

**TRANSACTIONS OF SOCIETY OF ACTUARIES
1977 REPORTS**

**REPORT OF THE COMMITTEE ON AVIATION
AND HAZARDOUS SPORTS**

I. AVIATION STATISTICS

THIS report covers statistics obtained from United States and Canadian governmental services, both civilian and military, supplemented by publications of the aviation industry. The emphasis in the report is primarily on new data that have become available during the past year. Data for earlier periods are included for comparison and to indicate trends. Intercompany experience data are also shown.

For the first time since 1964, all military aviation fatality rates exclude deaths due to hostile action. Aviation statistics are to be published on a biennial basis, so there will be none in the next report. However, fatality statistics for certain aviation sports activities may be published in Part II, "Hazardous Sports," in the next report.

UNITED STATES CIVIL AIR CARRIER FLEET

United States civil aviation 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. Supplemental Carriers are discussed later in this section. Commercial Operators are not included in this report because the small number of aircraft involved makes the experience difficult to analyze. 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.

Some companies not classified as part of the United States Civil Air Carrier Fleet, because they operate only aircraft weighing 12,500 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 conduct scheduled air transportation over specified routes as well as a limited amount of nonscheduled operations. They are divided into two groups—passenger/cargo and all-cargo. The September, 1977, issue of the monthly Civil Aeronautics Board publication *Air Carrier Traffic Statistics* listed 32 passenger/cargo air carriers (including 5 intra-Alaska, 2 intra-Hawaii, and 1 helicopter carrier) and 3 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, all pilots and copilots, and other crew members in domestic and international flying. The lives exposed as “All Pilot and Copilot” and “Other Crew Member” include persons who may do less than the normal amount of flying because of supervisory duties or other reasons.

The small number of fatal accidents and the relatively large number of passenger fatalities in some accidents result in passenger fatality rates that are subject to marked fluctuations from year to year. However, such rates have shown an improving trend 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.

Another type of carrier, for which statistics are not available, is the Intrastate Air Carrier. Such carriers must obey the general safety rules and regulations for carrying passengers as set by the Civil Aeronautics Board. However, the responsibility for regulating, licensing, and collecting flight and fatality statistics for each Intrastate Air Carrier rests solely with the respective state. Not all states have such carriers, and, of those that do, not all states collect statistics.

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 1965-77, there were 4 fatal accidents on helicopter airlines, resulting in a passenger death rate of 0.024 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				
1965-68 .....	.0008 (22)	.0013 (20)	.0007 (25)	.0004 (19)
1969-72 .....	.0004 (13)	.0006 (11)	.0003 (14)	.0002 (11)
1973-76 .....	.0003 (10)	.0004 (7)	.0002 (9)	.0001 (7)
1977§ .....	.0002 (1)	.0004 (2)	.0002 (2)	.0002 (3)
1965-77§ .....	.0004 (46)	.0007 (40)	.0003 (50)	.0002 (40)
International Operations				
1965-68 .....	.0004 (3)	.0011 (3)	.0009 (4)	.0009 (5)
1969-72 .....	.0000 (1)	.0000 (0)	.0000 (0)	.0000 (0)
1973-76 .....	.0012 (6)	.0015 (4)	.0009 (4)	.0013 (5)
1977§ .....	.0000 (0)	.0000 (0)	.0000 (0)	.0015 (1)
1965-77§ .....	.0005 (10)	.0008 (7)	.0005 (8)	.0008 (11)
Domestic and International Operations				
1965-68 .....	.0008 (25)	.0012 (23)	.0007 (29)	.0005 (24)
1969-72 .....	.0003 (14)	.0005 (11)	.0003 (14)	.0002 (11)
1973-76 .....	.0005 (16)	.0005 (11)	.0002 (13)	.0003 (12)
1977§ .....	.0001 (1)	.0004 (2)	.0002 (2)	.0004 (4)
1965-77§ .....	.0005 (56)	.0007 (47)	.0003 (58)	.0003 (51)

* 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.
 § 1977 figures are preliminary.

operation of scheduled air freight express and mail transportation over specified routes as well as nonscheduled flights that may include passengers.

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

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 operate passenger and cargo charter services supplementing the scheduled service of the Certificated Route Air

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)
1965-68	.0055 (4)	.0033 (4)
1969-72	.0035 (2)	.0019 (2)
1973-76	.0043 (2)	.0024 (2)
1977†	.0000 (0)	.0000 (0)
1965-77†	.0043 (8)	.0024 (8)

* Number of fatalities shown in parentheses.

† 1977 figures are preliminary.

Carriers. In addition, they may operate scheduled flights including the transportation of individually ticketed passengers and individually way-billed cargo, on a limited or temporary basis, as authorized by the Civil Aeronautics Board. There were 8 such air carriers listed in the September, 1977, issue of *Air Carrier Traffic Statistics*.

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 unique to any country influence the hazards of flying in that country. Each country has its own aviation regulations and methods of enforcement. These regulations may differ for domestic and international operations, the latter being affected by international agreements relating to the crossing of international boundaries.

World Air Transport Statistics, a publication of the International Air Transport Association (IATA), reports on the operations of the Association's members. In 1976, IATA member airlines, which numbered 107 on December 31, 1976, carried 83 percent of the world's scheduled airline traffic (excluding the U.S.S.R. and the People's Republic of China). Some companies operate only within the borders of a particular country and some only on an international basis, while others operate on both bases but in varying proportions.

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	
1965-68.....	.0020	.0006	.0008
1969-72.....	.0015	.0002	.0003
1973-76†.....	.0009	.0005	.0005
1976†.....	.0012	.0001	.0001
1965-76†.....	.0013	.0004	.0005

* Experience of helicopter air carriers is excluded.

† IATA figures are preliminary.

Table 3 gives passenger fatality rates per 1,000 scheduled passenger hours based on the experience of 9 members in the United States and 95 members in other countries (three IATA members do not operate scheduled passenger flights in fixed-wing aircraft). The safety record of airlines in countries other than the United States has shown improvement but continues to be less favorable than that of the United States scheduled airlines.

For 1976, 44 percent of the scheduled passenger hours reported to IATA were flown by the United States members, and these members accounted for 86 percent of the scheduled passenger hours flown by all United States Certificated Route Air Carriers. The combined international and domestic scheduled experience of all United States Certificated Route Air Carriers (passenger/cargo) is included in Table 3 for comparison.

UNITED STATES GENERAL AVIATION

General Aviation includes all domestic civil flying except that performed by the United States Civil Air Carrier Fleet and the Intrastate Air Carriers. The annual flying time in General Aviation is more than seven times that of the United States Civil Air Carrier Fleet's domestic flights. The FAA collects statistics on General Aviation by sending a registration form to all General Aviation aircraft owners each January requesting information such as the number of hours flown and the primary use of each aircraft. The data are compiled and adjusted for "non-reporting" aircraft, which account for about 25 percent of the total estimated flying hours.

Death rates are expressed per 1,000 airplane hours. Although it might be useful to relate deaths to the average hours flown in a year by pilots in each category of General Aviation shown in Table 4, such data cannot be estimated reliably from the information supplied by the National Transportation Safety Board. Some distortion in death rates by type of flying may occur because the methods used for assigning deaths are not entirely consistent with those used for assigning airplane hours.

Pleasure flying accounts for about 37 percent of the pilot flying time in General Aviation. Death rates in this category are probably overstated because there is a tendency for pilots to understate the amount of time they spend in pleasure flying and overreport hours for other types of flying (causing an understatement of death rates in these other categories). In Table 4 rental hours are included with "Pleasure" hours on the assumption that most pilots renting planes do so for pleasure purposes. In past Society reports (for flying done before 1970), most rental hours were probably included under "Instruction." Caution should be exercised, therefore, in analyzing long-term trends.

Instructional flying represents about 17 percent of the total hours flown in General Aviation. The experience under flight training of civilians includes the death of either the instructor or the student, depending on who was acting as pilot when the accident occurred. Practice flying not under the supervision of an instructor, either in the air or on the ground, is not included in the "Instruction" category. The higher pilot aviation death rates after 1969 reflect the reduced number of airplane hours due to the change in reporting method mentioned above for rental aircraft.

The "Business" and "Corporate" categories account for approximately 30 percent of the total General Aviation hours. Business flying is done by nonprofessional pilots flying for business reasons. Corporate flying is done by professional pilots receiving direct salary or compensa-

tion for piloting planes (not for public hire) operated by a corporation or business firm for the transportation of personnel or cargo in furtherance of the company's business.

Air taxi flying accounts for approximately 10 percent of the total General Aviation hours. This type of flying includes scheduled and non-scheduled passenger and cargo flying by professional pilots (other than corporate) that is not done by the United States Civil Air Carrier Fleet. In 1975 there were 26 pilot deaths in small fixed-wing aircraft (12,500 pounds or less), of which 12 deaths were in passenger flights and 14 were in cargo flights. There were no pilot deaths in large fixed-wing aircraft. In rotorcraft there were 4 pilot deaths in passenger flights and none in cargo flights.

Aerial application, which accounts for approximately 6 percent of General Aviation flying, consists primarily of crop dusting. Other activities include spraying to control insects, reseeding forests, and fertilizing. Fire control is not included in this category. The pilot fatality rates have been higher than those in other commercial activities, but in recent years these rates have shown much improvement. In 1970-75 the subdivision of experience by type of aircraft showed pilot aviation fatality rates per 1,000 airplane hours of 0.013 for rotorcraft (10 deaths) and 0.019 for fixed-wing aircraft (182 deaths). For pilots involved in agriculture, the average annual flying time for pilots having a local business confined to a single growing season is believed to be considerably less than that of pilots who either work more than one season or move from area to area.

In addition to the 550 pilot deaths recorded in all the categories shown in Table 4, there were 81 other pilot deaths during 1975. Of this number, 17 deaths occurred in aircraft being used for commercial purposes other than those shown in Table 4, such as power and pipeline patrol, fire control, mapping, advertising, and photography; 17 deaths were classified as noncommercial—other, a category that consists primarily of practice flying; and 47 deaths were classified as miscellaneous. Miscellaneous accidents included 13 deaths in ferrying, 8 in testing (including testing of homemade aircraft), 5 in search and rescue, and 4 in police patrol, with the remaining 17 deaths in activities such as demonstration, air-show racing, hunting, and unknown uses.

Of the 631 pilot deaths during 1975 in General Aviation, 591 were in small fixed-wing aircraft (12,500 pounds or less), 11 in large fixed-wing aircraft (over 12,500 pounds), 22 in rotorcraft, and 7 in gliders. There were 688 pilots involved in all fatal accidents, of whom 54 held student certificates, 328 private certificates, 243 commercial certificates, and 49

TABLE 4
 GENERAL AVIATION FLYING BY KIND
 PILOT AVIATION DEATH RATES PER 1,000 AIRPLANE HOURS

Years	Estimated Hours (000)	Aviation Deaths	Rate	Estimated Hours (000)	Aviation Deaths	Rate
	Pleasure			Instruction		
1973.....	10,140	381	.038	5,052	44	.009
1974.....	11,407	394	.035	4,969	49	.010
1975*.....	12,348	379	.031	5,070	40	.008
1973-75*	33,895	1,154	.034	15,091	133	.009
	Business			Corporate		
1973.....	5,451	67	.012	3,106	23	.007
1974.....	5,844	64	.011	3,296	14	.004
1975*.....	6,079	61	.010	3,466	14	.004
1973-75*	17,374	192	.011	9,868	51	.005
	Aerial Application			Air Taxi		
1973.....	1,847	30	.016	2,802	38	.014
1974.....	1,893	27	.014	3,303	28	.008
1975*.....	1,987	26	.013	3,347	30	.009
1973-75*	5,727	83	.014	9,452	96	.010

* 1975 figures are preliminary.

air transport certificates; 12 had no certificates, and 2 were listed as unknown or other.

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 Transport Canada and by Statistics Canada are shown in Table 5. 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 5.

Canadian scheduled airlines are 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,

operate from a designated base to serve a defined area, or are available for charter of an entire aircraft.

The fatality rates among Canadian civil pilots, by class of license, are shown in Table 6 separately, for the periods 1969-72 and 1973-76, based on figures furnished by Transport Canada. It should be noted that many pilots holding licenses may be inactive and that pilots holding airline transport licenses are not necessarily flying for scheduled airlines, since they may engage in other types of flying.

TABLE 5
CANADIAN AIRLINES
AVIATION FATALITY RATES*

Years	Passenger Rate per 1,000 Passenger Hours	First-Pilot Rate per 1,000 Airplane Hours
Scheduled Airlines		
1965-68 .....	.0012 (3)	.0018 (3)
1969-72 .....	.0009 (4)	.0010 (2)
1973-76 .....	.0000 (0)	.0000 (0)
1965-76 .....	.0006 (7)	.0008 (5)
1974-77 (est.) .....	.0000 (0)	.0000 (0)
Nonscheduled Airlines		
1969-72 .....	.0174 (71)	.0167 (53)
1973-76 .....	.0156 (81)	.0138 (57)
1969-76 .....	.0164 (152)	.0151 (110)

* Number of fatal accidents shown in parentheses.

The exposure data for 1976 used in preparing Table 6, normally obtainable from Transport Canada, were lost and had to be estimated.

UNITED STATES MILITARY

General

During the preparation of this year's report, it came to our attention that status changes—for example, reclassification from missing in action (MIA) to death—may not have been treated consistently by the various armed services over the years. As of the time of publication, it is uncertain how such status changes have been reported in the past, if at all. As a result, deaths due to hostile action may have been understated in

TABLE 6
CANADIAN CIVIL PILOTS BY CLASS OF LICENSE
1969-76 AVIATION FATALITY RATES

Class of License	Period	Life Years of Exposure	Aviation Fatalities	Rate per 1,000 Life Years of Exposure
Airline transport	{1969-72	10,734	23	2.1
	{1973-76	14,843	20	1.3
Senior commercial	{1969-72	2,883	16	5.5
	{1973-76	3,552	7	2.0
Commercial	{1969-72	19,362	74	3.8
	{1973-76	25,810	77	3.0
Private (excluding students)	{1969-72	98,920	115	1.2
	{1973-76	124,289	117	0.9
Glider	{1969-72	5,039	4	0.8
	{1973-76	6,748	3	0.4

previous years. At the very least the incidence figures for such deaths by calendar year were probably incorrect. We hope to resolve this matter before the next report is published and, if necessary, will revise figures previously reported. To our knowledge, there have been no problems in the reporting of fatalities from other than hostile action. For these reasons and because no deaths due to hostile action were reported for 1976, this year's report excludes all deaths due to hostile action.

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

In aggregate, the 1976 experience for the Air Force was less favorable than that reported for 1973, 1974, and 1975. The 1976 experience for the Navy and Marine Corps was similar to that reported for 1975 and continued at a lower level than that experienced in the late 1960's and early 1970's. The 1976 experience for the Army was more favorable than that reported for 1975 and continued at a much lower level than that reported for years prior to 1973.

Age and Rank

Table 7 shows aviation fatality rates by age group, while Table 8 presents 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. Nonpilot rated officers (in contrast to nonrated officers) in the Air Force are those who have flying duties other than as a pilot (i.e., navigators and observers).

The fatality rates for Air Force pilots and for nonpilot rated officers were higher in 1976 than in 1975, both in the aggregate and for most age and rank categories. For pilots, the overall fatality rate in 1976 was higher than it was in 1973, 1974, or 1975. The overall fatality rate among nonpilot rated officers was higher than it had been for at least ten years, largely as a result of the high fatality rate in the 25-29 age group.

TABLE 7
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 EXCLUDED

Age Group	1969-72	1973-76	1976
Air Force Pilots			
Under 25.....	2.4	2.4	2.4
25-29.....	3.7	1.6	2.1
30-34.....	2.8	1.5	1.5
35-39.....	1.5	1.0	2.4*
40 and over.....	1.3	0.4	0.5*
All.....	2.3	1.3	1.9
Air Force Nonpilot Rated Officers			
Under 25.....	0.5*	1.3*	1.8*
25-29.....	0.9	1.6	2.5
30-34.....	0.8	0.5*	0.7*
35-39.....	0.8	0.8	0.9*
40 and over.....	1.5	1.0	0.0*
All.....	0.8	1.1	1.8
Navy and Marine Corps Pilots			
Under 25.....	7.4	3.2	1.3*
25-29.....	7.1	3.8	4.4
30-34.....	4.6	1.9	1.8
35-39.....	2.4	1.3	0.0*
40 and over.....	1.3	0.4	0.0*
All.....	4.7	2.4†	2.1

* Based on 5 or fewer deaths.

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

In the aggregate, the 1976 fatality rate for Navy and Marine Corps pilots was similar to that reported for 1975, with no general trend by age or rank. Fatality rates for Navy and Marine Corps pilots were at a much higher level in the late 1960's and early 1970's but declined steadily to the level experienced in 1975 and 1976.

TABLE 8
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 EXCLUDED

Rank (Pay Grade)*	1969-72	1973-76	1976
Air Force Pilots			
2d Lieutenant (O-1)	5.2	2.2	0.0†
1st Lieutenant (O-2)	2.9	1.8	3.0
Captain (O-3)	3.1	1.6	1.8
Major (O-4)	2.3	1.1	2.6
Lieutenant Colonel (O-5)	1.2	0.5	0.6†
General and Colonel (O-6 and up)	0.7	0.1†	0.0†
All	2.3	1.3	1.9
Air Force Nonpilot Rated Officers			
2d Lieutenant (O-1)	0.0†	0.9†	2.4†
1st Lieutenant (O-2)	1.6	1.4	1.8†
Captain (O-3)	0.8	1.3	2.2
Major (O-4)	0.9	0.8	0.8†
Lieutenant Colonel (O-5)	0.6†	0.9†	0.0†
General and Colonel (O-6 and up)	0.0†	0.0†	0.0†
All	0.8	1.1	1.8
Navy and Marine Corps Pilots			
Ensign (O-1)	1.7†	1.6†	0.0†
Lieutenant Junior Grade (O-2)	9.3	4.1	4.8
Lieutenant (O-3)	5.4	3.5	3.2
Lieutenant Commander (O-4)	3.4	1.5	0.9†
Commander (O-5)	1.8	0.5	0.0†
Admiral and Captain (O-6 and up)	0.0†	0.2†	0.0†
All	4.7†	2.4†	2.1†

* Ranks shown under "Navy and Marine Corps Pilots" are for Navy; equivalent Marine Corps ranks are similar to Air Force pilot ranks.

† Based on 5 or fewer deaths.

‡ A small portion of total Navy and Marine Corps pilots and pilot deaths were not identified by rank.

Duty Assignment

Aviation fatality rates among Air Force pilots with full-time flying duties are shown according to duty assignment in Table 9. In contrast to the exposures underlying Tables 7 and 8, Air Force pilots who were not assigned to a specific flying duty but flew chiefly to maintain pro-

TABLE 9
 UNITED STATES AIR FORCE, NAVY, AND
 MARINE CORPS PILOTS,
 BY DUTY ASSIGNMENT
 AVIATION FATALITY RATES
 PER 1,000 LIFE YEARS OF EXPOSURE
 DEATHS DUE TO HOSTILE ACTION EXCLUDED

Duty Assignment	1973-76	1976
Air Force Pilots*		
Search rescue.....	0.0†	0.0†
Helicopter.....	2.8	3.7†
Tanker.....	1.3	4.4
Bomber.....	1.1	0.0†
Reconnaissance.....	1.1†	2.3†
Trainer.....	1.3	1.1†
Cargo.....	0.8	0.5†
Observation.....	1.7†	0.0†
Fighter.....	3.7	3.5
Utility.....	0.0†	0.0†
Liaison.....	0.0†	0.0†
All.....	1.6	2.0
Navy and Marine Corps Pilots‡		
Navy carrier-based jet.....	3.6	4.1
Marine fighter/attack jet.....	4.6	3.8†
Navy carrier-based prop.....	2.0	1.6†
Marine fighter/attack/OBS prop§.....	3.1†	0.0†
Navy patrol/transport.....	0.3†	0.0†
Marine patrol/transport.....	2.1†	0.0†
Navy helicopter.....	1.5	0.4†
Marine helicopter.....	3.5	4.5
All.....	2.4	2.1

* In this table Air Force pilots who were not assigned to a specific flying duty but flew chiefly to maintain proficiency were excluded from the exposure.

† Based on 5 or fewer deaths.

‡ A small portion of total Navy and Marine Corps pilots and pilot deaths were not identified by duty assignment.

§ OBS prop = observation/counterinsurgency propeller.

iciency were excluded from the experience, although the number of such pilots diminished significantly in 1975 and 1976. The aggregate fatality rates for 1976 were higher than those reported for 1973, 1974, and 1975, largely due to the increase in the fatality rate among pilots who flew tankers.

For the Navy and Marine Corps all pilots were included, since no exclusion of pilots flying chiefly to maintain proficiency was possible. As with the experience among Navy and Marine Corps pilots by age group and by rank, the aggregate fatality rate for 1976 was similar to that reported for 1975, with no general relationship by individual duty assignment between the two years.

Hours of Flying

Average hours of flying are based on the combined flying time of pilots who fly chiefly to maintain proficiency and those with full-time flying duties.

In 1976 Navy pilots flew an average of 70 hours, much less than the 161 hours recorded for 1975 and a level similar to that recorded for 1974. Marine Corps pilots flew an average of 68 hours in 1976, which was similar to the 71 hours recorded for 1975 and much lower than the average hours recorded for 1973 and 1974. Naval Reserve pilots flew an average of 81 hours in 1976, somewhat more than the average recorded for 1974 and 1975. Average flying hours for Marine Corps Reserve pilots were not available for 1976.

During 1976, nonstudent Army pilots who were qualified to fly fixed-wing aircraft flew an average of 27 hours in such aircraft, while those qualified for rotary-wing aircraft flew an average of 45 hours in that type of aircraft. A significant percentage of the pilots were qualified to fly both fixed-wing and rotary-wing aircraft; those dual-qualified pilots were included in the calculation of average flying hours for both types of aircraft. For both types of aircraft combined, nonstudent Army pilots flew an average of 54 hours during 1976. All of these average flying hours are slightly lower than those reported for 1975.

The average number of aircraft hours for Air Force pilots was not available. In 1976 the average annual flying time for Air National Guard pilots on flying status was 107 hours, similar to that recorded for 1974 and 1975. Army Reserve pilots and Army National Guard pilots flew an average of 58 and 65 hours, respectively, in 1976, which was similar to the experience in 1974 and 1975.

Military Air Command (MAC)

Aviation fatality rates among pilots and crew members of MAC, a branch of the Air Force, are shown in Table 10. For both pilots and crew

members the fatality rates in 1976 were higher than they have been for a number of years, largely as a result of the high rate among transport units. However, the number of fatalities each year was small. The experience of MAC pilots was also included in Tables 7-9.

TABLE 10
MILITARY AIR COMMAND (MAC)
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE
DEATHS DUE TO HOSTILE ACTION EXCLUDED

	1969-72	1973-76	1976
Pilots:			
Transport units.....	0.7	1.5	2.6
Other units.....	1.6	1.0*	0.0*
All.....	1.0	1.3	1.8
Crew members:			
Transport units.....	0.7	2.3	3.4
Other units.....	2.0	0.8	0.0*
All.....	1.2	1.9	2.7

* Based on 5 or fewer deaths.

United States Army

Table 11 includes data for all flying operations among nonstudent Army pilots and crew members. All 1976 rates were lower than those in 1975. These rates remain substantially below those recorded prior to 1973.

As mentioned in last year's report, student and nonstudent flying hours were split for the first time in 1975. Therefore, the method of reporting average flying hours and the pilot fatality rates by type of aircraft was changed last year so that all figures in Table 11 would be based on nonstudent pilots only. In calculating the fatality rates per 1,000 aircraft hours for 1973-76, it was estimated that the ratio of nonstudent to student flying hours reported for 1975 was also applicable to 1973 and 1974.

Student Pilots

Table 12 presents aviation fatality rates for student pilots in the military services. There is significant fluctuation in the fatality rates from year to year because of the small number of deaths each year.

Coast Guard

No fatalities among Coast Guard personnel on flight orders, either pilots or crew members, have occurred in the last five years. There have

been no aviation fatalities among Coast Guard student pilots and observers for the last twenty years.

Active Reserves and National Guard

Table 13 shows the aviation fatality rates for Army, Navy, and Marine Corps pilots in the active reserves and for Air and Army National Guard pilots. Such pilots are not on full-time active duty but generally fly on

TABLE 11
UNITED STATES ARMY—ALL FLYING OPERATIONS
DEATHS DUE TO HOSTILE ACTION EXCLUDED

	1973-76	1976
	Aviation Fatality Rates per 1,000 Life Years of Exposure	
Pilots	1.0	1.0
Crew members	2.2	1.6
	Pilot Fatality Rates per 1,000 Aircraft Hours	
Fixed-wing aircraft . . . . .	.0297	.0138*
Rotary-wing aircraft . . . . .	.0134	.0188
All types of aircraft . . . . .	.0158	.0179

* Based on 5 or fewer deaths.

TABLE 12
UNITED STATES AIR FORCE, NAVY, AND MARINE CORPS,
AND ARMY STUDENT PILOTS
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

	1969-72	1973-76	1976
Air Force*	2.3	1.9	1.6†
Navy and Marine Corps*			
Basic course	2.7	1.4	4.3†
Advanced course	8.0	2.6	0.0†
Army	3.2	1.3†‡	0.0†

* Commissioned officers only.

† Rates based on 5 or fewer deaths.

‡ Rate based on data excluding 1974, for which year data are not available.

TABLE 13
 PILOTS IN THE ACTIVE RESERVES AND NATIONAL GUARD
 AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

	1969-72	1973-76	1976
Navy and Marine Corps Reserves:			
Ages under 30	2.0	0.0*	0.0*
Ages 30 and over	1.5	0.7	0.5*
All ages	1.6	0.6	0.4*
Army Reserves	N.A.†	0.9*	0.0*
Air National Guard	2.4	1.6	1.6
Army National Guard	1.4	0.4	0.8*

* Based on 5 or fewer deaths.
 † N.A. = Not available.

weekend and/or short-term (usually two weeks) training duty. The number of deaths among these pilots is very small each year.

Air Force Flight Surgeons and Nurses

No fatalities among Air Force flight surgeons have occurred in the last five years. There have been no fatalities among Air Force flight nurses in the last fifteen years.

Graduates of Academies—Assignment to Aviation

Among graduates of the military service academies in 1976 who were accepted for flight training by the Air Force, 99.4 percent were from the Air Force Academy, 0.6 percent were from the Military Academy, and none were from the Naval Academy.

Of the commissioned Air Force Academy graduates in 1976, 98.8 percent received their assignments in the Air Force, 1.1 percent in the Army, 0.1 percent in the Navy, and none in the Marine Corps.

CANADIAN MILITARY

Aviation fatality rates among Canadian regular military forces, excluding reserves, for the period 1971-76 are shown in Table 14 by age, rank, and functional classification.

The average number of flying hours for all pilots combined has remained steady at approximately 300 hours per year over the six-year period and shows little variation by age group. Crew members averaged 350 hours per year. There was some variation by functional classification,

but this could not be determined accurately because of duplicate counting in different functions. Pilots and crew members flying more than one type of aircraft were counted in each function in which flying was done. The extent of overstatement by type of aircraft is unknown. The unadjusted average annual flying time for pilots and crew in the transport and maritime categories was considerably higher than for those in the fighter, training, and helicopter categories. The former group averaged 350 hours per year and the latter approximately 140 hours per year.

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 fly occasionally to maintain proficiency.

TABLE 14
CANADIAN REGULAR FORCES
1971-76 AVIATION FATALITY RATES
PER 1,000 LIFE YEARS OF EXPOSURE

	Pilots	Crew
Age group:		
Under 25.....	7.0	1.7*
25-29.....	3.8	0.9*
30-34.....	4.3	2.8
35-39.....	1.5*	1.6*
40 and over.....	0.4*	0.4*
All.....	3.1	1.5
Rank:		
Lieutenant and lower rank.....	4.5	2.1
Captain.....	3.6	0.6*
Major.....	1.4*	0.0*
Lieutenant Colonel and higher rank.....	0.0*	0.0*
All.....	3.1	1.5
Functional classification:†		
Fighter.....	2.6	1.1*
Training.....	1.5	0.0*
Transport.....	1.3*	1.1*
Maritime.....	4.7	1.1*
Helicopter.....	1.8*	2.5*
Others.....	2.3*	0.8*
All.....	2.0	1.2

* Based on 5 or fewer deaths.

† The fatality rates by functional classification are understated because some pilots and crew members fly more than one type of aircraft. The extent of understatement in total can be determined by comparing the fatality rates of the "All" categories.

INTERCOMPANY EXPERIENCE

This report and the data contained in Tables 15-17 were based on the combined experience of 1975-76 and 1971-76 for the issues of 1967 and subsequent years. The 1971-76 experience has been added to the tables because there were few deaths and small exposure in many of the categories of the tables for the 1975-76 experience. All experience is by number of policies, and the insured is classified according to status at the time of application for insurance. Policies with an aviation exclusion clause are not included. Exposure for policies with aviation extra premiums is terminated when the extra premium is discontinued. However, for those policies with civilian flying hazards and where there is still an aviation hazard after discontinuance of the extra premium, companies were encouraged to transfer the exposure to the "Without Aviation Extra Premium" category. Unfortunately, not all companies were able to do this, and consequently the experience for that category includes only a portion of such cases. The older the issue, the greater the chance that the classification does not properly reflect current flying activity such as that for student pilots. The data used were submitted by sixteen companies, as compared with twenty companies contributing to the study two years ago.

Civilian Aviation

Table 15 covers the experience for various classifications of pilots for policies issued with and without aviation extra premiums. The "Scheduled airline" classification includes United States Certificated Route Air Carriers and corresponding major Canadian airlines. The "Corporate" classification covers hired pilots flying company-owned planes. Included in "Charter and other airlines" are the supplemental air carriers and intrastate and foreign airlines, as well as air taxi and charter operations. The "Others" classification 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. Pilots with either student or private certificates are defined as (1) private pilots (if they have 100 or more solo hours of pleasure or personal business flying) or (2) student pilots (if they have less than 100 solo hours of flying).

The 1975-76 experience in the "With Aviation Extra Premium" category shows a mixed picture of improvements relative to the previous report, which covered the 1971-74 experience. Within the classification "Other commercial," poorer experience was observed for "Instructing" (2.9 versus 2.7) and "Corporate" (2.4 versus 1.1), while the experience

for the "Charter and other airlines" classification showed a slight improvement (3.4 versus 3.6). The classifications "Private pilots" and "Student pilots" both exhibited improved experience (0.9 versus 1.1 and 0.3 versus 0.6, respectively). However, the 1975-76 fatality rates for each status at issue were based on 5 or fewer deaths, except for instructors and private pilots.

The experience under "Without Aviation Extra Premium" showed little change from the previous report except for "Student pilots," where there were no deaths in 1975-76.

Table 16 shows the experience for private pilots, both with and without aviation extra premiums, subdivided by hours flown, type of flying

TABLE 15
INTERCOMPANY EXPERIENCE ON PILOTS IN CIVILIAN
AVIATION—BY POLICIES*
(1975-76 and 1971-76 Experience on 1967 and Subsequent Issues)

STATUS AT ISSUE	YEARS	WITH AVIATION EXTRA PREMIUM			WITHOUT AVIATION EXTRA PREMIUM		
		Years of Ex- posure	Avia- tion Fa- talities	Rate per 1,000	Years of Ex- posure	Avia- tion Fa- talities	Rate per 1,000
Scheduled airline pilots	{1975-76	314	0	0.0	3,939	3	0.8
	{1971-76	939	1	1.1	5,781	9	1.6
Other commercial pilots flying for hire: Instructing (at least half-time).....	{1975-76	2,088	6	2.9	205	0	0.0
	{1971-76	5,752	16	2.8	436	1	2.3
Corporate.....	{1975-76	1,246	3	2.4	1,948	1	0.5
	{1971-76	3,127	5	1.6	5,012	2	0.4
Charter and other airlines.....	{1975-76	1,456	5	3.4	361	0	0.0
	{1971-76	4,221	15	3.6	882	1	1.1
Others†.....	{1975-76	1,623	5	3.1	454	0	0.0
	{1971-76	4,069	11	2.7	1,077	1	0.9
Private pilots.....	{1975-76	13,097	12	0.9	52,614	47	0.9
	{1971-76	35,372	36	1.0	137,715	134	1.0
Student pilots.....	{1975-76	18,454	5	0.3	3,276	0	0.0
	{1971-76	53,583	26	0.5	7,993	9	1.1

* 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.

certificate, and attained age. The exposure for issues without aviation extra premiums includes an unknown proportion of pilots who have discontinued their flying activities. The total 1975-76 experience under both the "With Aviation Extra Premium" and "Without Aviation Extra Premium" categories remained essentially the same as the 1971-74

TABLE 16
 INTERCOMPANY EXPERIENCE ON PILOTS FLYING FOR
 PLEASURE OR PERSONAL BUSINESS—BY POLICIES*
 (1975-76 and 1971-76 Experience on 1967 and Subsequent Issues)

	YEARS	WITH AVIATION EXTRA PREMIUM			WITHOUT AVIATION EXTRA PREMIUM		
		Years of Ex- posure	Avia- tion Fa- talities	Rate per 1,000	Years of Ex- posure	Avia- tion Fa- talities	Rate per 1,000
By hours flown:†							
Under 100.....	{ 1975-76 1971-76	7,121 19,087	4 12	0.6 0.6	33,797 88,878	12 49	0.4 0.6
100-199.....	{ 1975-76 1971-76	2,989 8,418	4 9	1.3 1.1	14,641 38,779	31 73	2.1 1.9
200-299.....	{ 1975-76 1971-76	1,331 3,640	3 6	2.3 1.6	1,766 4,511	3 5	1.7 1.1
300 or more.....	{ 1975-76 1971-76	1,375 3,562	1 7	0.7 2.0	1,059 2,409	1 3	0.9 1.2
By type of flying cer- tificate:							
Commercial or trans- port.....	{ 1975-76 1971-76	3,419 9,401	4 10	1.2 1.1	11,041 28,280	6 26	0.5 0.9
Private.....	{ 1975-76 1971-76	9,678 25,971	8 26	0.8 1.0	41,573 109,435	41 108	1.0 1.0
By attained age:							
Under 35.....	{ 1975-76 1971-76	8,214 22,283	5 16	0.6 0.7	10,141 29,275	7 25	0.7 0.9
35-49.....	{ 1975-76 1971-76	3,482 9,680	5 17	1.4 1.8	30,322 80,829	22 71	0.7 0.9
50 and over.....	{ 1975-76 1971-76	1,401 3,409	2 3	1.4 0.9	12,151 27,611	18 38	1.5 1.4
Total.....	{ 1975-76 1971-76	13,097 35,372	12 36	0.9 1.0	52,614 137,715	47 134	0.9 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.

† Hours flown in 12 months preceding issue. Excludes experience of companies unable to subdivide data.

experience of the previous report (0.9 versus 1.1 and 0.9 versus 1.0, respectively). The experience in the "With Aviation Extra Premium" category by hours flown showed that, compared with the previous report, improvements were observed in the "under 100" classification while the "100-199" and "200-299" classifications exhibited higher fatality rates. By attained age, the experience at ages under 50 showed

TABLE 17

INTERCOMPANY EXPERIENCE ON MILITARY PILOTS BY BRANCH OF SERVICE
AND FLYING DUTIES—WITH AVIATION EXTRA PREMIUM*
(1975-76 and 1971-76 Experience on 1967 and Subsequent Issues—by Policies)

STATUS AT ISSUE AND ATTAINED INSURANCE AGE	YEARS	OPERATIONAL			ADMINISTRATIVE		
		Years of Ex- posure	Avia- tion Fa- talities	Rate per 1,000	Years of Ex- posure	Avia- tion Fa- talities	Rate per 1,000
U.S. Air Force Under 35	{ 1975-76	2,041	3	1.5	267	0	0.0
	{ 1971-76	7,269	11	1.5	753	2	2.7
35 and over	{ 1975-76	1,454	2	1.4	616	1	1.6
	{ 1971-76	4,823	7	1.5	2,342	4	1.7
Total	{ 1975-76	3,495	5	1.4	883	1	1.1
	{ 1971-76	12,092	18	1.5	3,095	6	1.9
U.S. Army: Under 35	{ 1975-76	1,818	4	2.2	1,036	0	0.0
	{ 1971-76	5,648	15	2.7	3,472	2	0.6
35 and over	{ 1975-76	521	0	0.0	652	1	1.5
	{ 1971-76	1,304	1	0.8	1,824	3	1.6
Total	{ 1975-76	2,339	4	1.7	1,688	1	0.6
	{ 1971-76	6,952	16	2.3	5,296	5	0.9
U.S. Navy	{ 1975-76	853	1	1.2	439	1	2.3
	{ 1971-76	3,190	4	1.3	1,567	1	0.6
U.S. Marine Corps	{ 1975-76	348	1	2.9	169	0	0.0
	{ 1971-76	1,085	1	0.9	549	0	0.0
U.S. Air Force, Army, Navy, and Marine Corps Reserve	{ 1975-76				357	1	2.8
	{ 1971-76				1,283	3	2.3
U.S. Air National Guard	{ 1975-76				768	0	0.0
	{ 1971-76				1,645	2	1.2

* Exposure is terminated on discontinuance of extra premium.

an improvement over the experience in the previous report. By type of flying certificate, "Commercial or transport" flying showed a slight increase (1.2 versus 1.0), while "Private" flying showed a slight decrease (0.8 versus 1.1). Again, the 1975-76 fatality rates for all but one classification were based on 5 or fewer deaths.

Policies in the "Without Aviation Extra Premium" category showed similar trends in fatality rates by hours flown and attained age.

Military Aviation

Table 17 shows aviation fatality rates for the years 1975-76 and 1971-76 among military aviation pilots with policies issued only with an aviation extra premium. The fatality rates in Table 17 are shown for both operational pilots and administrative pilots. Administrative pilots are defined as those flying only 40-150 hours annually, whereas operational pilots are defined as those flying over 150 hours annually. It is difficult to draw any meaningful conclusions because of the relatively few military aviation deaths and the small exposure included in this table. Only by combining six years of experience for the "Operational" category can fatality rates be obtained that are based on more than 5 deaths in a few classifications.

II. HAZARDOUS SPORTS

IN THE last report, fatality statistics on hazardous sports were shown for the first time. Additional data may be published in the next report if fatality statistics are available from sources outside the insurance industry.

The first biennial intercompany experience study had insufficient data to show any significant results for the last report. To obtain sufficient data, we again urge that additional companies contribute their data to future studies.

It is planned that sports statistics will be published on a biennial basis.

