853
NON ARMY AIRCRAFT	0	1(U-10)	0	0	0	2(C123)	0	0	0	17	0	0	20
TOTAL	0	8	14	19	32	31	49	58	122	136	186	218	873

CODE: 0 entry denotes crashes but no injuries reported; --- entry denotes no crashes recorded.

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Table C-2 (C). Fatal Injuries to U S. Army Personnel in Aircraft Combat Incidents per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		
Half	I	II	I	II	I	II	I	II	I	II	I	II	Total
Armed UH-1B/C	---	0	0	---	13	9	18	18	2	34	28	21	143
UH-1B Transport	---	---	---	---	---	0	---	---	---	---	---	---	0
UH-1B (Unk. if armed)	---	---	---	0	6	0	6	8	6	3	0	0	29
UH-1D/H Transport	---	---	---	---	---	---	4	0	20	14	16	38	92
TOTAL UH-1	---	0	0	0	19	9	28	26	28	51	44	59	264
CH-21C	---	1	0	2	---	---	---	---	---	---	---	---	3
CH-37	---	---	---	4	---	---	---	---	---	---	---	---	4
CH-47 (incl. armed)	---	---	---	---	---	---	---	---	1	0	9	0	10
CH-54A	---	---	---	---	---	---	---	---	---	---	---	---	---
OH-13S (incl. armed)	---	---	---	---	---	---	---	1	3	1	4	3	12
OH-23 G (incl. armed)	---	---	---	---	---	---	---	---	---	0	2	2	4
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	---	---	---	0	0
SUB TOTAL	---	1	0	6	---	---	---	1	4	1	15	5	33
TOTAL HELICOPTERS	---	1	0	6	19	9	28	27	32	52	59	64	297
O-1	---	---	---	---	3	0	1	0	3	3	2	2	14
OV-1A/B/C	---	---	1	1	0	0	---	1	0	1	---	---	4
CV-2B	---	---	---	---	---	---	---	---	---	---	---	---	---
U-1A	---	---	---	4	---	---	---	---	---	---	---	---	4
U-6A	---	---	---	---	---	---	---	0	---	---	---	---	0
U-8D	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL FIXED WING	---	---	1	5	3	0	1	1	3	4	2	2	22
TOTAL ARMY AIRCRAFT	---	1	1	11	22	9	29	28	35	56	61	66	319
NON ARMY AIRCRAFT	---	1(U10)	---	---	---	2(C123)	---	---	---	3(H43)	---	---	6
TOTAL	---	2	1	11	22	11	29	28	35	59	61	66	325

CODE: 0 entry denotes injuries but no fatal injuries recorded; --- entry denotes no injuries recorded.

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Table C-3 (C). Aircraft Combat Incidents with Reported Injuries (Including Fatal); Time vs Aircraft Type (U)

Calendar Year / Half	62-64	1965 I	1965 II	1966 I	1966 II	1967 I	1967 II	Total
Armed UH-1B/C	11	6	8	7	15	16	17	80
Unarmed UH-1B	2	---	---	---	---	---	---	2
UH-1B (Unk. if armed)	7	6	5	10	3	1	4	36
Unarmed UH-1D/H	---	1	1	11	12	19	34	78
UH-1 (Unspecified)	---	---	---	2	4	5	2	13
TOTAL UH-1	20	13	14	30	34	41	57	209
CH-21C	5	---	---	---	---	---	---	5
CH-37	1	---	---	---	---	---	---	1
CH-47 (Incl. armed)	---	---	---	1	1	3	2	7
CH-54A	---	---	---	---	---	---	---	---
OH-13S (Incl. armed)	---	---	1	2	5	6	5	19
OH-23G (Incl. armed)	---	---	---	---	1	2	3	6
OH-6A (Incl. armed)	---	---	---	---	---	---	2	2
SUB TOTAL	6	---	1	3	7	11	12	40
TOTAL HELICOPTERS	26	13	15	33	41	52	69	249
O-1	3	2	1	5	2	8	6	27
OV-1A/B/C	7	---	2	2	1	---	---	12
CV-2B	---	---	---	---	---	---	---	---
U-1A	1	---	---	---	---	---	0	1
U-6A	---	0	1	---	---	---	---	1
U-8D	---	---	---	---	---	---	---	---
TOTAL FIXED WING	11	2	4	7	3	8	6	41
TOTAL ARMY AIRCRAFT	37	15	19	40	44	60	75	290
NON-ARMY AIRCRAFT	2	---	0	0	2	0	0	4
TOTAL	39	15	19	40	46	60	75	294

Table C-4 (C). Aircraft Combat Crash Incidents with Personnel Fatalities; Time vs Aircraft Type (U)

Calendar Year / Half	62-64	1965 I	1965 II	1966 I	1966 II	1967 I	1967 II	Total
Armed UH-1B/C	7	5	6	1	10	8	8	45
Unarmed UH-1B	0	---	---	---	---	---	---	0
UH-1B (Unk. if armed)	2	3	3	2	1	0	0	11
Unarmed UH-1D/H	---	1	0	5	4	6	10	26
TOTAL UH-1	9	9	9	8	15	14	18	82
CH-21C	2	---	---	---	---	---	---	2
CH-37	1	---	---	---	---	---	---	1
CH-47 (Incl. armed)	---	---	---	1	0	2	0	3
CH-54A	---	---	---	---	---	---	---	---
OH-13S (Incl. armed)	---	---	1	2	1	2	2	8
OH-23G (Incl. armed)	---	---	---	---	0	1	1	2
OH-6A (Incl. armed)	---	---	---	---	---	---	0	0
SUB TOTAL	3	---	1	3	1	5	3	16
TOTAL HELICOPTERS	12	9	10	11	16	19	21	98
O-1	2	1	0	2	2	2	1	10
OV-1A/B/C	2	---	1	0	1	---	---	4
OV-2B	---	---	---	---	---	---	---	---
U-1A	1	---	---	---	---	---	---	1
U-6A	---	---	0	---	---	---	---	0
U-8D	---	---	---	---	---	---	---	---
TOTAL FIXED WING	5	1	1	2	3	2	1	15
TOTAL ARMY AIRCRAFT	17	10	11	13	19	21	22	113
NON-ARMY AIRCRAFT	2(U-10)	---	---	---	1(H-43)	---	---	3
TOTAL	19	10	11	13	20	21	22	116

* Includes 1 forced landing with one fatality.
0 denotes injury but no fatality; --- denotes no reported injury.

Table C-5 (C). Combat Crashes with No Survivors; Time vs Aircraft Type (U)

Calendar Year		1965		1966		1967		
Half	62-64	I	II	I	II	I	II	Total
Armed UH-1B/C	4	4	4	0	6	4	3	25
Unarmed UH-1B	---	---	---	---	---	---	---	0
UH-1B (Unk. if armed)	1	1	1	0	0	---	---	3
Unarmed UH-1D/H	---	1	---	2	3	1	4	11
TOTAL UH-1	5	6	5	2	9	5	7	39
CH-21C	0	---	---	---	---	---	---	0
CH-37	0	---	---	---	---	---	---	0
CH-47 (Incl. armed)	---	---	---	0	---	1	---	1
OH-13S (Incl. armed)	---	---	0	1	0	2	1	4
OH-23G (Incl. armed)	---	---	---	---	---	1	0	1
SUB TOTAL	0	---	0	1	0	4	1	6
TOTAL HELICOPTERS	5	6	5	3	9	9	10	45
O-1	1	0	---	1	1	0	1	4
OV-1A/B/C	0	---	0	---	0	---	---	0
CV-2B	---	---	---	---	---	---	---	0
U-1A	1	---	---	---	---	---	---	1
U-6A	---	---	---	---	---	---	---	0
TOTAL FIXED WING	2	0	0	1	1	0	1	5
TOTAL ARMY AIRCRAFT	7	6	5	4	10	9	11	50
NON-ARMY AIRCRAFT	---	---	---	---	---	---	---	0
TOTAL	7	6	5	4	10	9	11	50

0 denotes injury but no fatality; --- denotes no reported injury.

Table C-6 (C). Average Number of Flying Hours per Reported Injury & per Fatal Injury vs Aircraft Type (1962 - 1967) (U)

Aircraft Type	Flying Hours (1000's)	Reported Injuries	Fatal Injuries	Flying Hours per Injury	Flying Hours per Fatal Injury
Armed UH-1B/C*	562.8	217-304	103-120	2,593-1,849	5,464-4,690
Unarmed UH-1B*	212.7	0-87	0-17	**	**
Unarmed UH-1D/H *	1,581.5	273-290	88	5,793-5,453	17,972.
TOTAL UH-1	2,681.2	684	264	3,920.	10,156.
CH-21C	67.3	20	3	3,265.	22,400
CH-37	3.1	5	4	620.	775.
CH-47	176.7	34	10	5,197.	17,670.
CH-54A	4.8	0	0	>4,800.	>4,800
SUB TOTAL	251.9	59	17	4,270.	14,818
OH-13S/23G/6A	338.1	49	16	6,900.	21,131.
TOTAL HELICOPTERS	3,271.2	792	297	4,130.	11,014.
O-1	554.0	38	14	14,579.	39,571.
OV-1A/B/C	89.0	16	4	5,563.	22,250.
CV-2B	166.4	0	0	>166,400.	>166,400.
U-1A/6A/8D/21	341.1	7	4	48,729.	85,275.
TOTAL FIXED WING	1,150.5	61	22	18,861.	52,295.
TOTAL ARMY AIRCRAFT	4,421.7	853	319	5,184.	13,861.

* July 65 through December 67.
** Data inadequate.

Table C-7 (C). Average Number of Flying Hours per Reported Injury & per Fatal Injury vs Time (U)

Aircraft Type	Period (CY)	Flying Hours (1000's)	Reported Injuries	Fatal Injuries	Flying Hours per Injury	Flying Hours per Fat. Injury
Armed UH-1B/C	62-65	*	90-143	58-78	*	*
	66	218.0	78-122	36-45	2,795.-1,787.	6,056-4,844.
	67	270.7	108-136	49	2,506.-1,990.	5,524.
Unarmed UH-1B	62-65	*	6-59	0-20	*	*
	66	93.5	0-44	0-9	*	*
	67	64.6	0-28	0	*	*
Unarmed UH-1D/H	62-65	*	8	4	*	*
	66	495.4	77-85	34	6,434-5,828.	14,571.
	67	1,016.1	192-201	54	5,292-5,055	18,817
UH-1	62-65	523.0	157	82	3,331	6,378
	66	806.9	199	79	4,055	10,214
	67	1,351.4	328	103	4,120	13,120
Other Rotary Wing	62-65	83.5	26	8	3,212	10,438
	66	167.8	25	5	6,712	33,560
	67	338.7	57	20	5,942	16,935
Total Rotary Wing	62-65	606.5	183	90	3,314	6,739
	66	974.7	224	84	4,351	11,604.
	67	1,690.0	385	123	4,390	13,740
Fixed Wing	62-65	387.2	25	11	15,488	35,200
	66	360.1	17	7	21,182	51,443
	67	403.2	19	4	21,221	100,800
Total Army Aircraft	62-65	993.7	208	101	4,777	9,839
	66	1,334.9	241	91	5,539	14,669
	67	2,093.2	404	127	5,181	16,482
Total Army Aircraft	62-67	4,421.8	853	319	5,184	13,861

* Data inadequate.

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Table C-8 (C). Average Number of Aircraft Sorties Hit per Reported Injury & per Fatal Injury vs Aircraft Type (1962-1967) (U)

Aircraft Type	Aircraft Hit	Reported Injuries	Fatal Injuries	Aircraft Sorties Hit per Injury	Aircraft Sorties Hit per Fat. Injury
Armed UH-1A/B/C	3,972	276-401	143-172	14.4-9.9	27.88-23.1
Unarmed UH-1B	662	6-131	0-29	**	**
Unarmed UH-1D/H	3,148	277-294	92	11.4-10.7	34.2
TOTAL UH-1	7,775.	684	264	11.37	29.45
CH-21C	364	20	3	18.2	121.3
CH-37	19	5	4	3.8	4.8
CH-47	485	34	10	14.3	48.5
CH-54A	14	0	0	>14	>14
SUB TOTAL	882	59	17	15.0	51.9
OH-13S/23G	415	44	16	9.4	25.9
OH-6A	23	5	0	4.6	>23.
TOTAL HELICOPTERS	9,095.	792	297	11.48	30.62
O-1	481	38	14	12.7	34.4
OV-1A/B/C	540	16	4	33.8	135.0
CV-2B	223	0	0	>233.	>223.
U-1A/6A/8D/21	96	7	4	13.7	24.0
TOTAL FIXED WING	1,575*	61	22	25.82	71.59
TOTAL ARMY AIRCRAFT	10,670	853	319	12.51	33.45

* Includes 235 sorties hit on unspecified fixed wing aircraft.
** Data inadequate.

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Table C-9 (C). Average Number of Aircraft Sorties Hit per Reported Injury & per Fatal Injury vs Time (U)

Aircraft Type	Period (CY)	Aircraft Hit	Reported Injuries	Fatal Injuries	Aircraft Sorties Hit per Injury	Aircraft Sorties Hit per Fat. Injury
Armed UH-1A/B/C **	62-65	1,398	90-143	58-78	15.5-9.8	24.1-17.9
	66	1,239	78-122	36-45	15.9-10.2	34.4-27.5
	67	1,328	108-136	49	7.4-9.8	27.1
Unarmed UH-1B**	62-65	336	6-59	0-20	*	*
	66	95	0-44	0-9	*	*
	67	231	0-28	0	*	*
Unarmed UH-1D/H**	62-65	249	8	4	31.1	62.3
	66	1,059	77-85	34	13.8-12.5	31.1
	67	1,840	192-201	54	9.6-9.2	34.1
Total UH-1	62-65	1,983	157	82	12.6	24.2
	66	2,393	199	79	12.0	30.3
	67	3,399	328	103	10.4	33.0
Other Rotary Wing	62-65	412	26	8	15.8	51.5
	66	349	25	5	14.0	69.8
	67	559	57	20	9.8	28.0
Total Rotary Wing	62-65	2,395	183	90	13.1	26.6
	66	2,742	224	84	12.2	32.6
	67	3,958	385	123	10.3	32.2
Fixed Wing	62-65	631	25	11	25.2	57.4
	66	568	17	7	33.4	81.1
	67	376	19	4	19.8	94.0
Total Army Aircraft	62-65	3,026	208	101	14.5	30.0
	66	3,310	241	91	13.7	26.1
	67	4,334	404	127	10.7	34.1
Total Army Aircraft	62-67	10,670	853	319	12.5	33.4

* Data inadequate.

** Range covers unspecified UH-1 types and models.

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Table C-10 (C). Average Number of Aircraft Sorties Hit per Sortie With Reported Injury or With Fatal Injury vs Aircraft Type (U)

Aircraft Type	Reported Hit	Reported Injuries	Fatal Injury	Aircraft Sorties Hit per Sortie With Injury	Aircraft Sorties Hit per Sortie With Fat. Injury
Armed UH-1A/B/C	3,972	80-129	45-56	44-31	88-71
Transport UH-1B	662	2-51	0-11	**	**
Transport UH-1D/H	3,148	78-91	26	40-35	121
TOTAL UH-1	7,775	209	82	37.2	94.8
CH-21C	364	5	2	73	182
CH-37	19	1	1	19	19
CH-47	485	7	3	69	162
CH-54	14	0	---	>14	>14
SUB TOTAL	882	13	6	68	147
OH-13S/23G/6A	438	27	10	16.2	43.8
TOTAL HELICOPTERS	9,095	249	98	36.5	92.8
O-1	481	27	10	18.	48.
OV-1A/B/C	540	12	4	45.	135.
CV-2B	223	0	---	>223.	>223.
U-1A/6A/8D/21	96	2	1	48.	96.
TOTAL FIXED WING	1,575*	41	15	38.4	105.0
TOTAL ARMY AIRCRAFT	10,670	290	113	36.8	94.4

* Includes 235 sorties hit on unspecified fixed wing aircraft.
** Data inadequate.

Table C- 11 (C). Average Number of Reported Injuries & Fatal Injuries per Combat Crash vs Aircraft Type (U)

Aircraft Type	Combat Crashes	Reported Injuries	Fatal Injuries	Injury per Combat Crash	Fat. Injury per Combat Crash
Armed UH-1A/B/C	86-99	276-401	143-172	3.2-4.1	1.6-1.7
Unarmed UH-1B	3-16	6-131	0-29	*	0. - 1.8
Unarmed UH-1D/H	89	277-294	92	3.1-3.3	1.03
TOTAL UH-1	191	684	264	3.5	1.4
CH-21C	6	20	3	3.3	0.5
CH-37	1	5	4	5.	4.
CH-47	7	34	10	4.8	1.4
CH-54A	0	---	---	*	*
OH-13S	24	32	12	1.3	0.5
OH-23G	8	12	4	1.5	0.5
OH-6A	3	5	0	1.6	0.
SUB TOTAL	49	108	33	2.2	0.7
TOTAL HELICOPTERS	240	792	297	3.3	1.2
O-1	25	38	14	1.5	0.6
OV-1A/B/C	19	16	4	0.8	0.2
CV-2B	1	0	0	*	*
U-1A	1	4	4	4.	4.
U-6A	2	3	0	1.5	*
U-8D/21	0	---	---	*	*
TOTAL FIXED WING	48	61	22	1.3	0.5
TOTAL ARMY AIRCRAFT	288	853	319	2.96	1.11

* Data inadequate.

Table C-12 (C). Average Number of Reported Injuries & Fatal Injuries per Combat Crash vs Time (U)

Aircraft Type	Period (CY)	Aircraft Hit	Reported Injuries	Fatal Injuries	Combat Crash per Injury	Combat Crash per Fat. Injury
Armed UH-1A/B/C	62-65	33-38	90-143	58-78	2.7-3.7	1.8-2.1
	66	25-33	78-122	36-45	3.1-3.7	1.4
	67	28	108-136	49	3.9-4.9	1.8
Unarmed UH-1B	62-65	3-8	6-59	0-20	*	*
	66	0-8	0-44	0-9	*	*
	67	0	0-28	0	*	*
Unarmed UH-1D/H	62-65	3	8	4	2.66	1.33
	66	30	77-85	34	2.6-2.8	1.1
	67	56	192-201	54	3.4-3.6	.96
Total UH-1	62-65	44	157	82	3.6	1.9
	66	63	199	79	3.2	1.3
	67	84	328	103	3.9	1.2
Other Rotary Wing	62-65	9	26	8	2.9	.89
	66	10	25	5	2.5	.5
	67	30	57	20	1.9	.66
Total Rotary Wing	62-65	53	183	90	3.5	1.7
	66	73	224	84	3.1	1.2
	67	114	385	123	3.4	1.1
Fixed Wing	62-65	21	25	11	1.2	.5
	66	15	17	7	1.1	.5
	67	12	19	4	1.6	.33
Total Army Aircraft	62-65	74	208	101	2.8	1.4
	66	88	241	91	2.7	1.0
	67	126	404	127	3.2	1.0
Total Army Aircraft	62-67	288	853	319	2.96	1.11

* Data inadequate.

Table C-13 (C). Combat Crash Survivability vs Aircraft Type (1962 through 1967) (U)

Aircraft Type	Total Crashes	Incidents Reporting Injuries	Crashes With Injuries	Crashes* With Fatalities	Crashes With No Survivors	U.S.A. Personnel Tot. Rep. Injured	U.S.A. Personnel Injured Fatally
Armed UH-1B/C	86	80	73	45	25	276	143
Unarmed UH-1B	3	2	1	0	---	6	0
UH-1B (Unk. if armed)	13	36	30	11	3	108	29
Unarmed UH-1D/H	89	78	68	26	11	277	92
UH-1 (Unspecified)	0	13	12	---	---	17	0
TOTAL UH-1	191	209	184	82	39	684	264
CH-21C	6	5	5	2	0	20	3
CH-37	1	1	1	1	0	5	4
CH-47 (Incl. armed)	7	7	6	3	1	34	10
CH-54A	0	---	---	---	---	---	---
OH-13S (Incl. armed)	24	19	17	8	4	32	12
OH-23G (Incl. armed)	8	6	5	2	1	12	4
OH-6A (Incl. armed)	3	2	2	0	---	5	0
SUB TOTAL	49	40	36	16	6	108	33
TOTAL HELICOPTERS	240	249	220	98	45	792	297
O-1	25	27	23	10	4	38	14
OV-1A/B/C	19	12	12	4	0	16	4
CV-2B	1	0	---	---	---	0	---
U-1A	1	1	1	1	1	4	4
U-6A	2	1	0	0	---	3	0
U-8D/21	0	---	---	---	---	---	---
TOTAL FIXED WING	48	41	36	15	5	61	22
TOTAL ARMY AIRCRAFT	288	290	256	113	50	853	319
NON-ARMY AIRCRAFT	(?)	4	4	3	0	20	6
TOTAL	---	294	260	116	50	873	325

* Includes 1 forced landing with 1 fatality.

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Table C-14 (C). Number of Reported Injuries by Crew Station vs Aircraft Type (U)

Aircraft Type	All Reported Injuries: Pilots & Copilots	Crew Chiefs & Gunners	Others	Total	Fatalities Only: Pilots & Copilots	Crew Chiefs & Gunners	Others	Total
Armed UH-1A/B/C	137	129	10	276	70	66	7	143
Unarmed UH-1B	2	3	1	6	---	---	---	0
UH-1B (Unk. if armed)	42	51	15	108	15	12	2	29
Unarmed UH-1D/H	90	97	90	277	28	30	34	92
UH-1 (Unspecified)	10	2	5	17	---	---	---	0
TOTAL UH-1	281	282	121	684	113	108	43	264
CH-21C	7	8	5	20	2	1	0	3
CH-37	2	2	1	5	2	2	0	4
CH-47 (Incl. armed)	9	14	11	34	2	3	5	10
CH-54A	---	---	---	0	---	---	---	0
OH-13S (Incl. armed)	15	1	16	32	5	---	7	12
OH-23G (Incl. armed)	5	1	6	12	2	---	2	4
OH-6A (Incl. armed)	2	1	2	5	---	---	---	0
SUB TOTAL	40	27	41	108	13	6	14	33
TOTAL HELICOPTERS	321	309	162	792	126	114	57	297
O-1	19	---	19	38	6	---	8	14
OV-1A/B/C	13	---	3	16	4	---	0	4
OV-2B	---	---	---	0	---	---	---	---
U-1A	2	1	1	4	2	1	1	4
U-6A	2	0	1	3	---	---	---	0
U-8D & U-21	---	---	---	0	---	---	---	0
TOTAL FIXED WING	36	1	24	61	12	1	9	22
TOTAL ARMY AIRCRAFT	357	310	186	853	138	115	66	319
NON-ARMY AIRCRAFT	---	---	20	20	---	---	6	6
TOTAL	357	310	206	873	138	115	72	325

Table C-15 (C). Distribution (%) of Injuries by Crew Station vs Aircraft Type (U)

Aircraft Type	All Injuries: Pilots & Copilots	All Injuries: Crew Chiefs & Gunners	All Injuries: Others	Fatal Injuries: Pilots & Copilots	Fatal Injuries: Crew Chiefs & Gunners	Fatal Injuries: Others
Armed UH-1A/B/C	50.-47	47-45	3-8	49	46	5
Unarmed UH-1B	33.-41	50-43	17-16	0-52	0-41	0-7
Unarmed UH-1D/H	32.-34	35-34	32	30.4	32.6	37.0
TOTAL UH-1	41.1	41.2	17.7	42.8	40.9	16.3
CH-21C	35.	40.	25.	67.	33.	0
CH-37	40.	40.	20.	50.	50.	0
CH-47 (Incl. armed)	27.	41.	32.	20.	30.	50.
OH-13S (Incl. armed)	47.	---	53.	42.	---	58.
OH-23G (Incl. armed)	50.	---	70.	50.	---	50.
OH-6A (Incl. armed)	40.	---	60.	---	---	---
TOTAL HELICOPTERS	40.5	39.0	20.5	42.4	38.4	19.2
O-1	50.	---	50.	43.	---	57.
OV-1A/B/C	81.	---	19.	100.	---	0
U-1A/6A	57.	---	43	50.	---	50.
TOTAL FIXED WING	59.	---	41.	54.5	---	45.5
TOTAL ARMY AIRCRAFT	41.9	36.3	21.8	42.4	35.4	22.2

Table C-16 (C). $\frac{\text{Fatal Injuries}}{\text{All Injuries}}$ (%) By Crew Station vs Aircraft Type (U)

Aircraft Type	Pilots & Copilots	Crew Chiefs & Gunners	Others	All Stations
Armed UH-1B/C *	51-45	51-43	70-30	[illegible]-43
Unarmed UH-1B *	0-28	0-21	0-10	0-22
Unarmed UH-1D/H*	31-28	31-30	38-36	33-31
TOTAL UH-1	40.2	38.3	35.5	38.6
CH-21C/37/47	31.	25.	29.	29.
CH-13S/23G/6A	32.	---	33.	33.
TOTAL HELICOPTERS	39.2	36.9	35.2	37.5
TOTAL FIXED WING	33.	---	40.	36.
TOTAL ARMY AIRCRAFT	38.7	37.1	35.5	37.4
TOTAL	38.7	37.1	35.0	37.2

* Range includes unspecified UH-1 types and models.

Table C-17 (C). Injury Severity vs Aircraft Type (U)

Aircraft Type	Number				Percent			
	All Injuries	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious
Armed UH-1A/B/C	276	143	8	125	31.62	16.38	0.92	14.32
Unarmed UH-1B	6	0	0	6	0.69	0.0	0.0	0.69
UH-1B (Unk. if armed)	108	29	5	74	12.37	3.32	0.57	8.48
Unarmed UH-1D/H	277	92	13	172	31.73	10.54	1.49	19.70
UH-1 (Unspecified)	17	0	2	15	1.95	0.0	0.23	1.72
TOTAL UH-1	684	264	28	392	78.35	30.24	3.21	44.90
CH-21C	20	3	3	14	2.29	0.34	0.34	1.60
CH-37	5	4	0	1	0.57	0.46	0.0	0.11
CH-47 (Incl. armed)	34	10	0	24	3.89	1.15	0.0	2.75
CH-54A	0	---	---	---	0.0	---	---	---
OH-13S (Incl. armed)	32	12	2	18	3.67	1.37	0.23	2.06
OH-23G (Incl. armed)	12	4	0	8	1.37	0.46	0.0	0.92
OH-6A (Incl. armed)	5	0	0	5	0.57	0.0	0.0	0.57
SUB TOTAL	108	33	5	70	12.37	3.78	0.57	8.02
TOTAL HELICOPTERS	792	297	33	462	90.72	34.02	3.78	52.92
O-1	38	14	1	23	4.35	1.60	0.11	2.63
OV-1A/B/C	16	4	3	9	1.83	0.46	0.34	1.03
CV-2B	0	---	---	---	0.0	---	---	---
U-1A	4	4	0	0	0.46	0.46	0.0	0.0
U-6A	3	0	0	3	0.34	0.0	0.0	0.34
U-8D & U-21	0	---	---	---	---	---	---	---
TOTAL FIXED WING	61	22	4	35	6.99	2.52	0.46	4.01
TOTAL ARMY AIRCRAFT	853	319	37	497	97.71	36.54	4.24	56.93
NON-ARMY AIRCRAFT	20	6	0	14	2.29	0.69	0.0	1.60
TOTAL	873	325	37	511	100.0	37.23	4.24	58.53

Table C-18 (C). Injury Category vs Severity (U)

Category	Number				Percent		
	All Severities	Fatal	Serious	Non-Serious	Fatal	Serious	Non-Serious
Lacerations	197	0	10	187	0.0	1.2	21.4
Fatal Injuries & Burns	148	148	0	0	17.0	---	---
Fatal Injuries	107	107	0	0	12.3	---	---
Broken Bone	105	3	15	87	0.3	1.7	10.0
Burns	100	46	5	49	5.3	0.6	5.6
Contusion	96	1	1	94	0.1	0.1	10.8
Sprain	43	0	1	42	---	0.1	4.8
Abrasions	33	0	0	33	---	---	3.8
Drowning	14	14	0	0	1.6	---	---
Concussion	10	1	4	5	0.1	0.5	0.6
Asphyxiation	4	4	0	0	0.5	---	---
Internal Injury	3	0	0	3	---	---	0.3
Amputation	1	0	1	0	---	0.1	---
Unknown	12	1	0	11	0.1	---	1.3
TOTAL	873	325	37	511	37.23	4.24	58.53

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Table C-19 (C). Injury Cause vs Severity (U)

Cause (Code)	All Severities	Fatal	Serious	Non-Serious	Percent Fatal	Percent Serious	Percent Non-Serious
Exploded in Flight (CA)	30	30	---	---	3.44	---	---
Fire-in-Flight, Crashed (CF)	117	53	2	62	6.07	0.23	7.10
Crashed & Exploded (CE)	48	44	2	2	5.04	0.23	0.23
Crashed & Burned (CB)	239	131	12	96	15.01	1.37	11.00
Crashed, No Fire (CR)	328	65	18	245	7.45	2.06	28.06
Forced Landing on Fire (FF)	13	0	0	13	---	---	1.49
Forced Landing (Hard) (FL)	57	1	0	56	0.11	---	6.41
Ejecting (EJ)	9	0	3	6	---	0.34	0.69
Parachuting (PA)	4	1	0	3	0.11	---	0.34
Unknown (UN)	28	0	0	28	---	---	3.21
TOTAL	873	325	37	511	37.23	4.24	58.53
Crashes w/All Fires	434	258	16	160	29.55	1.83	18.33
Crashes w/o Fire	328	65	18	245	7.45	2.06	28.06
Forced Landings	70	1	0	69	0.11	---	7.90
Other & Unknown	41	1	3	37	0.11	0.34	4.24

Table C-20 (C). Distribution of Injuries by Cause & Severity vs Aircraft Type (U)

Aircraft Type	Crash Injury Causes: Expl. in Flight	Fire -in- Flight	Crashed & Expl.	Crashed & Burned	Non-Crash: Crash No Fire	Forced Landing	Other & Unknown	All Causes
FATAL ONLY								
Armed UH-1B/C	20	28	32	41	22	0	0	143
UH-1B (Unk. if Armed)	0	4	0	15	9	1	0	29
Unarmed UH-1D/H	10	10	12	41	19	0	0	92
TOTAL UH-1	30	42	44	97	50	1	0	264
CH-21C, CH-37, & CH-47	0	5	0	10	2	0	0	17
OH-13S, & OH-23G	0	3	0	8	5	0	0	16
ALL HELICOPTERS	30	50	44	115	57	1	0	297
FIXED WING	0	3	0	10	8	0	1	22
ALL ARMY AIRCRAFT	30	53	44	125	65	1	1	319
SERIOUS ONLY								
Armed UH-1B/C	0	1	1	2	4	0	0	8
UH-1B (Unk. if Armed)	0	1	0	4	2	0	0	7
Unarmed UH-1D/H	0	0	1	3	9	0	0	13
TOTAL UH-1	0	2	2	9	15	0	0	28
CH-21C, CH-37, & CH-47	0	0	0	1	2	0	0	3
OH-13S, & OH-23G	0	0	0	2	0	0	0	2
ALL HELICOPTERS	0	2	2	12	17	0	0	33
FIXED WING	0	0	0	0	1	0	3	4
ALL ARMY AIRCRAFT	0	2	2	12	18	0	3	37
NON-SERIOUS ONLY								
Armed UH-1B/C	0	25	2	25	55	18	0	125
UH-1B (Unk. if Armed)	0	3	0	7	52	7	3	72
Unarmed UH-1D/H	0	11	0	36	99	22	4	172
UH-1 (Other & Unk.)	0	0	0	4	6	8	5	23
TOTAL UH-1	0	39	2	72	212	55	12	392
CH-21C, CH-37, & CH-47	0	19	0	7	12	1	0	39
OH-13S, OH-23G, & OH-6A	0	2	0	9	13	5	2	31
ALL HELICOPTERS	0	60	2	88	237	61	14	462
FIXED WING	0	2	0	8	8	8	9	35
ALL ARMY AIRCRAFT	0	62	2	96	245	69	23	497
TOTAL	30	117	48	233	328	70	27	853

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Table C-21 (C). Distribution of Injuries by Cause & Severity vs Crew Station (All Army Aircraft) (U)

Crew Station	Crash Injury Causes: Expl. in Flight	Fire -in- Flight	Crashed & Expl.	Crashed & Burned	Non-Crash: Crash No Fire	Forced Landing	Other & Unknown	All Causes
FATAL ONLY								
Pilot & Copilot (Front)	14	25	18	48	31	1	1	138
Crew Chief & Gunner	14	20	19	43	19	0	0	115
Others (Rear)	2	8	7	34	15	0	0	66
TOTAL	30	53	44	125	65	1	1	319
FATAL & SERIOUS								
Pilot & Copilot	14	27	20	54	39	1	3	158
Crew Chief & Gunn[illegible]	14	20	19	46	23	0	0	122
Others	2	8	7	37	21	0	1	76
TOTAL	30	55	46	137	83	1	4	356
NON-SERIOUS ONLY								
Pilot & Copilot	0	23	1	33	101	31	10	199
Crew Chief & Gunner	0	29	1	35	98	17	7	187
Others	0	10	0	28	46	21	6	111
TOTAL	0	62	2	96	245	69	23	497
ALL SEVERITIES								
Pilot & Copilot	14	50	21	87	140	32	13	357
Crew Chief & Gunner	14	49	20	81	121	17	7	310
Others	2	18	7	65	67	21	7	186
TOTAL	30	117	48	233	328	70	27	853

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Table C-22 (C). Distribution of Fat Injuries by Cause vs Aircraft Type & Crew Station (U)

Aircraft Type	Crew Station	Crash Injury Causes: Expl. in Flight	Fire -in- Flight	Crashed & Expl.	Crashed & Burned	Non-Crash: Crash No Fire	Forced Landing	Other & Unknown	All Causes
Armed UH-1B/C (Specified)	Pi & Cp.	10	13	15	21	11	0	0	70
	CC & Gu.	10	11	15	19	11	0	0	66
	Others	0	4	2	1	0	0	0	7
Unarmed Uh-1D/H (Specified)	Pi & Cp.	4	4	3	11	6	0	0	28
	CC & Gu.	4	5	4	12	5	0	0	30
	Others	2	1	5	18	8	0	0	34
All UH-1 (Incl. B's Unknown if Armed)	Pi & Cp.	14	19	18	38	23	1	0	113
	CC & Gu.	14	18	19	38	19	0	0	108
	Others	2	5	7	21	8	0	0	43
Large R/W (CH-21C, CH-37,& CH-47)	Pi & Cp.	0	2	0	2	2	0	0	6
	CC & Gu.	0	2	0	4	0	0	0	6
	Others	0	1	0	4	0	0	0	5
Small R/W (OH-13S, OH-23G)	Pilots	0	2	0	3	2	0	0	7
	Others	0	1	0	5	3	0	0	9
All Helicopters	Front	14	23	18	43	27	1	0	126
	CC & Gu.	14	20	19	42	19	0	0	114
	Others	2	7	7	30	11	0	0	57
Fixed Wing	Pilot	0	2	0	5	4	0	1	12
	Side	0	0	0	1	0	0	0	1
	Rear	0	1	0	4	4	0	0	9
All Army Aircraft	Front	14	25	18	48	31	1	1	138
	CC & Gu.	14	20	19	43	19	0	0	115
	Others	2	8	7	34	15	0	0	66
All Army Aircraft	All	30	53	44	125	65	1	1	319

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Table C-23 (C). Distribution of Serious Injuries by Cause vs Aircraft Type & Crew Station (U)

Aircraft Type	Crew Station	Crash Injury Causes: Expl. in Flight	Fire -in- Flight	Crashed & Expl.	Crashed & Burned	Crash No Fire	Non-Crash: Forced Landing	Other & Unknown	All Causes
Armed UH-1B/C (Specified)	Pi & Cp.	0	1	1	1	3	0	0	6
	CC & Gu.	0	0	0	1	[illegible]	0	0	2
	Others	0	0	0	0	0	0	0	0
Unarmed UH-1D/H (Specified)	Pi & Cp.	0	0	1	1	3	0	0	5
	CC & Gu.	0	0	0	2	1	0	0	3
	Others	0	0	0	0	5	0	0	5
All UH-1 (Incl. B's Unknown if Armed)	Pi & Cp.	0	2	2	5	6	0	0	15
	CC & Gu.	0	0	0	3	3	0	0	6
	Others	0	0	0	1	6	0	0	7
Large R/W (CH-21C, CH-37,& CH-47)	Pi & Cp.	0	0	0	0	1	0	0	1
	CC & Gu.	0	0	0	0	1	0	0	1
	Others	0	0	0	1	0	0	0	1
Small R/W (OH-13S & OH-23G)	Pilots	0	0	0	1	0	0	0	1
	Others	0	0	0	1	0	0	0	1
All Helicopters	Front	0	2	2	6	7	0	0	17
	CC & Gu.	0	0	0	3	4	0	0	7
	Others	0	0	0	3	6	0	0	9
Fixed Wing	Pilot	0	0	0	0	1	0	2	3
	Side	0	0	0	0	0	0	0	0
	Rear	0	0	0	0	0	0	1	1
All Army Aircraft	Front	0	2	2	6	8	0	2	20
	CC & Gu.	0	0	0	3	4	0	0	7
	Others	0	0	0	3	6	0	1	10
All Army Aircraft	All	0	2	2	12	18	0	3	37

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Table C-24 (C). Distribution of Non-Serious Injuries by Cause vs Aircraft Type & Crew Station (U)

Aircraft Type	Crew Station	Crash Injury Causes: Expl. in Flight	Fire -in- Flight	Crashed & Expl.	Crashed & Burned	Non-Crash: Crash No Fire	Forced Landing	Other & Unknown	All Causes
Armed UH-1B/C	Pi & Cp.	0	10	1	9	31	10	0	61
	CC & Gu.	0	14	1	15	23	8	0	61
	Others	0	1	0	1	1	0	0	3
Unarmed UH-1D/H	Pi & Cp.	0	5	0	11	34	6	1	57
	CC & Gu.	0	6	0	15	40	3	0	64
	Others	0	0	0	10	25	13	3	51
All UH-1 (Incl. 3's Unknown if Armed)	Pi & Cp.	0	16	1	24	85	24	3	153
	CC & Gu.	0	22	1	32	91	15	6	167
	Others	0	1	0	16	36	16	3	72
Large R/W (CH-21C, CH-37, & CH-47)	Pi & Cp.	0	5	0	3	3	0	0	11
	CC & Gu.	0	7	0	3	7	1	0	18
	Others	0	7	0	1	2	0	0	10
Small R/W (OH-13S, OH-23G, & OH-6A)	Pilots	0	1	0	3	8	2	0	14
	Others	0	1	0	6	5	3	2	17
All Helicopters	Front	0	22	1	30	96	26	3	178
	CC & Gu.	0	29	1	35	98	17	7	187
	Others	0	9	0	23	43	18	4	97
Fixed Wing	Pilots	0	1	0	3	5	5	7	21
	Side	0	0	0	0	0	0	0	0
	Rear	0	1	0	5	3	3	2	14
All Army Aircraft	Front	0	23	1	33	101	31	10	199
	CC & Gu.	0	29	1	35	98	17	7	187
	Others	0	10	0	28	46	21	6	111
All Army Aircraft	All	0	62	2	96	245	69	23	497

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Table C-25 (C). Distribution of Injuries (All Severities) by Cause vs Aircraft Type & Crew Station (U)

Aircraft Type	Crew Station	Crash Injury Causes: Expl. in Flight	Fire -in- Flight	Crashed & Expl.	Crashed & Burned	Non-Crash: Crash No Fire	Forced Landing	Other & Unknown	All Causes
Armed UH-1B/C (Specified)	Pi & Cp.	10	24	17	31	45	10	0	137
	CC & Gu.	10	25	16	35	35	8	0	129
	Others	0	5	2	2	1	0	0	10
Unarmed UH-1D/H (Specified)	Pi & Cp.	4	9	4	23	43	6	1	90
	CC & Gu.	4	11	4	29	46	3	0	97
	Others	2	1	5	28	36	13	3	90
All UH-1 (Incl. B's Unknown if Armed)	Pi & Cp.	14	37	21	67	114	25	3	281
	CC & Gu.	14	40	20	73	113	15	6	281
	Others	2	6	7	38	50	16	3	122
Large R/W (CH-21C, CH-37, & CH-47)	Pi & Cp.	0	7	0	5	6	0	0	18
	CC & Gu.	0	9	0	7	8	1	0	27
	Others	0	8	0	6	2	0	0	14
Small R/W (OH-13S, OH-23G, & OH-6A)	Pilots	0	3	0	7	10	2	0	22
	Others	0	2	0	12	8	3	2	27
All Helicopters	Front	14	47	21	79	130	27	3	321
	CC & Gu.	14	49	20	80	121	17	7	308
	Others	2	16	7	56	60	18	4	163
Fixed Wing	Pilots	0	3	0	8	10	5	10	36
	Side	0	0	0	1	0	0	0	1
	Rear	0	2	0	9	7	3	3	24
All Army Aircraft	Front	14	50	21	87	140	32	13	357
	CC & Gu.	14	49	20	81	121	17	7	310
	Others	2	18	7	65	67	21	7	186
All Army Aircraft	All	30	117	48	233	328	70	27	853

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Table C-26 (C). Number of Injury Sorties per Multiple of Personnel Injured vs Cause-All Aircraft (U)

Injury Multiple / Cause	1	2	3	4	5	6	7-10	Total
FATAL ONLY								
Exploded in Flight	0	0	0	6	0	1	0	7
Fire-in-Flight	4	4	1	7	2	0	-	18
Crashed & Exploded	0	2	0	8	0	0	1	11
Crashed & Burned	17	7	6	12	1	1	3	47
Crashed, No Fire	13	11	6	3	0	-	-	33
Forced Landing,No Fire	1	0	-	-	-	-	-	1
Ejecting	0	-	-	-	-	-	-	0
Parachuting	1	0	-	-	-	-	-	1
TOTAL	36	24	13	36	3	2	4	118
FATAL OR SERIOUS								
Exploded in Flight	0	0	0	6	0	1	0	7
Fire-in-Flight	6	4	1	7	2	0	-	20
Crashed & Exploded	0	1	1	7	1	0	1	11
Crashed & Burned	17	11	6	13	1	1	3	52
Crashed, No Fire	19	9	9	3	0	0	1	41
Forced Landing,No Fire	1	0	-	-	-	-	-	1
Ejecting	1	1	-	-	-	-	-	2
Parachuting	1	0	-	-	-	-	-	1
TOTAL	45	26	17	36	4	2	5	135
ALL SEVERITIES								
Exploded in Flight	0	0	0	6	0	1	0	7
Fire-in-Flight	3	4	5	14	5	0	1	32
Crashed & Exploded	0	0	1	8	1	0	1	11
Crashed & Burned	20	19	9	23	4	2	4	81
Crashed, No Fire	25	19	25	33	2	2	5	111
Forced Landing, W/Fire	2	0	1	2	0	-	-	5
Forced Landing,No Fire	15	5	5	3	1	0	-	29
Ejecting	3	3	0	-	-	-	-	6
Parachuting	4	0	-	-	-	-	-	4
Unknown	14	0	-	-	-	-	-	14
TOTAL	86	50	46	89	13	5	11	300

(CONFIDENTIAL) APPENDIX D (Wounds)

Table

Table D-1 (C). Reported Wounds to U.S. Army Personnel Aboard Aircraft (U)

Calendar Year	1962		1963		1964		1965		1966		1967		Total
Half	I	II	I	II	I	II	I	II	I	II	I	II	
Armed UH-1B/C	---	1	9	55	79	57	64	39	54	67	70	129	624
UH-1B Transport	---	---		6	2	5	---	10	-	---	---	---	24
UH-1B (Unk. if armed)	---	---	2	6	16	40	84	85	95	37	45	62	472
UH-1D/H Transport	--	---	---	---	---	---	0	13	128	123	239	306	829
UH-1 (Unspecified)	-	---	---	---	---	---	--	-	110	166	191	95	562
TOTAL UH-1	---	1	12	67	97	102	158	149	387	393	555	590	2511
CH-21C	8	20	22	15	14	---	---	---	---	---	---	---	79
CH-37	---	---	---	3	---	1	2	---	--	---	- -	---	6
CH-47 (incl. armed)	---	---	---	---	- -	---	---	2	21	37	28	38	107
CH-54A	---	---	---	---	---	---	---	---	---	---	--	---	---
OH-13S (incl. armed)	---	---	---	---	---	---	---	4	11	17	27	24	83
OH-23G (incl. armed)	---	---	---	---	---	---	- -	---	---	4	4	12	20
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	-	---	- -	6	6
SUB TOTAL	8	20	22	18	14	1	2	6	32	58	60	80	301
TOTAL HELICOPTERS	8	21	34	85	111	103	160	155	419	431	615	670	2812
O-1	---	2	---	2	6	4	6	7	6	11	8	13	65
OV-1A/B/C	---	---	3	2	0	3	1	4		4	1	5	26
CV-2B	---	---	1	3	3	3	1	2	2	3	- -	---	18
U-1A	- -	---	---		3	1	2	---	1	--	1	--	10
U-6A	---	---	---	---	---	---	1	0	- -	--	---	--	1
U-8D	---	---	---	---	---	---	---	-		-	1	---	1
TOTAL FIXED WING	---	2	4	9	12	11	11	13	12	18	11	18	121
TOTAL ARMY AIRCRAFT	8	23	38	94	123	114	171	168	431	449	626	688	2933
NON ARMY HELICOPTER	---	---	---	---	1(CH34)	---	---	---	2(-H34)	0	1(UH1F)	2(CH34,37)	6
NON ARMY F/W	---	-	---	1(C123)	---		---	2(AIL C123)	---	1(C123,	1(C123)	2(AIF,028)	7
TOTAL	8	23	38	95	124	114	171	170	433	450	628	692	2946

CODE: 0 entry denotes casualties but no wounds recorded, --- entry denotes no casualties recorded.

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Table D-2 (C). Fatal Wounds to U.S. Army Personnel Aboard Aircraft per Half-Year vs Aircraft Type (U)

Calendar Year	1962		1963		1964		1965		1966		1967		
Half	I	II	I	II	I	II	I	II	I	II	I	II	Total
Armed UH-1B/C	---	1 (UH-1A)	1	2	0	3	2	4	4	4	4	4	29
UH-1B Transport	---	---	---	---	---	1	---	---	---	---	---	---	1
UH-1B (Unk. if armed)	---	---	1	---	0	2	4	3	6	3	5	0	24
UH-1D/H Transport	---	---	---	---	---	---	0	3	17	12	22	21	75
UH-1 (Unspecified)	---	---	---	---	---	---	---	---	---	1	1	---	2
TOTAL UH-1	---	1	2	2	0	6	6	10	27	20	32	25	131
CH-21C	---	3	2	0	2	---	---	---	---	---	---	---	7
CH-37	---	---	---	0	---	---	---	---	---	---	---	---	0
CH-47 (incl.armed)	---	---	---	---	---	---	---	1	1	1	1	0	4
CH-54A	---	---	---	---	---	---	---	---	---	---	---	---	---
OH-13S (incl.armed)	---	---	---	---	---	---	---	0	1	0	2	1	4
OH-23G (incl. armed)	---	---	---	---	---	---	---	---	---	0	0	1	1
OH-6A (incl. armed)	---	---	---	---	---	---	---	---	---	---	---	0	0
SUB TOTAL	---	3	2	0	2	---	---	1	2	1	3	2	16
TOTAL HELICOPTERS	---	4	4	2	2	6	6	11	29	21	35	27	147
O-1	---	---	---	---	0	0	0	0	0	2	0	1	3
OV-1A/B/C	---	---	0	0	0	0	---	0	0	0	---	---	0
CV-2B	---	---	1	---	---	---	---	---	1	---	---	---	2
U-1A	---	---	---	0	---	---	---	---	---	---	---	---	0
U-6A	---	---	---	---	---	---	1	0	---	---	---	---	1
U-8D	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL FIXED WING	---	---	1	0	0	0	1	0	1	2	0	1	6
TOTAL ARMY AIRCRAFT	---	4	5	2	2	6	7	11	30	23	35	28	153
NON ARMY AIRCRAFT	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	---	4	5	2	2	6	7	11	30	23	35	28	153

CODE: 0 entry denotes wounds but no fatal wounds recorded; --- entry denotes no wounds recorded.

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Table D-3 (U) Average Number of Wounds & Fatal Wounds per Wound Incident vs Aircraft Type (U)

Aircraft Type	Reported Wounds	Number Fatal Wounds	Wound Incidents	Average Number Per Wound Incident: Wounds	Average Number Per Wound Incident: Fatal Wounds
Armed UH-1B/C	624	29	544	1.15-1.10	.053-.036
UH-1B Transport	24	1	22	1.09-1.18	.045-.027
UH-1B (Unk. if armed)	472	24	436	—	—
UH-1D/H Transport	829	75	678	1.22-1.16	.111-.064
UH-1 (Unspecified)	562	2	525	—	—
TOTAL UH-1	2511	131	2205	1.14	.059
CH-21C	79	7	63	1.25	.11
CH-37	6	0	5	1.2	.0
CH-47 (Incl. armed)	107	4	92	1.16	.043
CH-54A	0	0	0	—	—
OH-13S (Incl. armed)	83	4	78		
OH-23G (Incl. armed)	20	1	19	1.08	.050
OH-6A (Incl. armed)	6	0	4		
SUB TOTAL	301	16	261	1.15	.061
TOTAL HELICOPTERS	2812	147	2466	1.14	.060
U-1	65	3	65	1.0	.046
OV-1A/B/C	26	0	26	1.0	.0
CV-2B	18	2	15	1.2	.13
U-1A	10	0	8		
U-6A	1	1	1	1.2	.1
U-8D	1	0	1		
TOTAL FIXED WING	121	6	116	1.04	.052
TOTAL ARMY AIRCRAFT	2933	153	2582	1.14	.059
NON-ARMY HELICOPTERS	6	0	6	1.	.0
NON-ARMY F/W	7	0	7	1.	.0
TOTAL	2946	153	2595	1.14	.059

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Table D-4 (C). Average Number of Flying Hours per Wound & per Fatal Wound vs Aircraft Type (U)

Aircraft Type	Flying Hours (X1000)	Wounds	Fatal Wounds	Flying Hours per Wound	Flying Hours per Fatal Wound
Armed UH-1B/C	563	624	29	340-900	10,200-19,400
UH-1B Transport	213	24	1	2,000-8,800	7,800-213,000
UH-1B (Unk. if armed)	---	472	24	---	---
UH-1D/H Transport	1,592	829	75	1,100-1,900	20,700-21,200
UH-1 (Unspecified)	---	562	2	---	---
TOTAL UH-1	2,681	2,511	131	1,068	20,466
CH-21C	67.3	79	7	852	9,614
CH-37	3.1	6	0	517	>3,100
CH-47 (Incl. armed)	176.7	107	4	1,652	44,175
CH-54A	4.8	---	---	>4,800	>4,800
SUB TOTAL	251.9	192	11	1,307	22,900
OH-13S/23G/6A	338.1	109	5	3,102	67,620
TOTAL HELICOPTERS	3,271	2,812	147	1,163	22,252
O-1	554.0	65	3	8,523	184,700
OV-1A/A/C	89.0	26	0	3,400	>89,000
CV-2B	166.4	18	2	9,800	83,200
U-1A/6A/8D/21	341.0	12	1	28,000	341,000
TOTAL FIXED WING	1150.4	121	6	9,510	192,000
TOTAL ARMY AIRCRAFT	4,421	2,933	153	1,507	28,888

Table D-5 (C) Average Number of Aircraft Sorties Hit per Wound & per Fatal Wound vs Aircraft Type (U)

(1962 through 1967)

Aircraft Type	Aircraft Hit	Reported Wounds	Fatal Wounds	Aircraft Sorties Hit per Wound	Aircraft Sorties Hit per Fatal Wound
Armed UH-1B/C	3,965	624	29	2.4-6.4	72-136
Unarmed UH-1B Transport	662	24	1	*	*
UH-1B (Unk. if armed)	---	472	24	---	---
Unarmed UH-1D/H Transport	3,148	829	75	2.3-3.8	41-42
UH-1 (Unspecified)	---	562	2	---	---
TOTAL UH-1	7,782	2,511	131	3.1	59
CH-21C	364	79	7	4.6	52
CH-37	19	6	0	3.	>19
CH-47 (Incl. armed)	485	107	4	4.5	121
CH-54A	14	---	---	>14.	>14
SUB TOTAL	882	192	11	4.6	80
OH-13S/23G/6A	438	109	5	4.0	88
TOTAL HELICOPTERS	9,102	2,812	147	3.2	62
O-1	481	65	3	7.3-11.0	160-240
OV-1A/B/C	540	26	0	21.-30.	540-770
CV-2B	223	18	2	12.-25.	111-229
U-1A/6A/8D/21	96	12	1	8.-28.	96-331
F/W (Unspecified)	235	---	---	---	---
TOTAL FIXED WING	1,575	121	6	13.0	263
TOTAL ARMY AIRCRAFT	10,677	2,933	153	3.6	70

* Data inadequate.

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Table D-6 (C) Wounds & Wound Rates vs Time - All Army Aircraft (1962-1967) (U)

	Wound Severity	Body Site	Crew Station	1962 I	1962 II	1963 I	1963 II	1964 I	1964 II	1965 I	1965 II	1966 I	1966 II	1967 I	1967 III	Total
Number of Wounds	All	All	All	8	25	38	94	125	114	171	168	431	449	626	688	2,933
	All	Torso	All	0	2	4	5	4	4	13	14	46	29	41	44	209
	All	Torso	Pi & Cp	-	1	1	1	1	2	4	6	20	10	14	14	74
	All	Torso	CC & Gu.	-	1	2	3	1	-	5	5	13	14	11	19	87
	All	Torso	Others	-	0	1	1	2	2	4	3	13	-	6	11	18
	Fatal	All	All	0	4	5	2	2	6	-	11	5	23	55	25	153
	Fatal	Torso	All	-	1	3	0	1	3	6	3	15	12	10	8	62
	Fatal	Torso	Pi & Cp.	-	0	0	-	0	2	5	2	9	3	5	1	24
	Fatal	Torso	CC & Gu.	-	1	2	-	1	1	2	2	2	-	5	3	26
	Fatal	Torso	Others	-	0	1	-	0	0	1	0	4	2	0	4	12
Flying Hours per Wound	All	All	All	2,250	1,700	1,700	1,100	800	1,200	1,200	2,000	1,400	1,700	1,400	1,700	1,510
	Fatal	Fatal	Fatal	>18,000	9,500	12,000	51,000	50,000	24,000	28,000	30,000	20,000	33,000	26,000	43,000	28,900
A/C Hit per Wound	All	All	All	2.2	3.9	4.8	4.7	3.3	3.8	5.1	5.3	4.1	3.4	3.4	3.2	3.63
	Fatal	Fatal	Fatal	>54	22	36	220	200	73	75	81	60	66	62	78	69.8
Percent of Wounds	All	Torso	All	0	8.8	10.5	5.3	3.3	6.2	7.7	8.3	10.7	6.5	6.6	6.4	7.12
	All	Torso	Pi & Cp.	-	4.4	2.6	1.1	0.8	1.8	2.3	3.5	4.7	2.2	2.2	2.0	2.5
	All	Torso	CC & Gu.	-	4.4	5.3	3.1	0.8	2.6	2.9	3.0	3.0	3.2	3.4	2.8	3.0
	All	Torso	Others	-	0.0	2.6	1.1	1.7	1.8	2.3	1.8	3.0	1.1	1.0	1.6	1.6
	Fatal	All	All	-	17.	13.	2.1	1.6	5.2	4.1	6.6	7.0	5	5.6	4.1	5.21
	Fatal	Non Torso	All	-	13.	5.	2.1	0.8	2.6	0.7	4.1	3.5	2.4	4.0	2.9	3.10
	Fatal	Torso	All	-	4.	8.	0.	0.8	2.6	3.4	2.5	3.5	2.7	1.6	1.2	2.11
	Fatal	Torso	Pi & Cp	-	0	0	0	0	1.7	1.7	0.5	2.1	0.7	0.5	0.1	0.82
	Fatal	Torso	CC & Gu	-	4	5.	0	0.8	0.9	1.1	2.5	0.5	1.6	0.6	0.5	0.88
	Fatal	Torso	Others	-	0	3.	0	0	0.0	0.6	0.9	0.9	0.4	0.0	0.6	0.41

Table D-7 (C). Distribution of Wound Severities vs Aircraft Type (U)

Aircraft Type	Number of Wounds				Percent			
	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious
Armed UH-1B/C	624	29	18	577	21.18	0.98	0.61	19.59
Unarmed UH-1B Transport	24	1	0	23	0.81	0.03	0.00	0.78
UH-1B (Unk. if armed)	472	24	7	441	16.02	0.81	0.24	14.97
Unarmed UH-1D/H Transport	829	75	15	739	28.14	2.55	0.51	25.08
UH-1 (Unspecified)	562	2	0	560	19.08	0.07	0.00	19.01
TOTAL UH-1	2,511	131	40	2,340	85.23	4.44	1.36	79.43
CH-21C	79	7	1	71	2.68	0.24	0.03	2.41
CH-37	6	0	0	6	0.2	0.00	0.00	0.2
CH-47 (Incl. armed)	107	4	2	101	3.63	0.13	0.07	3.43
CH-54A	0	---	---	---	---	---	---	---
OH-13S (Incl. armed)	83	4	5	74	2.81	0.13	0.17	2.51
OH-23G (Incl. armed)	20	1	0	19	0.7	0.03	0.00	0.67
OH-6A (Incl. armed)	6	0	0	6	0.2	0.00	0.00	0.2
SUB TOTAL	301	16	8	277	10.22	0.55	0.27	9.4
TOTAL HELICOPTERS	2,812	147	48	2,617	95.45	4.99	1.63	88.83
O-1	65	3	0	62	2.21	0.10	0.00	2.11
OV-1A/B/C	26	0	0	26	0 89	0.00	0.00	0.89
CV-2B	18	2	0	16	0.61	0.07	0.00	0.54
U-1A	10	0	0	10	0.34	0.00	0.00	0.34
U-6A	1	1	0	0	0.03	0.03	0.00	0.00
U-8D	1	0	0	1	0.03	0.00	0.00	0.03
TOTAL FIXED WING	121	6	0	115	4.11	0.20	0.00	3.91
TOTAL ARMY AIRCRAFT	2,933	153	48	2,732	99.56	5.19	1.63	92.74
NON-ARMY HELICOPTERS	6	0	0	6	0.2	0.0	0.00	0.2
NON-ARMY FIXED WING	7	0	1	6	0.24	0.0	0.04	0.2
TOTAL	2,946	153	49	2,744	100.00	5.19	1.67	93.14

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Table D-8 (C). Number of Reported Wounds & Fatal Wounds by Crew Station vs Aircraft Type (U)

Aircraft Type	All Wounds				Fatal Wounds			
	Pilots & Copilots	Cr. Chiefs & Gunners	Others	Total	Pilots & Copilots	Cr. Chiefs & Gunners	Others	Total
Armed UH-1B/C	305	289	30	624	14	13	2	29
UH-1B Transport	13	[illegible]	5	24	1	0	0	1
UH-1B (Unk. if armed)	190	212	70	472	8	12	4	24
UH-1D/H Transp	342	312	175	829	30	30	15	75
UH-1 (Unspecified)	228	205	129	562	0	1	1	2
TOTAL UH-1	1,078	1,024	409	2,511	53	56	22	131
CH-21C	38	36	5	79	2	5	0	7
CH-37	1	4	1	6	0	0	0	0
CH-47 (Incl. armed)	31	43	33	107	2	1	1	4
OH-13S (Incl. armed)	40	6	37	83	1	1	2	4
OH-23G (Incl. armed)	8	0	12	20	0	0	1	1
OH-6A (Incl. armed)	2	3	1	6	0	0	0	0
SUB TOTAL	120	92	89	301	5	7	4	16
TOTAL HELICOPTERS	1,198	1,116	498	2,812	58	63	26	147
O-1	34	---	31	65	3	---	0	3
OV-1A/B/C	21	---	5	26	0	---	0	0
CV-2B	6	4	8	18	0	0	2	2
U-1A	8	0	2	10	0	0	0	0
U-6A	0	0	1	1	0	0	1	1
U-8D	1	0	0	1	0	0	0	0
TOTAL FIXED WING	70	4	47	121	3	0	3	6
TOTAL ARMY AIRCRAFT	1,268	1,120	545	2,933	61	63	29	153
NON-ARMY AIRCRAFT	---	---	13	13	---	---	0	0
TOTAL	1,268	1,120	558	2,946	61	63	29	153

Table D-9 (C). Distribution (%) of Wounds & Fatal Wounds by Crew Station vs Aircraft Type (U)

Aircraft Type	All Wounds Pilots & Copilots	All Wounds Cr. Chiefs & Gunners	All Wounds Others	All Wounds Total	Fatal Wounds Pilots & Copilots	Fatal Wounds Cr. Chiefs & Gunners	Fatal Wounds Others	Fatal Wounds Total
Armed UH-1B/C	10.35	9.81	1.02	21.18	9.15	8.50	1.31	18.95
Unarmed UH-1B Transport	0.44	0.20	0.17	0.81	0.65	0.00	0.00	0.65
UH-1B (Unk. if armed)	6.45	7.20	2.37	16.02	5.23	7.84	2.61	15.69
UH-1D/H Transport	11.61	10.59	5.94	28.14	19.61	19.61	9.80	49.02
UH-1 (Unspecified)	7.74	6.96	4.38	19.08	0.00	0.65	0.65	1.31
TOTAL UH-1	36.59	34.76	13.88	85.23	34.64	36.60	14.38	85.62
CH-21C	1.29	1.22	0.17	2.68	1.31	3.28	0.00	4.59
CH-37	0.03	0.14	0.03	0.2	0.00	0.00	0.00	0.00
CH-47 (Incl. armed)	1.06	1.46	1.12	3.64	1.31	0.65	0.65	2.61
OH-13S (Incl. armed)	1.36	0.20	1.26	2.82	0.65	0.65	1.31	2.61
OH-23G (Incl.armed)	0.27	0.00	0.41	0.68	0.00	0.00	0.65	0.65
OH-6A (Incl. armed)	0.07	0.10	0.03	0.2	0.00	0.00	0.00	0.00
SUB TOTAL	4.08	3.12	3.02	10.22	3.27	4.58	2.61	10.46
TOTAL HELICOPTERS	40.67	37.88	16.90	95.45	37.91	41.18	16.99	96.08
O-1	1.15	---	1.06	2.21	1.96	---	0.00	1.96
OV-1A/B/C	0.72	---	0.17	0.89	0.00	---	0.00	0.00
OV-2B	0.20	0.14	0.27	0.61	0.00	0.00	1.31	1.31
U-1A	0.27	0.00	0.07	0.34	0.00	0.00	0.00	0.00
U-6A	0.00	0.00	0.03	0.03	0.00	0.00	0.65	0.65
U-8D	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00
TOTAL FIXED WING	2.37	0.14	1.60	4.11	1.96	0.00	1.96	3.92
TOTAL ARMY AIRCRAFT	43.04	38.02	18.50	99.56	39.87	41.18	18.95	100.00
NON-ARMY AIRCRAFT	---	---	0.44	0.44	---	---	0.00	0.00
TOTAL	43.04	38.02	18.94	100.00	39.87	41.18	18.95	100.00

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Table D-10 (C). $\frac{\text{Fatal Wounds}}{\text{All Wounds}}$ (%) by Crew Station vs Aircraft Type (U)

Aircraft Type	Pilot & Copilots	Crew Chiefs & Gunners	Others	All Stations
Armed UH-1B/C*	4.6-3.0	4.5-3.7	3.1-6.7	4.6-3.3
Unarmed UH-1B*	7.7-7.2	0.0-3.1	0.0-2.4	4.2-2.6
Unarmed UH-1D/H*	8.8-5.3	9.6-6.0	8.6-5.3	9.0-5.5
TOTAL UH-1	4.92	5.47	5.38	5.22
CH-21C/37/47	5.7	7.2	2.6	5.73
OH-13S/23G/6A	2.0	---	6.8	4.59
TOTAL HELICOPTERS	4.84	5.64	5.22	5.23
TOTAL FIXED WING	4.3	---	5.9	5.0
TOTAL ARMY AIRCRAFT	4.81	5.62	5.32	5.22
TOTAL	4.81	5.62	5.20	5.19

* Range includes unspecified UH-1 types and models.

Table D-11 (C). General Anatomical Location of Wounds by Severity vs Crew Station & Aircraft Type (U)

	All Aircraft				UH-1				Other Rotary Wing				Fixed Wing		
	All	Pi&Cp	CC&G	Others	All	Pi&Cp	CC&G	Others	All	Pi&Cp	CC&G	Others	All	Pi&Co	Others
FATAL WOUNDS															
Head & Neck	81	34	30	17	69	27	28	14	9	5	2	2	3	2	1
Torso	62	24	26	12	52	23	21	8	7	---	5	2	3	1	2
Legs	6	3	3	- -	6	3	3	---	---	---	---	---	---	---	---
Arms	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Numerous Wounds	2	---	2	---	2	---	2	---	---	---	---	---	---	---	---
Unknown	2	---	2	---	2	---	2	---	---	---	---	---	---	---	---
TOTAL	153	61	63	29	131	53	56	22	16	5	7	4	6	3	3
SERIOUS WOUNDS															
Head & Neck	16	8	4	4	16	8	4	4	---	---	---	---	---	---	---
Torso	18	8	6	4	13	4	6	3	4	4	---	---	1	---	1
Legs	10	2	7	1	8	1	6	1	2	1	1	---	---	---	---
Arms	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Numerous Wounds	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Unknown	5	2	1	2	3	2	1	---	2	---	---	2	---	---	---
TOTAL	49	20	18	11	40	15	17	8	8	5	1	2	1	---	1
NON-SERIOUS WOUNDS															
Head & Neck	322	174	95	53	255	137	81	37	44	21	12	11	23	16	7
Torso	130	41	58	31	109	37	53	19	15	3	5	7	6	1	5
Legs	655	282	292	81	545	232	258	55	81	35	27	19	29	15	14
Arms	580	274	230	76	486	231	202	53	58	21	26	11	36	22	14
Numerous Wounds	3	---	---	3	4	---	---	3	---	---	---	---	---	---	---
Unknown	1054	418	364	272	943*	373	357	213*	84	31	6	47	27	14	13
TOTAL	2744	1189	1039	516	2341*	1010	951	380*	282	111	76	95	121	68	53
TOTAL WOUNDS															
Head & Neck	419	216	129	74	340	172	113	55	53	26	14	13	26	18	8
Torso	210	73	90	47	174	64	80	30	26	7	9	10	10	2	8
Legs	671	287	302	82	559	236	267	56	83	36	28	19	29	15	14
Arms	580	274	230	76	486	231	202	53	58	21	26	11	36	22	14
Numerous Wounds	5	---	2	3	5	---	2	3	---	---	---	---	---	---	---
Unknown	1061	420	367	274	948*	375	360	213*	86	31	6	49	27	14	13
TOTAL	2946	1270	1120	556	2512*	1078	1024	410*	306	121	83	102	128	71	57

* Includes 1 UH-1F casualty.

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Table D-12 (C). Specific Anatomical Location of Wound vs Crew Station & Severity — All Aircraft (1962-1967) (U)

Site	Pilot - Copilot				Crew Chief & Gunner				Others				All Stations			
	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious
Forehead	12	5	1	6	8	4	---	4	10	3	---	7	30	12	1	17
Skull	8	4	1	3	12	8	---	4	9	5	2	2	29	17	3	9
Face	122	4	4	114	59	8	2	49	27	3	---	24	208	15	6	187
Eye	17	---	1	16	10	---	---	10	3	1	1	1	30	1	2	27
Ear/Mastoid	1	1	---	---	1	---	---	1	---	---	---	---	2	1	---	1
Head, Top	1	1	---	---	2	---	---	2	---	---	---	---	3	1	---	2
Head, Unknown	18	9	1	8	14	9	1	4	10	4	1	5	42	22	3	17
Neck	37	10	---	27	23	1	1	21	15	1	---	14	75	12	1	62
Chest	32	18	1	13	31	17	3	11	7	1	2	4	70	36	6	28
Abdomen	7	3	2	2	11	4	2	5	11	5	1	5	29	12	5	12
Back	10	2	2	6	14	3	---	11	11	3	1	7	35	8	3	24
Torso, Spine	---	---	---	---	2	1	---	1	---	---	---	---	2	1	---	1
Torso, Lumbar	1	1	---	---	2	1	---	1	---	---	---	---	3	2	---	1
Hip	6	---	1	5	7	---	---	7	1	---	---	1	14	---	1	13
Buttocks	10	---	---	10	14	---	---	14	11	1	---	10	35	1	---	34
Groin	2	---	1	1	3	---	1	2	4	1	---	3	9	1	2	6
Torso, Unknown	5	---	1	4	6	---	---	6	2	1	---	1	13	1	1	11
Upper Leg	45	3	---	42	64	3	1	60	13	---	---	13	122	6	1	115
Knee	19	---	---	19	28	---	3	25	1	---	---	1	48	---	3	45
Lower Leg	67	---	1	66	63	---	---	63	13	---	1	12	143	---	2	141
Ankle	16	---	---	16	10	---	1	9	1	---	---	1	27	---	1	26
Foot	44	---	---	44	36	---	---	36	12	---	---	12	92	---	---	92
Leg, Unknown	96	---	1	95	101	---	2	99	42	---	---	42	239	---	3	236
Shoulder	28	---	---	28	18	---	---	18	13	---	---	13	59	---	---	59
Upper Arm	33	---	---	33	25	---	---	25	8	---	---	8	66	---	---	66
Elbow	21	---	---	21	10	---	---	10	2	---	---	2	33	---	---	33
Lower Arm	65	---	---	65	43	---	---	43	11	---	---	11	119	---	---	119
Wrist	5	---	---	5	8	---	---	8	2	---	---	2	15	---	---	15
Hand	36	---	---	36	70	---	---	70	21	---	---	21	127	---	---	127
Arm, Unknown	86	---	---	86	56	---	---	56	19	---	---	19	161	---	---	161
Numerous Wounds	---	---	---	---	2	2	---	---	3	---	---	3	5	2	---	3
Unknown Site	420	---	2	418	367	2	1	364	274	---	2	272	1061	2	5	1054
TOTAL	1270	61	20	1189	1120	63	18	1039	556	29	11	516	2946	153	49	2744

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Table D-13 (C). Specific Anatomical Location of Wound vs Crew Station & Severity
UH-1 -(1962-1967) (U)

Site	Pilot - Copilot				Crew Chief & Gunner				Others				All Stations			
	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious
Forehead	10	1	1	5	8	4	---	4	7	3	---	4	25	11	1	13
Skull	6	3	1	2	8	7	---	1	8	4	2	2	22	14	3	5
Face	87	2	4	81	53	7	2	44	20	2	---	18	160	11	6	143
Eye	17	---	1	16	10	---	---	0	3	1	1	1	30	1	2	27
Ear/Mastoid	1	1	---	---	1	---	---	1	---	---	---	---	2	1	---	1
Head, Top	1	1	---	---	1	---	---	1	---	---	---	---	2	1	---	1
Head, Unknown	16	7	1	8	14	9	1	4	7	3	1	3	37	19	3	15
Neck	34	9	---	25	18	1	1	16	10	1	---	9	62	11	1	50
Chest	31	18	1	12	28	14	3	11	5	1	1	3	64	33	5	26
Abdomen	5	2	1	2	11	4	2	5	6	3	1	2	22	9	4	9
Back	8	2	1	5	12	1	---	11	8	2	1	5	28	5	2	21
Torso, Spine	--	---	---	---	2	1	---	1	---	---	---	---	2	1	---	1
Torso, Lumbar	1	1	---	---	2	1	---	1	---	---	---	---	3	2	---	1
Hip	5	---	---	5	6	---	---	6	---	---	---	---	11	---	---	11
Buttocks	8	---	---	8	12	---	---	12	7	1	---	6	27	1	---	26
Groin	2	---	1	1	3	---	1	2	2	---	--	2	7	---	2	5
Torso, Unknown	4	---	---	4	4	---	---	4	2	1	---	1	10	1	---	9
Upper Leg	36	3	---	33	55	3	1	51	7	---	---	7	98	6	1	91
Knee	18	---	---	18	26	---	3	23	1	---	---	1	45	---	3	42
Lower Leg	53	---	---	53	53	---	---	53	10	---	1	9	116	---	1	115
Ankle	15	---	---	15	9	---	1	8	1	---	---	1	25	---	1	24
Foot	35	---	---	35	35	---	---	35	8	---	---	8	78	---	---	78
Leg, Unknown	79	---	1	78	89	---	1	88	29	---	---	29	197	---	2	195
Shoulder	24	---	---	24	17	---	---	17	8	---	---	8	49	---	---	49
Upper Arm	27	---	---	27	23	---	---	23	4	---	---	4	54	---	---	54
Elbow	19	---	---	19	8	---	-	8	2	---	---	2	29	---	---	29
Lower Arm	50	---	---	50	33	---	---	33	8	---	---	8	91	---	---	91
Wrist	5	---	---	5	7	---	---	7	1	---	---	1	13	---	---	13
Hand	33	---	---	33	62	---	---	62	14	---	---	14	109	---	---	109
Arm, Unknown	73	---	---	73	52	---	---	52	16	---	---	16	141	---	---	141
Numerous Wounds	---	---	---	---	2	2	---	---	3	---	---	3	5	2	---	3
Unknown Site	375	---	2	373	360	2	1	357	213*	---	---	213*	948*	2	3	943*
TOTAL	1078	53	15	1010	1024	56	17	951	410*	22	8	380*	2512*	131	40	2341*

*Includes 1 UH-1F casualty.

Table D-14 (C). Specific Anatomical Location of Wound vs Crew Station & Severity
Armed UH-1, 1962-1967 (U)

Site	Pilot - Copilot				Crew Chief & Gunner				Others				All Stations			
	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious
Forehead	4	3	---	1	1	---	---	1	---	---	---	---	5	3	---	2
Skull	1	---	---	1	3	3	---	---	1	1	---	---	5	4	---	1
Face	34	---	1	33	21	1	---	20	3	---	---	3	58	1	1	56
Eye	10	---	1	9	5	---	---	5	---	---	---	---	15	---	1	14
Ear/Mastoid	1	1	---	---	---	---	---	---	---	---	---	---	1	1	---	---
Head, Top	1	1	---	---	---	---	---	---	---	---	---	---	1	1	---	---
Head, Unknown	3	---	1	2	4	2	1	1	1	1	---	---	8	3	2	3
Neck	15	3	---	12	8	---	1	7	2	---	---	2	25	3	1	21
Chest	7	4	---	3	7	2	1	4	1	---	1	---	15	6	2	7
Abdomen	3	---	1	2	3	2	1	---	---	---	---	---	6	2	2	2
Back	1	---	---	1	4	---	---	4	1	---	---	1	6	---	---	6
Torso, Spine	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---
Torso, Lumbar	1	1	---	---	---	---	---	---	---	---	---	---	1	---	---	---
Hip	1	---	---	1	2	---	---	2	---	---	---	---	3	---	---	3
Buttocks	1	---	---	1	4	---	---	4	---	---	---	---	5	---	---	5
Groin	2	---	1	1	1	---	1	---	---	---	---	---	3	---	2	1
Torso, Unknown	1	---	---	1	1	---	---	1	---	---	---	---	2	---	---	2
Upper Leg	18	1	---	17	28	2	1	25	1	---	---	1	47	3	1	43
Knee	7	---	---	7	12	---	2	10	1	---	---	1	20	---	2	18
Lower Leg	16	---	---	16	31	---	---	31	1	---	1	---	48	---	1	47
Ankle	5	---	---	5	5	---	1	4	---	---	---	---	10	---	1	9
Foot	13	---	---	13	15	---	---	15	1	---	---	1	29	---	---	29
Leg, Unknown	29	---	1	28	27	---	1	26	3	---	---	3	59	---	2	57
Shoulder	12	---	---	12	5	---	---	5	1	---	---	1	18	---	---	18
Upper Arm	12	---	---	12	10	---	---	10	1	---	---	1	23	---	---	23
Elbow	9	---	---	9	3	---	---	3	---	---	---	---	12	---	---	12
Lower Arm	28	---	---	28	19	---	---	19	---	---	---	---	47	---	---	47
Wrist	4	---	---	4	4	---	---	4	1	---	---	1	9	---	---	9
Hand	15	---	---	15	17	---	---	17	2	---	---	2	34	---	---	34
Arm, Unknown	30	---	---	30	20	---	---	20	2	---	---	2	52	---	---	52
Numerous Wounds	---	---	---	---	1	1	---	---	---	---	---	---	1	1	---	---
Unknown Site	21	---	---	21	28	---	---	28	7	---	---	7	56	---	---	56
TOTAL	305	14	6	285	289	13	10	266	30	2	2	26	624	29	18	577

* Excludes reports with model unspecified.

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Table L-15 (C). Specific Anatomical Location of Wound vs Crew Station & Severity
Transport UH-1, 1965-1967 (U)

Site	Pilot - Copilot				Crew Chief & Gunner				Others				All Stations			
	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious
Forehead	4	1	1	2	6	4	---	[illegible]	3	1	---	2	13	[illegible]	1	6
Skull	4	3	1	---	5	5	---	---	6	2	2	2	13	8	3	2
Face	25	2	1	22	19	5	---	4	12	2	---	10	56	9	1	46
Eye	5	---	---	5	2	---	---	2	1	---	1	---	8	---	1	7
Ear/Mastoid	---	---	---	---	1	---	---	1	---	---	---	---	1	---	---	1
Head, Top	---	---	---	---	1	---	---	1	---	---	---	---	1	---	---	1
Head, Unknown	9	5	---	[illegible]	7	5	---	[illegible]	6	2	1	3	22	12	1	9
Neck	12	5	---	7	3	---	---	3	4	2	---	2	19	7	---	12
Chest	15	8	---	7	13	8	2	3	3	1	---	2	31	17	2	12
Abdomen	2	2	---	---	7	1	1	5	6	3	1	2	15	6	2	7
Back	4	1	1	2	5	---	---	[illegible]	6	2	1	3	15	3	2	10
Torso, Spine	---	---	---	---	2	1	---	1	---	---	---	---	2	1	---	1
Torso, Lumbar	---	---	---	---	2	1	---	[illegible]	---	---	---	---	2	1	---	1
Hip	3	---	---	3	3	---	---	3	---	---	---	---	6	---	---	6
Buttocks	6	---	---	[illegible]	5	---	---	[illegible]	4	---	---	4	15	---	---	15
Groin	---	---	---	---	1	---	---	[illegible]	2	---	---	2	3	---	---	3
Torso, Unknown	1	---	---	1	1	---	---	1	2	1	---	1	4	1	---	3
Upper Leg	8	2	---	[illegible]	9	---	---	[illegible]	3	---	---	3	20	2	---	18
Knee	8	---	---	8	9	---	1	8	---	---	---	---	17	---	1	16
Lower Leg	26	---	---	26	9	---	---	9	8	---	---	8	43	---	---	43
Ankle	[illegible]	---	---	4	2	---	---	2	1	---	---	1	7	---	---	7
Foot	15	---	---	15	11	---	---	11	4	---	---	4	30	---	---	30
Leg Unknown	36	---	---	36	41	---	---	41	18	---	---	18	95	---	---	95
Shoulder	9	---	---	[illegible]	8	---	---	8	5	---	---	5	22	---	---	22
Upper Arm	10	---	---	10	5	---	---	5	2	---	---	2	17	---	---	17
Elbow	5	---	---	[illegible]	3	---	---	[illegible]	1	---	---	1	9	---	---	9
Lower Arm	10	---	---	10	5	---	---	5	3	---	---	3	18	---	---	18
Wrist	---	---	---	---	2	---	---	2	---	---	---	---	2	---	---	2
Hand	10	---	---	10	20	---	---	20	7	---	---	7	37	---	---	37
Arm, Unknown	22	---	---	22	20	---	---	20	11	---	---	11	53	---	---	53
Numerous Wounds	---	---	---	---	1	1	---	---	3	---	---	3	4	1	---	3
Unknown Site	85	---	1	84	86	1	---	85	58	---	---	58	229	1	1	227
TOTAL	338	29	5	304	312	30	4	278	179	16	6	157	829	75	15	739

* Excludes reports with models unspecified.

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Table D-16 (C). Specific Anatomical Location of Wound vs Crew Station & Severity
Other (Non UH-1) Rotary Wing, 1962 through 1967 (U)

Site	Pilot & Copilot				Crew Chief & Gunner				Others				All Stations			
	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious	Total	Fatal	Serious	Non-Serious
Forehead	1	1	---	---	---	---	---	---	2	---	---	2	3	1	---	2
Skull	1	---	---	1	3	1	---	2	1	---	---	1	5	1	---	4
Face	22	2	---	20	5	1	---	4	6	1	---	5	33	4	---	29
Eye	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Ear/Mastoid	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Head, Top	---	---	---	---	1	---	---	1	---	---	---	---	1	---	---	1
Head, Unknown	1	1	---	---	---	---	---	---	2	1	---	1	3	2	---	1
Neck	1	1	---	---	5	---	---	5	2	---	---	2	8	1	---	7
Chest	1	---	---	1	3	3	---	---	1	---	---	1	5	3	---	2
Abdomen	1	---	1	---	---	---	---	---	2	---	---	2	3	---	1	2
Back	2	---	1	1	1	1	---	---	3	2	---	1	6	3	1	2
Torso, Spine	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Torso, Lumbar	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Hip	1	---	1	---	1	---	---	1	1	---	---	1	3	---	1	2
Buttocks	1	---	---	1	2	---	---	2	2	---	---	2	5	---	---	5
Groin	---	---	---	---	---	---	---	---	1	1	---	---	1	1	---	---
Torso, Unknown	1	---	1	---	2	---	---	2	---	---	---	---	3	---	1	2
Upper Leg	7	---	---	7	8	---	---	8	3	---	---	3	18	---	---	18
Knee	1	---	---	1	2	---	---	2	---	---	---	---	3	---	---	3
Lower Leg	10	---	1	9	9	---	---	9	1	---	---	1	20	---	1	19
Ankle	1	---	---	1	---	---	---	---	1	---	---	1	2	---	---	2
Foot	5	---	---	5	1	---	---	1	2	---	---	2	8	---	---	8
Leg, Unknown	12	---	---	12	8	---	1	7	12	---	---	12	32	---	1	31
Shoulder	2	---	---	2	1	---	---	1	2	---	---	2	5	---	---	5
Upper Arm	5	---	---	5	2	---	---	2	1	---	---	1	8	---	---	8
Elbow	1	---	---	1	2	---	---	2	---	---	---	---	3	---	---	3
Lower Arm	6	---	---	6	9	---	---	9	2	---	---	2	17	---	---	17
Wrist	---	---	---	---	1	---	---	1	1	---	---	1	2	---	---	2
Hand	2	---	---	2	7	---	---	7	3	---	---	3	12	---	---	12
Arm, Unknown	5	---	---	5	4	---	---	4	2	---	---	2	11	---	---	11
Numerous Wounds	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Unknown Site	31	---	---	31	6	---	---	6	49	---	2	47	86	---	2	84
TOTAL	121	5	5	111	83	6	1	76	102	5	2	95	306	16	8	282

Table D-17 (C). Specific Anatomical Location of Wound vs Crew Station & Severity
CH-21C - 1962 - 1964 (U)

Site	Pilot & Copilot			Crew Chief & Gunner			Passenger			All Stations		
	Total	Fatal* & Serious	Non-Serious	Total	Fatal* & Serious	Non-Serious	Total	Fatal* & Serious	Non-Serious	Total	Fatal* & Serious	Non-Serious
Forehead	---	---	---	---	---	---	1	---	1	1	---	1
Skull	---	---	---	2	---	2	---	---	---	2	---	2
Face	12	2F	10	3	1F	2	---	---	---	15	3F	12
Eye	---	---	---	---	---	---	---	---	---	---	---	---
Ear/Mastoid	---	---	---	---	---	---	---	---	---	---	---	---
Head, Scalp	---	---	---	---	---	---	---	---	---	---	---	---
Head, Unknown	---	---	---	---	---	---	---	---	---	---	---	---
Neck	---	---	---	3	---	3	---	---	---	3	---	3
Chest	---	---	---	3	3F	---	---	---	---	3	3F	---
Abdomen	---	---	---	---	---	---	---	---	---	---	---	---
Back	---	---	---	1	1F	---	---	---	---	1	1F	---
Torso, Spine	---	---	---	---	---	---	---	---	---	---	---	---
Torso, Lumbar	---	---	---	---	---	---	---	---	---	---	---	---
Hip	1	1S	---	---	---	---	---	---	---	1	1S	---
Buttocks	---	---	---	---	---	---	---	---	---	---	---	---
Groin	---	---	---	---	---	---	---	---	---	---	---	---
Torso, Unknown	---	---	---	---	---	---	---	---	---	---	---	---
Upper Leg	1	---	1	4	---	4	---	---	---	5	---	5
Knee	---	---	---	1	---	1	---	---	---	1	---	1
Lower Leg	2	---	2	5	---	5	---	---	---	7	---	7
Ankle	---	---	---	---	---	---	---	---	---	---	---	---
Foot	1	---	1	---	---	---	---	---	---	1	---	1
Leg, Unknown	5	---	5	2	---	2	---	---	---	7	---	7
Shoulder	---	---	---	---	---	---	---	---	---	---	---	---
Upper Arm	4	---	4	1	---	1	---	---	---	5	---	5
Elbow	---	---	---	2	---	2	---	---	---	2	---	2
Lower Arm	4	---	4	6	---	6	2	---	2	12	---	12
Wrist	---	---	---	---	---	---	---	---	---	---	---	---
Hand	1	---		---	---	---	---	---	---	1	---	1
Arm, Unknown	4	---		2	---	2	1	---	1	7	---	7
Numerous Wounds	---	---	---	---	---	---	---	---	---	---	---	---
Unknown Site	3	---	3	1	---	1	1	---	1	5	---	5
TOTAL	38	3	35	36	5	31	5	0	5	79	8	71

* Fatal and Serious denoted as F&S.

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Table D-18 (C). Specific Anatomical Location of Wound vs Crew Station & Severity
CH-47 - 1965 - 1967 (U)

Site	Pilot & Copilot Total	Pilot & Copilot Fatal* & Serious	Pilot & Copilot Non-Serious	Crew Chief & Gunner Total	Crew Chief & Gunner Fatal* & Serious	Crew Chief & Gunner Non-Serious	Others Total	Others Fatal* & Serious	Others Non-Serious	All Stations Total	All Stations Fatal & Serious	All Stations Non-Serious
Forehead	1	1F	---	---	---	---	---	---	---	1	1F	---
Skull	1	---	1	1	1F	---	---	---	---	2	1F	1
Face	3	---	3	1	---	1	2	---	2	6	---	6
Eye	---	---	---	---	---	---	---	---	---	---	---	---
Ear/Mastoid	---	---	---	---	---	---	---	---	---	---	---	---
Head, Top	---	---	---	1	---	1	---	---	---	1	---	1
Head, Unknown	---	---	---	---	---	---	---	---	---	---	---	---
Neck	1	1F	---	2	---	2	---	---	---	3	1F	2
Chest	---	---	---	---	---	---	---	---	---	---	---	---
Abdomen	---	---	---	---	---	---	2	---	2	2	---	2
Back	---	---	---	---	---	---	2	1F	1	2	1F	1
Torso, Spine	---	---	---	---	---	---	---	---	---	---	---	---
Torso, Lumbar	---	---	---	---	---	---	---	---	---	---	---	---
Hip	---	---	---	1	---	1	1	---	1	2	---	2
Buttocks	---	---	---	2	---	2	1	---	1	3	---	3
Groin	---	---	---	---	---	---	---	---	---	---	---	---
Torso, Unknown	---	---	---	2	---	2	---	---	---	2	---	2
Upper Leg	2	---	2	4	---	4	---	---	---	6	---	6
Knee	---	---	---	1	---	1	---	---	---	1	---	1
Lower Leg	6	1S	5	4	---	4	1	---	1	11	1S	10
Ankle	1	---	1	---	---	---	---	---	---	1	---	1
Foot	1	---	1	1	---	1	---	---	---	2	---	2
Leg, Unknown	4	---	4	6	1S	5	5	---	5	15	1S	14
Shoulder	1	---	1	1	---	1	---	---	---	2	---	2
Upper Arm	1	---	1	---	---	---	1	---	1	2	---	2
Elbow	---	---	---	---	---	---	---	---	---	---	---	---
Lower Arm	1	---	1	3	---	3	---	---	---	4	---	4
Wrist	---	---	---	1	---	1	1	---	1	2	---	2
Hand	---	---	---	5	---	5	---	---	---	5	---	5
Arm, Unknown	1	---	1	2	---	2	1	---	1	4	---	4
Numerous Wounds	---	---	---	---	---	---	---	---	---	---	---	---
Unknown Site	7	---	7	5	---	5	16	---	16	28	---	28
TOTAL	31	3	28	43	2	41	33	1	32	107	6	101

* Fatal & Serious denoted as F&S.

Table D-19 (C). Specific Anatomical Location of Wound vs Crew Station & Severity OH-13S, OH-23G, & OH-6A (1965 through 1967) (U)

Site	Pilot Total	Pilot Fatal* & Serious	Pilot Non-Serious	Others Total	Others Fatal* & Serious	Others Non-Serious	All Stations Total	All Stations Fatal* & Serious	All Stations Non-Serious
Forehead	---	---	---	1	---	1	1	---	1
Skull	---	---	---	1	---	1	1	---	1
Face	7	---	7	4	1F	3	11	1F	10
Eye	---	---	---	---	---	---	---	---	---
Ear/Mastoid	---	---	---	---	---	---	---	---	---
Head, Top	---	---	---	---	---	---	---	---	---
Head, Unknown	1	1F	---	1	1F	---	2	2F	---
Neck	---	---	---	2	---	2	2	---	2
Chest	1	---	1	1	---	1	2	---	2
Abdomen	1	1S	---	---	---	---	1	1S	---
Back	2	1S	1	1	1F	---	3	2	1
Torso, Spine	---	---	---	---	---	---	---	---	---
Torso, Lumbar	---	---	---	---	---	---	---	---	---
Hip	---	---	---	---	---	---	---	---	---
Buttocks	1	---	1	1	---	1	2	---	2
Groin	---	---	---	1	1F	---	1	1F	---
Torso, Unknown	1	1S	---	---	---	---	1	1S	---
Upper Leg	4	---	4	3	---	3	7	---	7
Knee	1	---	1	---	---	---	1	---	1
Lower Leg	2	---	2	---	---	---	2	---	2
Ankle	---	---	---	1	---	1	1	---	1
Foot	3	---	3	2	---	2	5	---	5
Leg, Unknown	3	---	3	6	---	6	9	---	9
Shoulder	1	---	1	1	---	1	2	---	2
Upper Arm	---	---	---	---	---	---	---	---	---
Elbow	1	---	1	---	---	---	1	---	1
Lower Arm	---	---	---	---	---	---	---	---	---
Wrist	---	---	---	---	---	---	---	---	---
Hand	1	---	1	2	---	2	3	---	3
Arm, Unknown	---	---	---	---	---	---	---	---	---
Numerous Wounds	---	---	---	---	---	---	---	---	---
Unknown Site	20	---	20	31	2S	29	51	2S	49
TOTAL	50	4	46	59	6	53	109	10	99

* Fatal & Serious denoted as F&S.

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Table D-20 (C). Specific Anatomical Location of Wound vs Crew Station & Severity
Fixed Wing Aircraft (1962 through 1967) (U)

Site	Pilot & Copilots			Others			All Stations		
	Total	Fatal* & Serious	Non-Serious	Total	Fatal* & Serious	Non-Serious	Total	Fatal* & Serious	Non-Serious
Forehead	1	---	1	1	---	1	2	---	2
Skull	1	1	---	1	1F	---	2	2F	---
Face	13	---	13	2	---	2	15	---	15
Eye	---	---	---	---	---	---	---	---	---
Ear/Mastoid	---	---	---	---	---	---	---	---	---
Head, Top	---	---	---	---	---	---	---	---	---
Head, Unknown	1	1	---	1	---	1	2	1F	1
Neck	2	---	2	3	---	3	5	---	5
Chest	---	---	---	1	1S	---	1	1S	---
Abdomen	1	1	---	3	2F	1	4	3F	1
Back	---	---	---	1	---	1	1	---	1
Torso, Spine	---	---	---	---	---	---	---	---	---
Torso, Lumbar	---	---	---	---	---	---	---	---	---
Hip	---	---	---	---	---	---	---	---	---
Buttocks	1	---	1	2	---	2	3	---	3
Groin	---	---	---	1	---	1	1	---	1
Torso, Unknown	---	---	---	---	---	---	---	---	---
Upper Leg	2	---	2	4	---	4	6	---	6
Knee	---	---	---	---	---	---	---	---	---
Lower Leg	4	---	4	3	---	3	7	---	7
Ankle	---	---	---	---	---	---	---	---	---
Foot	4	---	4	2	---	2	6	---	6
Leg, Unknown	5	---	5	5	---	5	10	---	10
Shoulder	2	---	2	3	---	3	5	---	5
Upper Arm	1	---	1	3	---	3	4	---	4
Elbow	1	---	1	---	---	---	1	---	1
Lower Arm	9	---	9	2	---	2	11	---	11
Wrist	---	---	---	---	---	---	---	---	---
Hand	1	---	1	5	---	5	6	---	6
Arm, Unknown	8	---	8	1	---	1	9	---	9
Numerous Wounds	---	---	---	---	---	---	---	---	---
Unknown Site	14	---	14	13	---	13	27	---	27
TOTAL	71	3	68	57	4	53	128	7	121

* Fatal & Serious denoted as F&S.

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Table D-21 (C). Reported Cause of Wound vs Severity & General Anatomical Location
All Aircraft (U)

Site	Bullet	Shrapnel	Fragment	Missile	Land Mine	Booby Trap	Debris Metal	Debris Plexiglas	Unknown	Total
Fatal Wounds										
Head & Neck	72	3	2	1	3	---	---	---	---	81
Torso	60	---	---	1	1	---	---	---	---	62
Legs	6	---	---	---	---	---	---	---	---	6
Arms	---	---	---	---	---	---	---	---	---	0
Numerous Wounds	1	---	---	1	---	---	---	---	---	2
Unknown Site	1	---	---	---	1	---	---	---	---	2
TOTAL	140	3	2	3	5	---	---	---	---	153
Serious Wounds										
Head & Neck	9	1	2	1	---	---	2	1	---	16
Torso	16	1	---	1	---	---	---	---	---	18
Legs	8	---	---	2	---	---	---	---	---	10
Arms	---	---	---	---	---	---	---	---	---	0
Numerous Wounds	---	---	---	---	---	---	---	---	---	0
Unknown Site	5	---	---	---	---	---	---	---	---	5
TOTAL	38	2	2	4	---	---	2	1	---	49
Non-Serious Wounds										
Head & Neck	33	60	16	11	2	---	114	86	---	322
Torso	54	18	8	13	2	3	29	3	---	130
Legs	270	103	19	68	4	---	169	17	---	655
Arms	130	89	26	33	4	1	240	56	1	580
Numerous Wounds	---	3	---	---	---	---	---	---	---	3
Unknown Site	339	23	52	3	22	6	519	90	---	1,054
TOTAL	826	301	121	128	34	10	1,071	252	1	2,744
Total Wounds										
Head & Neck	114	64	20	13	5	0	116	87	---	419
Torso	130	19	8	15	3	3	29	3	---	210
Legs	284	108	19	70	4	0	169	17	---	671
Arms	130	89	26	33	4	1	240	56	1	580
Numerous Wounds	1	3	---	1	---	---	---	---	---	5
Unknown Site	345	23	52	3	23	6	519	90	---	1,061
TOTAL	1,004	306	125	135	39	10	1,073	253	1	2,946

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Table D-22 (C). Reported Cause of Wound vs Specific Anatomical Location
All Severities - All Aircraft (U)

Site	Bullet	Shrapnel	Fragment	Missile	Land Mine	Booby Trap	Debris Metal	Debris Plexiglas	Unknown	Total
Forehead	15	4	---	1	1	---	7	2	---	30
Skull	24	---	---	1	1	---	3	---	---	29
Face	23	44	9	4	1	---	61	66	---	208
Eye	2	5	6	1	---	---	9	7	---	30
Ear/Mastoid	2	---	---	---	---	---	---	---	---	2
Head, Top	1	---	---	---	1	---	1	---	---	3
Head, Unknown	27	---	5	3	1	---	6	---	---	42
Neck	20	11	---	3	---	---	29	12	---	75
Chest	51	6	1	3	2	1	5	1	---	70
Abdomen	20	2	1	3	---	---	3	---	---	29
Back	19	6	2	2	---	---	6	---	---	35
Torso, Spine	1	---	---	---	---	---	1	---	---	2
Torso, Lumbar	2	---	---	---	1	---	---	---	---	3
Hip	6	2	---	1	---	1	4	---	---	14
Buttocks	20	2	1	6	---	1	5	---	---	35
Groin	7	---	2	---	---	---	---	---	---	9
Torso, Unknown	4	1	1	---	---	---	5	2	---	13
Upper Leg	59	15	5	17	---	---	24	2	---	122
Knee	17	5	1	9	1	---	14	1	---	48
Lower Leg	54	26	7	12	1	---	39	4	---	143
Ankle	14	4	---	3	---	---	5	1	---	27
Foot	53	12	---	12	1	---	14	---	---	92
Leg, Unknown	87	46	6	17	1	---	73	9	---	239
Shoulder	26	11	3	3	1	1	13	1	---	59
Upper Arm	17	13	---	4	---	---	28	4	---	66
Elbow	7	7	1	1	---	---	15	2	---	33
Lower Arm	16	16	3	7	1	---	57	19	---	119
Wrist	3	2	---	3	---	---	6	1	---	15
Hand	26	17	11	7	1	---	52	12	1	127
Arm, Unknown	35	23	8	8	1	---	69	17	---	161
Numerous Wounds	1	3	---	1	---	---	---	---	---	5
Unknown Site	345	23	52	3	23	6	519	90	---	1,061
TOTAL	1,004	306	125	135	39	10	1,073	253	1	2,946

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Table D-23 (C). Reported Cause vs Specific Anatomical Location
Fatal Wounds Only (All Aircraft) (U)

Site	Bullet	Shrapnel	Fragment	Missile	Land Mine	Booby Trap	Debris Metal or Plexiglas	Total
Forehead	11	---	---	---	1	---	---	12
Skull	16	---	---	---	1	---	---	17
Face	12	2	---	---	1	---	---	15
Eye	---	---	1	---	---	---	---	1
Ear/Mastoid	1	---	---	---	---	---	---	1
Head, Top	1	---	---	---	---	---	---	1
Head, Unknown	20	---	1	1	---	---	---	22
Neck	11	1	---	---	---	---	---	12
Chest	35	---	---	---	1	---	---	36
Abdomen	11	---	---	1	---	---	---	12
Back	8	---	---	---	---	---	---	8
Torso, Spine	1	---	---	---	---	---	---	1
Torso, Lumbar	2	---	---	---	---	---	---	2
Hip	---	---	---	---	---	---	---	---
Buttocks	1	---	---	---	---	---	---	1
Groin	1	---	---	---	---	---	---	1
Torso, Unknown	1	---	---	---	---	---	---	1
Upper Leg	6	---	---	---	---	---	---	6
Leg, Other	---	---	---	---	---	---	---	---
Arm	---	---	---	---	---	---	---	---
Numerous Wounds	1	---	---	1	---	---	---	2
Unknown Site	1	---	---	---	1	---	---	2
TOTAL	140	3	2	3	5	---	---	153

Table D-24 (C). Reported Cause vs Specific Anatomical Location
Serious Wounds Only (All Aircraft) (U)

Site	Bullet	Shrapnel	Fragment	Missile	Land Mine or Booby Trap	Debris Metal	Debris Plexiglas	Total
Forehead	1	---	---	---	---	---	---	1
Skull	3	---	---	---	---	---	---	3
Face	3	---	1	1	---	1	---	6
Eye	---	1	---	---	---	---	1	2
Ear/Mastoid	---	---	---	---	---	---	---	---
Head, Top	---	---	---	---	---	---	---	---
Head, Unknown	2	---	1	---	---	---	---	3
Neck	---	---	---	---	---	1	---	1
Chest	4	1	---	1	---	---	---	6
Abdomen	5	---	---	---	---	---	---	5
Back	3	---	---	---	---	---	---	3
Torso, Spine	---	---	---	---	---	---	---	---
Torso, Lumbar	---	---	---	---	---	---	---	---
Hip	1	---	---	---	---	---	---	1
Buttocks	---	---	---	---	---	---	---	---
Groin	2	---	---	---	---	---	---	2
Torso, Unknown	1	---	---	---	---	---	---	1
Upper Leg	---	---	---	1	---	---	---	1
Knee	2	---	---	1	---	---	---	3
Lower Leg	2	---	---	---	---	---	---	2
Ankle	1	---	---	---	---	---	---	1
Foot	---	---	---	---	---	---	---	---
Leg, Unknown	3	---	---	---	---	---	---	3
Arm	---	---	---	---	---	---	---	---
Numerous Wounds	---	---	---	---	---	---	---	---
Unknown Site	5	---	---	---	---	---	---	5
TOTAL	38	2	2	4	---	2	1	49

Table D-25 (C). Reported Cause vs Specific Anatomical Location
Non-Serious Wounds Only (All Aircraft)(U)

Site	Bullet	Shrapnel	Fragment	Missile	Land Mine	Booby Trap	Debris Metal	Debris Plexiglas	Unknown	Total
Forehead	3	4	---	1	---	---	7	2	---	17
Skull	5	---	---	1	---	---	3	---	---	9
Face	8	42	8	3	---	---	60	66	---	187
Eye	2	4	5	1	---	---	9	6	---	27
Ear/Mastoid	1	---	---	---	---	---	---	---	---	1
Head, Top	---	---	---	---	1	---	1	---	---	2
Head, Unknown	5	---	3	2	1	---	6	---	---	17
Neck	9	10	---	3	---	---	28	12	---	62
Chest	12	5	1	2	1	1	5	1	---	28
Abdomen	4	2	1	2	---	---	3	---	---	12
Back	8	6	2	2	---	---	6	---	---	24
Torso, Spine	---	---	---	---	---	---	1	---	---	1
Torso, Lumbar	---	---	---	---	1	---	---	---	---	1
Hip	5	2	---	1	---	1	4	---	---	13
Buttocks	19	2	1	6	---	1	5	---	---	34
Groin	4	---	2	---	---	---	---	---	---	6
Torso, Unknown	2	1	1	---	---	---	5	2	---	11
Upper Leg	53	15	5	16	---	---	24	2	---	115
Knee	15	5	1	8	1	---	14	1	---	45
Lower Leg	52	26	7	12	1	---	39	4	---	141
Ankle	13	4	---	3	---	---	5	1	---	26
Foot	53	12	---	12	1	---	14	---	---	92
Leg, Unknown	84	46	6	17	1	---	73	9	---	236
Shoulder	26	11	3	3	1	1	13	1	---	59
Upper Arm	17	13	---	4	---	---	28	4	---	66
Elbow	7	7	1	1	---	---	15	2	---	33
Lower Arm	16	16	3	7	1	---	57	19	---	119
Wrist	3	2	---	3	---	---	6	1	---	15
Hand	26	17	11	7	1	---	52	12	1	127
Arm, Unknown	35	23	8	8	1	---	69	17	---	161
Numerous Wounds	---	3	---	---	---	---	---	---	---	3
Unknown Site	339	23	52	3	22	6	519	90	---	1,054
TOTAL	826	301	121	128	34	10	1,071	252	1	2,744

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Table D-26 (C). Cause of Wounds to Pilots & Copilots vs Anatomical Location - All Severities, All Aircraft (U)

Site	BU	MI	SH	DM	DP	FG	LM	BT	UN	TOTAL
Forehead	7		1	2	1		1			12
Skull	7			1						8
Face	8	1	17	36	57	3				122
Eye	2	1	3	6	3	2				17
Ear/Mastoid	1									1
Neck	10		7	13	7					37
Head, Top	1									1
Head, Unknown	14	2		1		1				18
Chest	24	1	3	1	1	1	1			32
Groin	2									2
Back	7	1		1		1				10
Abdomen	6	1								7
Hip	3		1	2						6
Buttocks	7	2		1						10
Torso, Lumbar	1									1
Torso, Unknown	2				2	1				5
Upper Leg	25	5	3	10	2					45
Knee	7	4	2	4	1	1				19
Lower Leg	28	2	12	17	4	4				67
Ankle	7	1	4	3	1					16
Foot	26	5	6	7						44
Leg, Unknown	29	4	21	33	6	2	1			96
Shoulder	13	1	6	5	1	2				28
Upper Arm	7	2	6	14	4					33
Elbow	2		5	12	2					21
Lower Arm	8	4	8	28	16	1				65
Wrist	1		1	3						5
Hand	9	1	5	11	9	1				36
Arm, Unknown	12	4	13	37	15	5				86
Unknown	131	2	9	192	70	11	5			420
TOTAL	407	44	133	440	202	36	8			1,270

Table D-27 (C). Cause of Wounds to Crew Chiefs & Gunners vs Anatomical Location - All Severities, All Aircraft (U)

Site	BU	MI	SH	DM	DP	FG	LM	PT	UN	TOTAL
Forehead	5			3						8
Skull	10			1			1			12
Face	9	3	22	19	1	4	1			59
Eye			1	3	4	2				10
Ear, Mastoid	1									1
Neck	6	2	4	10	1					23
Head, Top				1			1			2
Head, Unknown	9			3		2				14
Chest	24	1	2	4						31
Groin	1					2				3
Back	6		4	3		1				14
Abdomen	7		1	3						11
Hip	2	1	1	2				1		7
Buttocks	5	2	2	3		1		1		14
Torso, Lumbar	1						1			2
Torso, Spine	1			1						2
Torso, Unknown	1		1	4						6
Upper Leg	28	10	9	12		5				54
Knee	10	5	3	9			1			28
Lower Leg	22	8	12	17		3	1			63
Ankle	7	2		1						10
Foot	19	6	4	6			1			36
Leg, Unknown	36	10	20	28	3	4				101
Shoulder	8	1	3	4		1		1		18
Upper Arm	7	1	7	10						25
Elbow	4	1	2	2		1				10
Lower Arm	8	3	8	20	2	1	1			43
Wrist	2	2		3	1					8
Hand	12	4	10	33	2	8			1	70
Arm, Unknown	14	4	8	27		2	1			56
Numerous Wounds	1	1								2
Unknown Site	121		8	201	8	19	9	1		367
TOTAL	387	67	132	433	22	56	16	4	1	1,120

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Table D-28 (C). Cause of Wounds to "Other" Personnel vs Anatomical Location - All Severities, All Aircraft (U)

Site	BU	MI	SH	DM	DP	FG	LM	BT	UN	TOTAL
Forehead	3	1	3	2	1					10
Skull	7	1		1						9
Face	6		5	6	8	2				27
Eye			1			2				3
Neck	4	1		6	4					15
Head, Unknown	4	1		2		2	1			10
Chest	3	1	1				1	1		7
Groin	4									4
Back	6	1	2	2						11
Abdomen	7	2	1			1				11
Hip	1									1
Buttocks	8	2		1						11
Torso, Unknown	1			1						2
Upper Leg	6	2	3	2						13
Knee				1						1
Lower Leg	4	2	2	5						13
Ankle				1						1
Foot	8	1	2	1						12
Leg, Unknown	22	3	5	12						42
Shoulder	5	1	2	4			1			13
Upper Arm	3	1		4						8
Elbow	1			1						2
Lower Arm				9	1	1				11
Wrist		1	1							2
Hand	5	2	2	8	1	2	1			21
Arm, Unknown	9		2	5	2	1				19
Numerous Wounds			3							5
Unknown Site	93	1	6	126	12	22	9	5	14	288
TOTAL	210	24	41	200	29	33	13	6	14	570

Table D-29 (C). Distribution of Reported Wounds, All Aircraft - Gross Anatomical Location & Crew Station vs Severity & Cause (U)

	Head & Neck			Torso			Legs			Arms			Numerous or Unknown		
	Pi&Cp	CC&G	Others	Pi&Cp	CC&G	Others	Pi&Cp	CC&G	Others	Pi&Cp	CC&G	Others	Pi&Cp	CC&G	Others
FATAL															
Bullet	31	28	13	22	26	12	3	3	0	0	0	0	0	2	0
Shrapnel	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Fragment	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Missile	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0
Land Mine	1	2	0	1	0	0	0	0	0	0	0	0	0	1	0
Booby Traps & Debris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	34	30	17	24	26	12	3	3	0	0	0	0	0	4	0
SERIOUS															
Bullet	6	0	3	7	6	3	2	5	1	0	0	0	2	1	2
Shrapnel	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Fragment	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Missile	1	0	0	0	0	1	0	2	0	0	0	0	0	0	0
Land Mine & Booby Trap	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Debris, Metal	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Debris, Plexiglass	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8	4	4	8	6	4	2	7	1	0	0	0	2	1	2
NON-SERIOUS															
Bullet	13	12	8	23	16	15	117	114	39	52	55	23	129	119	91
Shrapnel	26	27	7	3	11	4	48	48	12	44	38	7	9	8	9
Fragment	6	6	4	3	4	1	7	12	0	9	13	4	11	19	22
Missile	3	5	3	4	4	5	21	39	8	12	16	5	2	0	1
Land Mine	0	1	1	0	1	1	1	3	0	0	2	2	5	8	9
Booby Trap	0	0	0	0	2	1	0	0	0	0	1	0	0	1	5
Debris, Metal	59	38	17	5	20	4	74	73	22	110	100	31	192	201	126
Debris, Plexiglass	67	6	13	3	0	0	14	3	0	47	5	4	70	8	12
TOTAL	174	95	53	41	58	31	282	292	81	274	230	76	418	364	275

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Table D-30 (C). Multiple Personnel Wounded on Same Sortie - Severity & Cause vs Multiple (U)
(All Aircraft)

Severity	Cause	Casualty Multiple 1	2	3	4	>4	Total Sorties
Fatal	Bullet	134	3	0	---	---	137
	Shrapnel	3	0	---	---	---	3
	Fragment	2	0	---	---	---	2
	Missile	3	0	---	---	---	3
	Land Mine	1	2	0	---	---	3
	Booby Trap	0	---	---	---	---	0
	Debris (Metal)	0	---	---	---	---	0
	Debris (Plexiglas)	0	---	---	---	---	0
	Unknown	0	---	---	---	---	0
	TOTAL	143	5	0	---	---	148
Fatal or Serious	Bullet	166	6	0	---	---	172
	Shrapnel	5	0	---	---	---	5
	Fragment	4	0	---	---	---	4
	Missile	7	0	---	---	---	7
	Land Mine	1	2	0	---	---	3
	Booby Trap	0	---	---	---	---	0
	Debris (Metal)	2	0	---	---	---	2
	Debris (Plexiglas)	1	0	---	---	---	1
	Unknown	0	---	---	---	---	0
	TOTAL	186	8	0	---	---	194
All Wounds	Bullet	840	61	10	3	0	914
	Shrapnel	212	32	8	0	1	253
	Fragment	78	12	5	0	1	96
	Missile	120	6	1	0	---	127
	Land Mine	16	5	3	1	0	25
	Booby Trap	6	2	0	---	---	8
	Debris (Metal)	840	84	16	4	0	944
	Debris (Plexiglas)	202	24	1	0	---	227
	Unknown	1	0	---	---	---	1
	TOTAL	2,315	226	44	8	2	2,595

Table D-31 (C). Reported Eye Wounds (U)

(1962 - 1967)
TOTAL: 30

Severity	Cause	Crew Station	Aircraft Type	Remarks
Fatal	Fragment	Passenger	UH-1B	Died later.
Serious	Bullet or Shrapnel	Passenger	UH-1D Transport	
	Plexiglass Debris	Copilot	UH-1B Armed	
Non-Serious	Bullet	Copilot	UH-1D Transport	
	Shrapnel	Copilot	UH-1D Transport	
	Shrapnel	Copilot	UH-1H Transport	
	Fragment	Pilot	UH-1D Transport	
	Fragment	Pilot	UH-1B	
	Fragment	Passenger	UH-1B	
	Fragment	Gunner	UH-1C Armed	
	Fragment (Burn)	Crew Chief	UH-1D Transport	
	Metal Debris	Pilot	UH-1B Armed	
	Metal Debris	Pilot	UH-1B Armed	
	Metal Debris	Pilot	UH-1B Armed	
	Metal Debris	Crew Chief	UH-1B Armed	
	Metal Debris	Crew Chief	UH-1H Transport	
	Metal Debris	Gunner	UH-1B	
	Metal Debris	Gunner	UH-1B Armed	
	Plexiglas Debris	Pilot	UH-1B	
	Plexiglas Debris	Pilot	UH-1B Armed	From windshield.
	Plexiglas Debris	Pilot	UH-1B Armed	From visor.
	Plexiglas Debris	Pilot	UH-1H Transport	
	Plexiglas Debris	Crew Chief	UH-1B	
	Plexiglas Debris	Crew Chief	UH-1B	
	Plexiglas Debris	Gunner	UH-1B Armed	
	Burn	Pilot	UH-1B Armed	
	Burn	Copilot	UH-1B Armed	
	Burn	Gunner	UH-1B Armed	
	Other	Copilot	UH-1B Armed	Rocket motor exploded.
	Unknown	Pilot	UH-1C Armed	

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13. ABSTRACT

All the reported casualties to U. S. Army combat personnel aboard aircraft from December 1961 through December 1967 in the Republic of Vietnam are analyzed. Combat casualties include those wounded directly by projectiles, fragments, and impact debris, as well as those injured in crashes by ground-fire hit on the aircraft. The data include crash injuries resulting from pure accidents and hostile incidents without hits on the aircraft. Most casualties occurred on Army UH-1 helicopters. Casualties are classified by type, severity, crew station, anatomical location, cause, etc., in detailed appendixes. Discussion includes comments on casualty reduction and lessons learned. (U)

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