

**TRANSACTIONS OF SOCIETY OF ACTUARIES  
1973 REPORTS**

**REPORT OF THE COMMITTEE ON AVIATION**

**AVIATION STATISTICS**

**T**HIS report covers statistics obtained from United States and Canadian governmental services, both civilian and military, supplemented by publications of the aviation industry. The report also includes the experience from the annual intercompany study of aviation fatalities among insured lives, to which nineteen companies presently are contributing. The emphasis in the report is primarily on new data which have become available during the past year. Data for earlier periods are included for comparison and to indicate trends.

Preliminary statistics for United States General Aviation in calendar year 1972 were not available at press time, and, as a consequence, that section of the report has been omitted this year.

The experience in the subdivisions of intercompany data by type of flying and type of plane, which was first published two years ago, has been enlarged by the addition of the 1972 calendar-year experience.

**UNITED STATES CIVIL AIR CARRIER FLEET**

United States civil aviation flying is divided into two categories: the Civil Air Carrier Fleet and General Aviation. The United States Civil Air Carrier Fleet is made up largely of Certificated Route Air Carriers (passenger/cargo and all cargo), which are the major airlines in the United States. The balance of the United States Civil Air Carrier Fleet, as defined in the *FAA Statistical Handbook of Aviation*, is comprised of Supplemental Carriers and Commercial Operators. Commercial Operators include all carriers operating at least one aircraft weighing over 12,500 pounds that are not classified as Certificated Route Air Carriers or Supplemental Carriers. The experience of Commercial Operators is very limited because of the small number of aircraft, and it is not included in this report because the number of flying hours and the number of fatal accidents are not available.

Some companies not classified as part of the United States Civil Air Carrier Fleet because they operate only aircraft weighing 12,500 pounds or less may use such terms as "airlines," "airways," and "carrier" and may provide scheduled passenger service on a limited basis (e.g., commuter or feeder airlines). Such aircraft are included under General Aviation, and data regarding their activities are not included in this section of the report.

*Certificated Route Air Carriers (Passenger/Cargo)*

Certificated Route Air Carriers are air carriers holding certificates of public convenience and necessity issued by the Civil Aeronautics Board, authorizing them to perform scheduled air transportation over specified routes and a limited amount of nonscheduled operations. They are divided into two groups—passenger/cargo and all-cargo. A recent issue of the monthly Civil Aeronautics Board publication *Air Carrier Traffic Statistics* listed 31 such passenger/cargo air carriers (including 3 intra-Alaska, 2 intra-Hawaii, and 3 helicopter carriers) and 3 such all-cargo carriers.

“Domestic” operations are, in general, within and between the fifty states of the United States, including intra-Alaska and intra-Hawaii operations. “International” (technically, “international and territorial”) operations are, in general, outside the territory of the United States, including operations between the United States and foreign countries and the United States and its territories or possessions.

Table 1 shows the recent aviation fatality rates of United States Certificated Route Air Carriers (passenger/cargo) for passengers, first pilots, and other crew members in domestic and international flying. The lives exposed as “all pilots and copilots” and “other crew members” include persons who may do less than the normal amount of flying on account of having some supervisory duties or for other reasons.

The small number of fatal accidents and the relatively large number of passenger fatalities in some accidents result in passenger fatality rates which are subject to marked fluctuation from year to year. However, such rates have shown a trend of improvement over the years.

Pilots engaged in air carrier flying may not, under government regulations, fly more than 100 hours per month or 1,000 hours per year in domestic operations. Pilots in international operations are generally limited to either 100 hours per month or 300 hours every 90 days, depending on the size of the flight crew. In actual practice, pilots average 600–700 hours per year because they have ground duties before and after flights.

Helicopter airlines designated as “Certificated Route Air Carriers” are excluded from the experience for passengers and first pilots in Table 1. During the thirteen years 1961–73 there were 4 fatal accidents on helicopter airlines, resulting in a passenger death rate of 0.021 per 1,000 scheduled passenger hours.

*Certificated Route Air Carriers (All Cargo)*

Carriers in this class hold temporary certificates of public convenience and necessity issued by the Civil Aeronautics Board, authorizing the

TABLE 1  
 UNITED STATES CERTIFICATED ROUTE AIR CARRIER  
 (PASSENGER/CARGO) AVIATION DEATH RATES\*

Years	Passenger Rate per 1,000 Scheduled Passenger Hours†	First-Pilot Rate per 1,000 Scheduled Airplane Hours†	All Pilot and Copilot Rate per Life Year‡	Other Crew Member Rate per Life Year‡
Domestic Operations				
1961-64.....	.0008 (18)	.0012 (15)	.0008 (22)	.0008 (16)
1965-68.....	.0008 (22)	.0013 (20)	.0007 (25)	.0004 (19)
1969-72.....	.0004 (13)	.0005 (11)	.0003 (14)	.0002 (11)
1973§.....	.0004 (4)	.0004 (2)	.0002 (2)	.0002 (3)
1961-73§.....	.0006 (57)	.0009 (48)	.0005 (63)	.0004 (49)
International Operations				
1961-64.....	.0014 (3)	.0005 (2)	.0011 (4)	.0018 (4)
1965-68.....	.0004 (3)	.0011 (3)	.0009 (4)	.0009 (5)
1969-72.....	.0000 (1)	.0000 (0)	.0000 (0)	.0000 (0)
1973§.....	.0009 (2)	.0013 (1)	.0011 (1)	.0013 (1)
1961-73§.....	.0005 (9)	.0007 (6)	.0006 (9)	.0007 (10)
Domestic and International Operations				
1961-64.....	.0009 (21)	.0012 (17)	.0008 (26)	.0009 (20)
1965-68.....	.0008 (25)	.0012 (23)	.0007 (29)	.0005 (24)
1969-72.....	.0003 (14)	.0005 (11)	.0003 (14)	.0002 (11)
1973§.....	.0005 (6)	.0005 (3)	.0002 (3)	.0003 (4)
1961-73§.....	.0006 (66)	.0009 (54)	.0005 (72)	.0004 (59)

\* Number of fatal accidents shown in parentheses.

† Based on scheduled operations only; experience of helicopter air carriers is excluded.

‡ Based on all operations, scheduled and nonscheduled, including helicopter operations.

§ 1973 figures are preliminary.

performance of scheduled air freight express and mail transportation over specified routes as well as the conduct of nonscheduled operations, which may include passengers.

The first-pilot fatality rates for all-cargo carriers are shown in Table 2 for recent four-year periods, together with the rates for Supplemental Carriers.

*Supplemental Carriers*

These airlines form a class of carriers holding temporary certificates of public convenience and necessity issued by the Civil Aeronautics Board, authorizing them to perform passenger and cargo charter services supplementing the scheduled service of the Certificated Route Air Carriers. In addition, they may perform on a limited or temporary basis, as authorized by the Civil Aeronautics Board, scheduled operations including the transportation of individually ticketed passengers and individually way-billed cargo. There were 14 such air carriers listed in a recent edition of the *Air Carrier Traffic Statistics*.

TABLE 2  
ALL-CARGO CARRIERS AND SUPPLEMENTAL CARRIERS  
FIRST-PILOT AVIATION DEATH RATES  
PER 1,000 AIRPLANE HOURS\*

Years	All-Cargo All Operations	Supplemental (All Operations)
1961-64.....	.0068 (5)	.0045 (4)
1965-68.....	.0055 (4)	.0033 (4)
1969-72.....	.0036 (2)	.0019 (2)
1973†.....	.0075 (1)	.0038 (1)
1961-73†.....	.0056 (12)	.0032 (11)

\* Number of fatalities shown in parentheses.

† 1973 figures are preliminary.

The figures shown in Table 2 include experience in operations under contracts with military authorities. There has been a decline in first-pilot fatality rates over the years, on the basis of limited experience.

#### AIR CARRIERS OF COUNTRIES OTHER THAN THE UNITED STATES

The general conditions and aviation technology peculiar to any country influence the hazards of flying in that country. Each country has its own aviation regulations and methods of enforcement. These may be different for domestic and international operations, the latter being affected by such compromises as the crossing of international boundary lines may require. From *World Air Transport Statistics*, a publication of the International Air Transport Association, the Committee has summarized the experience of the Association's members. In 1972 these members carried 90 per cent of the world's scheduled airline traffic (excluding the U.S.S.R. and the People's Republic of China). Some companies operated only within the borders of a particular country, some only on an international basis, and some on both bases in varying proportions.

By making reasonable assumptions regarding average speed, passenger fatality rates per 1,000 scheduled passenger hours were derived and are shown in Table 3. The 1972 issue of *World Air Transport Statistics* lists 93 IATA members in countries other than the United States and 11 United States members who operate scheduled passenger flights in fixed-wing aircraft. The safety record of the scheduled services of the airlines of other countries has shown improvement but continues to be less favorable than that of United States scheduled air carriers.

TABLE 3  
SCHEDULED AIR CARRIERS OF  
UNITED STATES AND OTHER COUNTRIES  
(PASSENGER/CARGO) AVIATION DEATH RATES  
PER 1,000 SCHEDULED PASSENGER HOURS\*

YEARS	MEMBERS REPORTING TO IATA		ALL UNITED STATES AIR CARRIERS
	Countries Other than the United States	United States	
1961-64. . . . .	.0035	.0010	.0009
1965-68. . . . .	.0020	.0006	.0008
1969-72†. . . . .	.0016	.0000	.0003
1972†. . . . .	.0024	.0000	.0004
1961-72†.	.0021	.0004	.0006

\* Experience of helicopter air carriers is excluded.  
† IATA figures are preliminary.

For 1972, 51 per cent of the scheduled passenger hours reported to IATA were flown by the United States members. These air carriers accounted for 94 per cent of the scheduled passenger hours flown by all United States Certificated Route Air Carriers in 1972. The combined international and domestic scheduled experience of all United States Certificated Route Air Carriers (passenger/cargo) is included in Table 3 for comparison.

CANADIAN CIVIL FLYING

Passenger and first-pilot aviation fatality rates per 1,000 hours in domestic and international operations of Canadian scheduled airlines derived from figures furnished by the Canadian Department of Transport and Statistics are shown in Table 4. Comparable passenger and first-pilot aviation fatality rates for Canadian nonscheduled airlines have been estimated from the same sources and are also shown in Table 4.

Canadian scheduled airlines comprise air carriers that serve designated points in accordance with a definite service schedule. Nonscheduled airlines are those that follow a route pattern with some degree of regularity or operate from a designated base to serve a defined area or on charter of an entire aircraft.

The fatality rates among Canadian civil pilots, by class of license, are shown in Table 5 separately, for the periods 1965-68 and 1969-72, based on figures furnished by the *Canadian Department of Transport*. It should

TABLE 4  
CANADIAN AIRLINES  
AVIATION FATALITY RATES\*

Years	Passenger Rate per 1,000 Passenger Hours	First-Pilot Rate per 1,000 Airplane Hours
Scheduled Airlines		
1961-64 . . . . .	.0024 (3)	.0015 (2)
1965-68 . . . . .	.0012 (3)	.0018 (3)
1969-72 . . . . .	.0009 (3)	.0010 (2)
1961-72 . . . . .	.0013 (9)	.0014 (7)
1970-73 (est.) . . . . .	.0007 (1)	.0005 (1)
Nonscheduled Airlines		
1965-68 . . . . .	.0173 (49)	.0186 (46)
1969-72 . . . . .	.0174 (25)	.0170 (54)
1965-72 . . . . .	.0174 (74)	.0177 (100)

\* Number of fatal accidents shown in parentheses.

be noted that pilots holding airline transport licenses are not necessarily flying for scheduled airlines, since they may engage in other types of flying.

#### UNITED STATES MILITARY

##### *General*

Where the necessary information is available, aviation fatality rates are shown both including and excluding deaths due to hostile action. As in the previous report, fatality rates which include deaths due to hostile action are shown without brackets and fatality rates which exclude such deaths are shown within brackets.

TABLE 5  
CANADIAN CIVIL PILOTS, BY CLASS OF LICENSE  
1965-72 AVIATION FATALITY RATES

Class of License	Period	Life Years of Exposure	Aviation Fatalities	Rate per 1,000 Life Years of Exposure
Airline transport.....	{1965-68	7,355	18	2.4
	{1969-72	10,734	23	2.1
Senior commercial.....	{1965-68	1,770	7	4.0
	{1969-72	2,883	16	5.5
Commercial.....	{1965-68	14,622	86	5.9
	{1969-72	19,362	74	3.8
Private (excluding students).....	{1965-68	74,886	127	1.7
	{1969-72	98,920	115	1.2
Glider.....	1969-72	5,039	4	0.8

All the United States military aviation statistics in this report are shown on a calendar-year basis.

*Age and Rank*

Table 6 shows aviation fatality rates by age group, and Table 7 shows aviation fatality rates by rank for Air Force pilots and nonpilot rated officers and for Navy and Marine Corps pilots on active duty. This experience includes pilots who flew chiefly to maintain proficiency, as well as those with full-time flying duties. Rated (in contrast to nonrated) officers in the Air Force are those whose duties include flying other than as passengers. Air Force data by age group for 1971 were in error. Therefore, fatality rates in Table 6 for all time periods based on 1971 data have been recomputed and reappear in this report. Corresponding Navy and Marine Corps rates from last year's report are shown only for convenient comparison.

The over-all fatality experience for Air Force pilots and nonpilot rated officers remains approximately the same in 1971, on the basis of the corrected data. The major changes occur for ages under 35. Although the experience for 1972 is less favorable than that for 1971, the experience averaged over the four-year periods generally shows a steady decrease since the 1965-68 period for Air Force pilots and nonpilot rated officers.

Except for age groups 25-29 and 35-39, where significant changes occurred, fatality rates by age group in 1972 for Navy and Marine Corps

pilots remain at about the same level as in 1971. For the ranks of Captain and Major there were significant changes in the levels of mortality. The over-all fatality rate for the period 1969-72 is at a lower level than for the period 1965-68. The over-all level of mortality in 1972 is now quite close to that for Air Force pilots.

TABLE 6  
UNITED STATES AIR FORCE, NAVY, AND  
MARINE CORPS FLYERS, BY AGE  
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE  
DEATHS DUE TO HOSTILE ACTION INCLUDED\*

Age Group	1965-68	1968-71†	1969-72	1971†	1972
Air Force Pilots					
Under 25.....	7.8 [6.0]	4.7 [3.0]	4.2 [2.6]	1.5 [1.2]	3.3 [2.7]
25-29.....	8.0 [4.8]	6.3 [4.1]	5.6 [3.8]	3.9 [2.4]	4.2 [2.6]
30-34.....	6.0 [3.4]	4.0 [2.7]	3.6 [2.7]	3.8 [3.0]	6.1 [4.8]
35-39.....	5.1 [2.9]	3.0 [1.9]	2.1 [1.6]	2.1 [1.8]	1.7 [1.4]
40 and over..	1.8 [1.2]	1.6 [1.2]	1.4 [1.1]	1.4 [1.3]	2.4 [2.1]
All.....	4.7 [2.9]	3.8 [2.5]	3.4 [2.3]	2.6 [1.9]	3.5 [2.6]
Air Force Nonpilot Rated Officers					
Under 25.....	3.0 [2.1]	0.5‡ [0.5]‡	0.4‡ [0.4]‡	0.5‡ [0.5]‡	0.9‡ [0.9]‡
25-29.....	2.5 [1.9]	1.3 [0.9]	1.3 [1.0]	2.0 [1.3]‡	2.3 [1.8]
30-34.....	2.2 [1.6]	1.1 [0.8]	1.2 [0.8]	0.3‡ [0.3]‡	2.9 [2.0]
35-39.....	1.4 [0.8]	1.0 [0.7]	1.1 [0.8]	0.9‡ [0.9]‡	2.2 [1.9]
40 and over..	1.0 [0.9]	2.3 [1.8]	2.2 [1.4]	3.7‡ [3.7]‡	1.8‡ [0.6]‡
All.....	2.0 [1.5]	1.1 [0.8]	1.1 [0.9]	1.2 [1.0]	2.3 [1.6]
Navy and Marine Corps Pilots					
Under 25.....	9.4	12.6 [8.4]	9.6 [7.4]	5.3 [5.3]	5.2 [5.2]
25-29.....	10.1	10.9 [7.8]	8.8 [7.1]	4.5 [4.5]	6.0 [5.6]
30-34.....	7.8	8.0 [5.2]	5.4 [4.6]	3.3 [3.3]	3.8 [3.8]
35-39.....	5.4	4.1 [3.0]	2.6 [2.2]	2.9 [2.9]	1.6‡ [1.3]‡
40 and over..	1.0	1.8 [1.4]	1.6 [1.3]	0.7‡ [0.7]‡	0.2‡ [0.2]‡
All.....	6.9§	7.8 [5.3]§	5.8 [4.7]§	3.6 [3.4]§	3.6 [3.4]

\* Rates in brackets exclude deaths due to hostile action.

† 1971 data shown because of error in last year's report; see text.

‡ Based on 5 or fewer deaths.

§ A small proportion of total Navy and Marine Corps pilot deaths were not identified by age.



TABLE 7

UNITED STATES AIR FORCE, NAVY, AND MARINE CORPS FLYERS, BY RANK  
 AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE  
 DEATHS DUE TO HOSTILE ACTION INCLUDED\*

Rank (Pay Grade)†	1965-68	1969-72	1972
Air Force Pilots			
2d Lieutenant (01).....	5.8 [4.9]	5.1 [5.1]	3.4‡ [3.4]‡
1st Lieutenant (02).....	9.8 [6.4]	4.8 [2.8]	4.5 [3.1]
Captain (03).....	7.1 [4.1]	4.6 [3.1]	4.3 [3.0]
Major (04).....	3.7 [2.3]	3.4 [2.4]	3.9 [2.8]
Lieutenant Colonel (05).....	1.7 [1.3]	1.5 [1.2]	2.2 [1.9]
General and Colonel (06 and up).....	0.8 [0.7]	0.7 [0.7]	0.3‡ [0.3]‡
All.....	4.7 [2.9]	3.4 [2.3]	3.5 [2.6]
Air Force Nonpilot Rated Officers			
2d Lieutenant (01).....	1.6‡ [1.6]‡	0.0‡ [0.0]‡	0.0‡ [0.0]‡
1st Lieutenant (02).....	3.3 [2.7]	2.1 [1.6]	3.2 [1.9]‡
Captain (03).....	2.3 [1.7]	0.9 [0.9]	3.1 [2.4]
Major (04).....	1.3 [0.8]	1.2 [0.9]	2.0 [1.5]
Lieutenant Colonel (05).....	0.5‡ [0.5]‡	0.9 [0.6]‡	0.7‡ [0.0]‡
General and Colonel (06 and up).....	0.0‡ [0.0]‡	0.0‡ [0.0]‡	0.0‡ [0.0]‡
All.....	2.0 [1.5]	1.2 [0.9]	2.3 [1.6]
Navy and Marine Corps Pilots			
2d Lieutenant (01).....	4.7	3.4‡ [1.7]‡	0.0‡ [0.0]‡
1st Lieutenant (02).....	13.7	12.6 [9.3]	6.3 [6.3]
Captain (03).....	8.7	6.1 [5.4]	6.0 [5.6]
Major (04).....	5.7	4.2 [3.4]	1.1‡ [1.1]‡
Lieutenant Colonel (05).....	2.5	2.2 [1.8]	1.2‡ [0.9]‡
General and Colonel (06 and up).....	0.4	0.0‡ [0.0]‡	0.0‡ [0.0]‡
All.....	6.9§	5.8 [4.7]§	3.6 [3.4]

\* Rates in brackets exclude deaths due to hostile action.

† Ranks shown are for Army, Air Force, and Marine Corps; equivalent Navy ranks apply to Navy experience.

‡ Based on 5 or fewer deaths.

§ A small proportion of total Navy and Marine Corps pilot deaths were not identified by rank.

*Duty Assignment*

Aviation fatality rates among Air Force pilots according to duty assignment are shown in Table 8. The original data received from the Air Force for 1971 were in error, and fatality rates for 1971 were recomputed for this report. In this table, pilots who were not assigned to a specific flying duty but flew chiefly to maintain proficiency are excluded from the exposure, except for 1972, where the exclusion could not be made. However, fatalities for pilots who flew chiefly to maintain proficiency in 1972 are excluded from Table 8 in all years. As a result, the rates for all pilots combined show small differences from the corresponding rates in Tables 6 and 7.

TABLE 8  
UNITED STATES AIR FORCE PILOTS, BY DUTY ASSIGNMENT  
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

Duty Assignment*	1970-71 <sup>†</sup>	1970	1971 <sup>‡</sup>	1972
Including Deaths due to Hostile Action				
Pilot, helicopter.....	7.2	8.2	5.9 <sup>‡</sup>	5.9
Pilot, tanker.....	0.2 <sup>‡</sup>	0.0 <sup>‡</sup>	0.3 <sup>‡</sup>	0.0 <sup>‡</sup>
Pilot, bomber.....	3.5	1.2 <sup>‡</sup>	5.3	3.5
Pilot, reconnaissance.....	3.0	3.3 <sup>‡</sup>	2.6 <sup>‡</sup>	2.7 <sup>‡</sup>
Pilot, trainer.....	2.1	3.8	0.8	1.1
Pilot, cargo.....	4.0	5.8	2.2	3.0
Pilot, observation.....	21.3	24.3	17.7	12.4
Pilot, fighter.....	10.3	12.1	8.1	9.1
Pilot, utility.....	17.3	24.4 <sup>‡</sup>	12.5 <sup>‡</sup>	6.6
All.....	4.9	6.5	3.5	3.3
Excluding Deaths due to Hostile Action				
Pilot, helicopter.....	2.6 <sup>‡</sup>	3.7 <sup>‡</sup>	1.2 <sup>‡</sup>	2.0 <sup>‡</sup>
Pilot, tanker.....	0.2 <sup>‡</sup>	0.0 <sup>‡</sup>	0.3 <sup>‡</sup>	0.0 <sup>‡</sup>
Pilot, bomber.....	3.2	0.6 <sup>‡</sup>	5.3	2.7
Pilot, reconnaissance.....	2.3	2.6 <sup>‡</sup>	2.0 <sup>‡</sup>	2.7 <sup>‡</sup>
Pilot, trainer.....	2.0	3.8	0.6 <sup>‡</sup>	1.1
Pilot, cargo.....	3.5	4.8	2.2	2.1
Pilot, observation.....	7.6	5.6	10.0	2.6 <sup>‡</sup>
Pilot, fighter.....	6.7	8.0	5.3	7.5
Pilot, utility.....	9.9 <sup>‡</sup>	6.1 <sup>‡</sup>	12.5 <sup>‡</sup>	6.6
All.....	3.4	4.3	2.6	2.4

\* See texts for comments relating to experience of pilots flying to maintain proficiency.

<sup>†</sup> 1971 data shown because of error in last year's report; see text.

<sup>‡</sup> Based on 5 or fewer deaths.

*Hours of Flying*

On the average in 1972, Navy pilots flew 172 hours, while Active Naval Reserve pilots flew 117 hours, which represented decreases from the average hours flown in 1971. During 1972 Marine Corps pilots flew an average of 150 hours, while Active Marine Reserve pilots flew an average of 120 hours, which was more than the corresponding number of hours flown in 1971.

During 1972 Army pilots flew an average of 43 hours in fixed-wing aircraft and 125 hours in rotary-wing aircraft. This represented decreases from 1971.

TABLE 9  
MILITARY AIR COMMAND (MAC)  
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE  
DEATHS DUE TO HOSTILE ACTION INCLUDED\*

	1965-68	1969-72	1972
<b>Pilots:</b>			
Transport units....	0.9 [0.7]	0.9 [0.7]	0.0† [0.0]†
Other units.....	0.9 [0.3]†	3.0 [1.6]	7.0 [3.4]†
All.....	0.9 [0.6]	1.7 [1.1]	2.2 [1.1]†
<b>Crew members:</b>			
Transport units....	1.1 [0.9]	0.8 [0.8]	0.0† [0.0]†
Other units.....	1.7 [0.3]†	3.3 [1.9]	3.3 [0.4]†
All.....	1.3 [0.8]	1.8 [1.2]	1.1 [0.1]†

\* Rates in brackets exclude deaths due to hostile action.

† Based on 5 or fewer deaths.

The average number of aircraft hours for Air Force pilots is not available. In 1972, the average annual flying time for Air National Guard pilots was 106 hours, which was the same as in 1971.

*Military Air Command (MAC)*

Aviation fatality rates among pilots and crew members of MAC, a branch of the Air Force, are shown in Table 9. The reverse of the experience in 1971 held true in 1972; that is, there were no fatalities among pilots or crew members in MAC transport units, but there were fatalities in nontransport units. The experience of MAC pilots is also included in Tables 6-8.

*United States Army*

Table 10 includes data for the years 1964-67 and 1969-72 for Army pilots and crew members for all flying operations; data for 1968 are not

available. Fatality rates for pilots continued to decline in 1972. A notable exception is an increase in the rates for pilots of fixed-wing aircraft in 1972. The fatality rates for crew members also decreased, although not quite as substantially as the rates for pilots, and remained at much higher levels than the corresponding rates for pilots. As in previous years, fatality rates in 1972 for pilots in rotary-wing aircraft were approximately doubled as a result of deaths due to hostile action.

TABLE 10  
UNITED STATES ARMY—ALL FLYING OPERATIONS  
DEATHS DUE TO HOSTILE ACTION INCLUDED\*

	1964-67†	1969-72	1972
Aviation Fatality Rates per 1,000 Life Years of Exposure			
Pilots . . . . .	15.7 [9.8]	11.5 [5.9]	3.8 [1.7]
Crew members . . . . .	16.8 [8.8]	26.2 [11.1]	19.8 [7.3]
Pilot Fatality Rates per 1,000 Aircraft Hours			
Fixed-wing aircraft . . . . .	.0275 [.0221]	.0223 [.0179]	.0427 [.0396]
Rotary-wing aircraft . . . . .	.0694 [.0398]	.0650 [.0299]	.0359 [.0122]
All types of aircraft . . . . .	.0567 [.0344]	.0593 [.0289]	.0370 [.0165]

\* Rates in brackets exclude deaths due to hostile action.

† 1968 experience not available.

### *Student Pilots*

Table 11 presents aviation fatality rates for student pilots in the military services. Fatality rates for students in the Navy and Marine Corps were higher in 1972 than in 1971. The fatality rate for Army student pilots was also higher in 1972 than in 1971 but was based on five or fewer deaths.

### *Coast Guard*

During the four-year period 1969-72 the aviation fatality rates per 1,000 life years of exposure for Coast Guard personnel on flight orders were 1.1 for pilots and 0.4 for crew members. There have been no aviation fatalities among Coast Guard student pilots or observers during the last sixteen years.

TABLE 11  
 UNITED STATES AIR FORCE, NAVY, AND MARINE CORPS,  
 AND ARMY STUDENT PILOTS  
 AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

	1965-68	1969-72	1972
Air Force*	1.8	2.2	1.0†
Navy and Marine Corps:			
Basic course	2.9	2.7	3.5
Advanced course	9.0	8.0	8.0†
Army	3.5	3.2	3.0†

\* Commissioned officers only.

† Based on 5 or fewer deaths.

*Active Reserves and National Guard*

Table 12 shows the aviation fatality rates for Army, Navy, and Marine Corps pilots in the active reserves and Air and Army National Guard pilots. Such pilots are not on full-time active duty but fly on weekend and/or short-term (usually two weeks) training duty.

*Air Force Flight Surgeons and Nurses*

During the four-year period 1969-72 the fatality rate for Air Force flight surgeons was 0.3 per 1,000 life years of exposure. There have been no fatalities among Air Force flight nurses in the last eleven years.

*Graduates of Academies—Assignment to Aviation*

In 1972 only 1.0 per cent of military academy graduates and no Naval Academy graduates were placed in the Air Force for flight training.

TABLE 12  
 PILOTS IN THE ACTIVE RESERVES AND NATIONAL GUARD  
 AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

	1965-68	1969-72	1972
Navy and Marine Corps Reserves:			
Ages under 30	4.0	2.0	0.0*
Ages 30 and over	2.4	1.5	0.8*
All ages	2.7	1.6	0.6*
Army Reserves	N.A.†	N.A.	1.7*
Air National Guard	3.0	2.3	2.8
Army National Guard	0.4*	1.4	2.5

\* Based on 5 or fewer deaths.

† N.A. = Not available.

Of the commissioned Air Force Academy graduates in 1972, 99.6 per cent were placed in the Air Force, while 0.3 per cent received assignment in the Navy, 0.1 per cent in the Marine Corps, and none in the Army.

## CANADIAN MILITARY

Aviation fatality rates among Canadian regular military forces, excluding reserves, for the period 1969-72 are shown in Table 13 by age, rank, and functional classification. Fatality rates are based upon flying hours rather than upon life years of exposure. The average number of flying hours for all pilots combined has remained steady over the three-year period at approximately 300 hours per year and shows little variation by age group. Crew members average around 350 hours per year. There appears to be some variation by functional classification, but this cannot be accurately determined because of duplicate counting in different

TABLE 13  
CANADIAN REGULAR FORCES  
1969-72 AVIATION FATALITY RATES  
PER 1,000 FLYING HOURS OF EXPOSURE

	Pilots	Crew Members
Age group:		
Under 25.....	.0366	.0038*
25-29.....	.0096	.0060*
30-34.....	.0108*	.0053*
35-39.....	.0050*	*
40 and over.....	.0020*	.0019*
All.....	.0111	.0048
Rank:		
Lieutenant and others of lower rank.....	.0248	.0051
Captain.....	.0098	.0045*
Major.....	.0032*	*
Lieutenant Colonel and others of higher rank.....	*	*
All.....	.0111	.0048
Functional classification:		
Fighter.....	.0299	.0342
Training.....	.0175	*
Transport.....	.0052*	.0044*
Maritime.....	.0048*	.0019*
Helicopter.....	.0146*	.0266*
Others.....	.0061*	.0033*
All.....	.0111	.0048

\* Based on 5 or fewer deaths.

NOTE.—The functional classification "Others" is composed largely of pilots who ferry planes to air bases and test new planes, both accepted and experimental models. It also includes a small number of pilots whose primary assignment is on the ground but who occasionally fly to maintain proficiency.

functions. It would appear that the average annual flying time for transport and maritime pilots and crew is considerably higher than those in the categories of fighter, training, and helicopter. The former would appear to average in excess of 350 hours per year, the latter near 100 hours per year.

#### INTERCOMPANY EXPERIENCE

The tables shown this year are based on the 1968-72 experience on 1959 and subsequent issues of the same nineteen companies that contributed data last year. In analyzing the data, it should be kept in mind that the criteria by which the lives are classified are determined by the facts at issue and do not necessarily reflect current flying activity.

#### *Civilian Aviation*

Tables 14 and 15 show the fatality rates experienced in recent years among civilian pilots. The experience is by number of policies, and the classification of the insured is according to status at the time of application for insurance. Policies issued with an aviation clause are not included. Exposure in the "With Aviation Extra Premium" category is terminated when the extra premium is discontinued. For those policies where there is still an aviation hazard after discontinuance of the extra premium, companies have been encouraged to transfer the exposure to the "Without Aviation Extra Premium" classification. Not all companies have been able to do this, and consequently the experience for that classification includes only a portion of such cases.

Table 14, which corresponds to Table 16 of last year's report, covers the experience for various categories of pilots for policies issued with and without aviation extra premium. The "Scheduled airline" category is defined by the coding instructions as United States Certificated Route Air Carriers and corresponding major Canadian airlines. The "Corporate" category is defined as hired pilots flying company-owned planes. "Charter and other airlines" includes the supplemental air carriers and intrastate and foreign airlines, as well as air-taxi and charter operations, the latter two probably constituting more than half the exposure. The "Others" category includes corporate and charter pilots insured by companies unable to subdivide data, as well as specialty pilots in such occupations as aerial application, pipeline survey, advertising, and photography. Private pilots are defined by the coding instructions as those with 100 or more solo hours flying for pleasure or personal business only, and student pilots are defined as those with less than 100 solo hours. There were 8 war deaths among the 61 deaths of student pilots.

Table 15 conforms to Table 17 of last year and shows, both with and without aviation extra premium, the experience for private pilots subdivided by hours flown, type of flying certificate, and attained age. The exposure for issues without aviation extra premium include an unknown proportion of lives who have discontinued their flying activities which is not known by their insurer. A tabulation was made for private pilots without aviation extra premium using 1967 and subsequent issues only.

TABLE 14  
INTERCOMPANY EXPERIENCE ON PILOTS IN CIVILIAN  
AVIATION—BY POLICIES\*  
(1968-72 Experience on 1959 and Subsequent Issues)

STATUS AT ISSUE	WITH AVIATION EXTRA PREMIUM			WITHOUT AVIATION EXTRA PREMIUM		
	Years of Exposure	Aviation Fatalities	Rate per 1,000	Years of Exposure	Aviation Fatalities	Rate per 1,000
Scheduled airline pilots	903	4	4.4	13,598	10	0.7
Other commercial pilots flying for hire:						
Instructing (at least half-time) . . . . .	5,155	14	2.7	214	0	.....
Corporate . . . . .	2,822	6	2.1	5,065	8	1.6
Charter and other airlines . . . . .	3,860	18	4.7	962	1	.....
Others† . . . . .	5,426	18	3.3	1,790	3	1.7
Private pilots . . . . .	35,581	76	2.1	147,885	152	1.0
Student pilots . . . . .	54,436	61	1.1	4,329	1	.....

\* Exposure in "With Aviation Extra Premium" category is terminated upon discontinuance of extra premium. Exposure in "Without Aviation Extra Premium" category consists of pilots active at time of issue and rated standard or reduced to standard through liberalization of underwriting rules.

† Includes exposure of companies unable to subdivide data.

On the basis of experience covering 36,544 years of exposure with 35 deaths, the same over-all aviation fatality rate of 1.0 was produced, and the rates for the various categories were also not significantly different from those shown in Table 15.

#### *Military Aviation*

Tables 16-18 display the aviation fatality rates for the years 1968-72 among military aviation personnel on policies issued with an aviation extra premium. The experience is by number of policies, and the classification of the insured is determined by his status at the time of application for insurance. Exposure was terminated when the extra premium was discontinued. Deaths due to enemy action are excluded in the figures and rates shown in brackets.



Table 16 corresponds to Tables 18 and 20 of last year but is limited to pilot experience only (crew member experience is shown in Table 18). In addition, the experience for Navy pilots is shown separately from that for Marine pilots. The experience on administrative pilots is still quite limited, and some age subdivisions are not available. Administrative pilots are defined by the coding instructions as those flying only 40-150

TABLE 15  
 INTERCOMPANY EXPERIENCE ON PILOTS FLYING FOR PLEASURE  
 OR PERSONAL BUSINESS—BY POLICIES\*  
 (1968-72 Experience on 1959 and Subsequent Issues)

	WITH AVIATION EXTRA PREMIUM			WITHOUT AVIATION EXTRA PREMIUM		
	Years of Exposure	Aviation Fatalities	Rate per 1,000	Years of Exposure	Aviation Fatalities	Rate per 1,000
By hours flown:†						
Under 100.....	18,864	21	1.1	100,340	63	0.6
100-199.....	9,053	13	1.4	39,017	70	1.8
200-299.....	3,652	20	5.5	4,141	12	2.9
300 or more.....	3,579	21	5.9	1,912	5	2.6
By type of flying certificate:						
Commercial or transport.....	8,543	21	2.5	30,959	32	1.0
Private.....	27,038	55	2.0	116,926	120	1.0
By attained age:†						
Under 35.....	16,426	23	1.4	23,072	17	0.7
35-49.....	14,250	43	3.0	91,777	100	1.1
50 and over.....	4,600	6	1.3	29,771	35	1.2
Total‡.....	35,581	76	2.1	147,885	152	1.0

\* Exposure in "With Aviation Extra Premium" category is terminated upon discontinuance of extra premium. Exposure in "Without Aviation Extra Premium" category consists of pilots active at time of issue and rated standard or reduced to standard through liberalization of underwriting rules.

† Excludes exposure of companies unable to subdivide data.

‡ Includes exposure of companies unable to subdivide data.

hours annually; operational pilots are defined as those flying over 150 hours annually. The experience for Reserve and Air National Guard pilots is included below the "Administrative" column heading, since the annual hours flown are usually less than 150.

Using only issues of 1967 and later, a tabulation of the 1968-72 experience for United States Air Force and Army operational pilots was made. For Air Force pilots, the total fatality rate was 2.3 [2.0] per 1,000, based on 3,990 years of exposure with 9 [8] deaths, and for Army pilots the total fatality rate was 4.8 [2.7] per 1,000, based on 1,860 years of exposure

TABLE 16

INTERCOMPANY EXPERIENCE ON MILITARY PILOTS BY BRANCH OF SERVICE  
AND FLYING DUTIES—WITH AVIATION EXTRA PREMIUM\*  
(1968-72 Experience on 1959 and Subsequent Issues—by Policies)

STATUS AT ISSUE AND ATTAINED INSURANCE AGE	OPERATIONAL			ADMINISTRATIVE		
	Years of Exposure	Aviation Fatalities†	Rate per 1,000	Years of Exposure	Aviation Fatalities†	Rate per 1,000
U.S. Air Force pilots:						
Under 25.....	275	2 [1]	7.3	40	0 [0]	.....
25-29.....	3,755	14 [4]	3.7 [1.1]	199	0 [0]	.....
30-34.....	7,044	14 [9]	2.0 [1.3]	731	4 [3]	5.5 [4.1]
35-39.....	12,075	29 [14]	2.4 [1.2]	3,238	8 [7]	2.5 [2.2]
40 and over.....	9,482	12 [10]	1.3 [1.1]	5,814	8 [6]	1.4 [1.0]
Total.....	32,631	71 [38]	2.2 [1.2]	10,022	20 [16]	2.0 [1.6]
U.S. Army pilots:						
Under 25.....	725	16 [8]	22.1 [11.0]	2,175	11 [4]	5.1 [1.8]
25-29.....	1,794	9 [3]	5.0 [1.7]			
30-34.....	2,174	7 [1]	3.2			
35-39.....	2,687	8 [6]	3.0 [2.2]			
40 and over.....	1,607	1 [1]	.....			
Total.....	8,987	41 [19]	4.6 [2.1]	5,495	16 [6]	2.9 [1.1]
U.S. Navy pilots:						
Under 25.....	171	0 [0]	.....	21	0 [0]	.....
25-29.....	1,880	12 [5]	6.4 [2.7]	219	0 [0]	.....
30-34.....	2,933	7 [4]	2.4 [1.4]	635	3 [3]	4.7 [4.7]
35-39.....	3,269	14 [10]	4.3 [3.1]	1,480	3 [3]	2.0 [2.0]
40 and over.....	2,372	4 [3]	1.7 [1.3]	2,002	2 [2]	1.0 [1.0]
Total.....	10,625	37 [22]	3.5 [2.1]	4,357	8 [8]	1.8 [1.8]
U.S. Marine pilots:						
Under 25.....	52	0 [0]	.....	180	1 [1]	.....
25-29.....	468	2 [0]	4.3			
30-34.....	772	7 [6]	9.1 [7.8]			
35-39.....	921	1 [1]	.....			
40 and over.....	527	1 [0]	.....			
Total.....	2,740	11 [7]	4.0 [2.6]	1,016	2 [2]	2.0 [2.0]
U.S. Air Force, Army, Navy, and Marine Reserve pi- lots.....				3,751	9 [9]	2.4 [2.4]
U.S. Air National Guard pilots.....				2,348	2 [2]	0.9 [0.9]

\* Exposure is terminated on discontinuance of extra premium.

† Figures in brackets exclude deaths from enemy action but do not exclude other fatalities in combat missions.

and 9 [5] deaths. These rates are only slightly higher than the 2.2 [1.2] and 4.6 [2.1] rates in Table 16, primarily because of the relatively heavier exposure at the younger ages.

Table 17, which corresponds to the portion of Table 19 of last year that contained experience for operational pilots (the experience for administrative pilots is included only in Table 16), splits such experience by

TABLE 17  
 INTERCOMPANY EXPERIENCE ON MILITARY PILOTS (OPERATIONAL)  
 BY BRANCH OF SERVICE  
 AND TYPE OF AIRCRAFT—WITH AVIATION EXTRA PREMIUM\*  
 (1968-72 Experience on 1959 and Subsequent Issues—by Policies)

	ATTAINED AGES UNDER 35			ATTAINED AGES 35 AND OVER		
	Years of Exposure	Aviation Fatalities†	Rate per 1,000	Years of Exposure	Aviation Fatalities†	Rate per 1,000
U.S. Air Force—MAC:						
Transport	2,119	2 [1]	0.9	3,134	6 [3]	1.9 [1.0]
All other‡	443	0 [0]		572	0 [0]	
U.S. Air Force—						
Others:						
Fighter	835	7 [7]	8.4 [8.4]	2,071	4 [2]	1.9 [1.0]
Bomber	951	3 [1]	3.2	2,750	5 [5]	1.8 [1.8]
Transport	2,386	6 [2]	2.5 [0.8]	4,381	6 [2]	1.4 [0.5]
Reconnaissance	150	0 [0]		339	0 [0]	
Helicopter	293	0 [0]		393	1 [0]	
All other‡	3,897	12 [3]	3.1 [0.8]	7,917	19 [12]	2.4 [1.5]
U.S. Army:						
Helicopter	2,598	23 [11]	8.9 [4.2]	1,688	2 [2]	1.2 [1.2]
All other‡	2,095	9 [1]	4.3	2,606	7 [5]	2.7 [1.9]
U.S. Navy—Carrier-						
based:						
Fighter	154	3 [1]	19.5	308	2 [2]	6.5 [6.5]
All other‡	620	1 [0]		363	0 [0]	
U.S. Navy—Other:						
Fighter	226	2 [2]	8.9 [8.9]	614	3 [3]	4.9 [4.9]
Bomber	278	1 [1]		357	3 [2]	8.4 [5.6]
Transport	427	0 [0]		745	2 [1]	2.7
Reconnaissance	503	1 [1]		525	1 [1]	
Helicopter	630	2 [0]	3.2	379	0 [0]	
All other‡	2,143	9 [4]	4.2 [1.9]	2,350	7 [4]	3.0 [1.7]
U.S. Marines:						
Fighter	217	2 [1]	9.2	259	0 [0]	
All other‡	1,078	7 [5]	6.5 [4.6]	1,189	2 [1]	1.7
All branches	22,043	90 [41]	4.1 [1.9]	32,940	70 [45]	2.1 [1.4]

\* Exposure is terminated on discontinuance of extra premium.

† Figures in brackets exclude deaths from enemy action but do not exclude other fatalities in combat missions.

‡ Includes type of aircraft not stated.

type of aircraft, separated into two attained-age groups—under 35, and 35 and over. The experience by type of aircraft has been enlarged by the addition of another year's experience but is still rather limited.

Table 18 presents the experience of military crew members by branch of service and corresponds to Table 21 of last year with another year's experience included.

TABLE 18  
INTERCOMPANY EXPERIENCE ON MILITARY CREW MEMBERS (OPERATIONAL) —  
WITH AVIATION EXTRA PREMIUM\*  
(1968-72 Experience on 1959 and Subsequent Issues—by Policies)

	Years of Exposure	Aviation Fatalities†	Rate per 1,000
U.S. Air Force:			
MAC . . . . .	4,655	7 [4]	1.5 [0.9]
Bombers . . . . .	4,472	9 [7]	2.0 [1.6]
All others:			
Under age 35 . . . . .	10,772	24 [18]	2.2 [1.7]
35 and over . . . . .	10,161	11 [11]	1.1 [1.1]
U.S. Army . . . . .	556	1 [1]	
U.S. Navy:			
Carrier-based . . . . .	110	0 0	
Noncarrier-based:			
Bombers . . . . .	251	1 [1]	
All others . . . . .	3,695	4 [3]	1.1 [0.8]
U.S. Marines . . . . .	348	2 [0]	5.7
All branches . . . . .	35,020	59 [45]	1.7 [1.3]

\* Exposure is terminated on discontinuance of extra premium.

† Figures in brackets exclude deaths from enemy action but do not exclude other fatalities in combat missions.