

**TRANSACTIONS OF SOCIETY OF ACTUARIES
1979 REPORTS**

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

AVIATION STATISTICS

THIS section of the report covers statistics obtained from United States and Canadian governmental sources, 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 two years. Data for earlier periods are included for comparison and to indicate trends.

The fatality rates for Canadian military pilots are generally higher than for United States military pilots.

Fatality rates for many categories of flying are now shown in identical five- and ten-year groupings to facilitate comparisons. It is anticipated that all categories will be similarly grouped in the next report.

UNITED STATES CIVIL AVIATION

United States civil aviation can be divided into four major types: Certificated Route Air Carriers, Charter Air Carriers (formerly called Supplemental Air Carriers), Commercial Operators (sometimes called Intrastate Air Carriers), and General Aviation. In earlier reports, the first three types were classified singly as the United States Civil Air Carrier Fleet. Definitions as to what constitutes a particular aviation type or activity are formulated either by the Civil Aeronautics Board or the Federal Aviation Administration.

Pilots engaged in air carrier flying may not, under government regulations, fly more than 100 hours per month nor more than 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. The Certificated Route Air Carrier pilots, in particular, under a union-negotiated contractual obligation are allowed to fly only a maximum of 700–800 hours per year but actually average 600–700 hours. Other air carriers, with no such obligation, generally require pilots to fly the maximum annual number of regulation hours.

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 December, 1978, issue of the monthly Civil Aeronautics Board publication *Air Carrier Traffic Statistics* listed 34 passenger/cargo air carriers (including 5 intra-Alaska, 2 intra-Hawaii, and 1 helicopter carrier) and 3 all-cargo carriers.

As defined by the Civil Aeronautics Board, “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.

Helicopter airlines designated as “Certificated Route Air Carriers” are excluded from the experience in Table 1. The last flight of such airlines took place in early 1979 with no indication that flights would ever resume again.

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 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 are shown in Table 2.

Charter Air Carriers

Charter Air Carriers 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 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 December, 1978, issue of *Air Carrier Traffic Statistics*.

The figures shown in Table 2 include experience in operations under contracts with military authorities.

Commercial Operators

A Commercial Operator is a person who, for compensation or hire, engages in air commerce of persons or property other than as an air carrier or air taxi. Formerly the Commercial Operators were called Intrastate

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				
1969-73.....	.0004 (17)	.0005 (13)	.0003 (16)	.0002 (14)
1974-78.....	.0002 (10)	.0003 (7)	.0001 (9)	.0001 (7)
1977.....	.0001 (1)	.0002 (1)§	.0001 (1)§	.0002 (2)
1978.....	.0003 (3)	.0004 (1)§	.0001 (1)§	.0000 (1)§
1969-78.....	.0003 (27)	.0004 (20)	.0002 (25)	.0001 (21)
International Operations				
1969-73.....	.0002 (3)	.0003 (1)§	.0002 (1)§	.0002 (1)
1974-78.....	.0007 (4)	.0010 (3)§	.0006 (3)	.0011 (5)
1977.....	.0000 (0)§	.0000 (0)§	.0000 (0)§	.0015 (1)
1978.....	.0000 (0)§	.0000 (0)§	.0000 (0)§	.0000 (0)§
1969-78.....	.0005 (7)	.0006 (4)§	.0003 (4)	.0007 (6)
Domestic and International Operations				
1969-73.....	.0004 (20)	.0005 (14)	.0003 (17)	.0002 (15)
1974-78.....	.0003 (14)	.0004 (10)	.0002 (12)	.0002 (12)
1977.....	.0001 (1)	.0002 (1)§	.0001 (1)§	.0004 (3)
1978.....	.0000 (3)	.0003 (1)§	.0001 (1)§	.0000 (1)§
1969-78.....	.0003 (34)	.0004 (24)	.0002 (29)	.0002 (27)

* 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; experience of helicopter air carriers is excluded.

§ Based on 5 or fewer deaths.

Air Carriers; flight statistics for this subclass of civil aviation were collected on an irregular basis by the individual states.

Commercial Operators of large aircraft are those operating aircraft of more than 12,500 pounds maximum certificated takeoff weight. Statistics for this class have recently become available and appear in Table 3. In 1978 one accident with 128 passenger fatalities resulted in the very high death rate.

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

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

Years	All-Cargo (All Operations)	CHARTER (Revenue Operations)
1969-73	.0043 (3)	.0023 (3)
1974-78	.0036 (2)	.0010 (1)
1977	.0095 (1)	.0000 (0)
1978	.0000 (0)	.0000 (0)
1969-78	.0040 (5)	.0017 (4)

* Number of fatalities shown in parentheses.

TABLE 3
COMMERCIAL OPERATORS OF LARGE AIRCRAFT
PASSENGER AND CREW MEMBER DEATH RATE
PER 1,000 AIRPLANE HOURS*

Years	Passenger Rate (All Operations)	Crew Member Rate (All Operations)
1975	.0000 (0)	.0122 (2)
1976	.0000 (0)	.0178 (3)
1977	.0000 (0)	.0162 (3)
1978	.4648 (128)	.0254 (7)
1975-78	.1614 (128)	.0189 (15)

* Number of fatalities shown in parentheses.

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 1978, IATA member airlines, which numbered 106 on June 1, 1978, carried 71 percent of the world's scheduled airline traffic (excluding the U.S.S.R. and the People's Republic of China). United States membership has averaged about 10 airlines per year with a membership in 1978 of 7, which included one helicopter air carrier. 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 4 gives passenger fatality rates per 1,000 scheduled passenger hours. 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 1978, 40 percent of the scheduled passenger hours reported to IATA were flown by the United States members, and these members accounted for 69 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 4 for comparison.

TABLE 4
SCHEDULED AIR CARRIERS (PASSENGER/CARGO) OF
UNITED STATES AND OTHER COUNTRIES
PASSENGER 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	
1969-73.....	.0014	.0002	.0004
1974-78.....	.0007	.0003	.0003
1977.....	.0003	.0000	.0001
1978.....	.0005	.0000	.0000
1969-78.....	.0010	.0003	.0003

* Experience of helicopter air carriers is excluded.

UNITED STATES GENERAL AVIATION

General Aviation includes all domestic civil flying except that performed by the United States Civil Air Carrier Fleet. The flying time in General Aviation during 1978 was more than seven times that of the United States Civil Air Carrier Fleet's domestic flights. Prior to 1977 the FAA collected 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 were compiled and adjusted for "nonreporting" aircraft, which accounted for about 25 percent of the total estimated flying hours. Beginning in 1977, a sample of approximately 14 percent of all registered General Aviation aircraft was selected as a basis for determining hours flown by all aircraft according to primary use. Standard errors for the sample in 1977 ranged from 3.9 percent for pleasure flying to 9.8 percent for rental flying.

Death rates are expressed per 1,000 aircraft 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 5, 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 aircraft hours. Both rotary- and fixed-wing aircraft are included.

A category of General Aviation flying that is not included in this report because there was insufficient data is industrial flying. In 1977, it accounted for 1.3 percent of all flying hours.

In the five-year period 1974-78, pleasure flying accounted for about 36 percent of pilot flying time in General Aviation. Death rates in this

TABLE 5
GENERAL AVIATION FLYING BY KIND
PILOT AVIATION DEATH RATES PER 1,000 AIRCRAFT HOURS*

Years	Pleasure	Instruc- tion	Business	Corporate	Aerial Application	Air Taxi
1969-73	.037 (1,736)	.010 (253)	.016 (367)	.005 (69)	.022 (169)	.014 (160)
1974-78	.031 (1,936)	.008 (226)	.009 (288)	.004 (75)	.012 (119)	.011 (199)
1977	.031 (376)	.006 (39)	.008 (52)	.005 (16)	.011 (22)	.009 (39)
1978	.031 (401)	.001 (54)	.007 (57)	.004 (20)	.010 (20)	.014 (60)
1969-78	.034 (3,672)	.009 (479)	.012 (655)	.005(144)	.016 (288)	.012 (359)

* Number of fatalities shown in parentheses.

category are probably overstated because there is a tendency for pilots to understate the amount of time they spend in pleasure flying and over-report hours for other types of flying (causing an understatement of death rates in these other categories). In Table 5, 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 very long-term trends. In 1977, rental hours accounted for 7.8 percent of all General Aviation flying hours.

Instructional flying in the same period represented about 16 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 pilot aviation death rates after 1969 reflect the reduced number of aircraft hours due to the change in reporting method mentioned above for rental aircraft.

The "Business" and "Corporate" categories accounted for approximately 31 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 compensation for piloting aircraft (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 accounted for approximately 11 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. Scheduled air taxi flying comprises the commuter air carriers, third-level airlines, and the feeder airlines. Table 5 includes both scheduled and non-scheduled air taxi flying. Scheduled air taxi (commuter air carrier) experience is shown in Table 6 and is available only for the period 1975-78. Passenger and crew member fatality rates in 1978 were more than twice those in 1975 for passenger operations of commuter air carriers. In contrast, the crew member fatality rate in cargo operations from 1975 to 1976 decreased by two-thirds and then remained relatively level through 1978.

Aerial application, which accounted for approximately 6 percent of General Aviation flying, consists primarily of crop dusting. Other ac-

TABLE 6
 COMMUTER AIR CARRIER FLYING
 (SCHEDULED AIR TAXI)
 AVIATION DEATH RATES PER 1,000 AIRPLANE HOURS*

YEARS	PASSENGER OPERATIONS		CARGO OPERATIONS
	Passenger Rate	Crew Member Rate	Crew Member Rate
1975 .....	.0147 (11)	.0040 (3)	.0417 (9)
1976 .....	.0187 (14)	.0067 (5)	.0138 (3)
1977 .....	.0230 (20)	.0081 (7)	.0110 (3)
1978 .....	.0325 (33)	.0089 (9)	.0146 (4)
1975-78 .....	.0231 (78)	.0071 (24)	.0194 (19)

* Number of fatalities shown in parentheses.

tivities 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 1977 the subdivision of experience by type of aircraft showed pilot aviation fatality rates per 1,000 aircraft hours of 0.0050 for rotorcraft (1 death) and 0.012 for fixed-wing aircraft (19 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.

CANADIAN CIVIL FLYING

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.

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 7. 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 7. For scheduled airlines, rates shown in Table 7 generally compare very

TABLE 7
CANADIAN AIRLINES
AVIATION FATALITY RATES

Years	Passenger Rate per 1,000 Passenger Hours*	First Pilot Rate per 1,000 Airplane Hours †
Scheduled Airlines		
1969-73 .....	.0007 (4) (102)	.0008 (2)
1974-78 .....	.0002 (4) (49)	.0011 (3)
1977 .....	.0001 (1) (5)	.0018 (1)
1978 .....	.0009 (3) (44)	.0041 (2)
1969-78 .....	.0004 (8) (151)	.0009 (5)
Nonscheduled Airlines		
1969-73 .....	.0170 (97) (151)	.0174 (72)
1974-78 .....	.0143 (85) (161)	.0112 (62)
1977 .....	.0120 (12) (30)	.0076 (9)
1978 .....	.0137 (18) (39)	.0123 (15)
1969-78 .....	.0155 (182) (312)	.0138 (134)

* Number of fatal accidents and passenger fatalities shown in parentheses.

† Number of fatal accidents shown in parentheses.

favorably with the corresponding rates from the United States in Table 1.

The fatality rates among Canadian civil pilots, by class of license, are shown in Table 8 separately, for the periods 1971-74 and 1975-78, 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.

UNITED STATES MILITARY

General

As in the previous report, deaths due to hostile action are omitted. In this and later reports, experience will be grouped in five-year intervals rather than the four-year intervals of earlier studies.

While the 1977 and 1978 experiences for the Air Force were similar to that reported for 1976, they were less favorable than those reported for 1974 and 1975. The 1978 experience for the Navy and Marine Corps was less favorable than that for any year from 1974 to 1977.

TABLE 8
CANADIAN CIVIL PILOTS BY CLASS OF LICENSE
1971-78 AVIATION FATALITY RATES

Class of License	Period	Life Years of Exposure	Aviation Fatalities	Rate per 1,000 Life Years of Exposure
Airline transport	{ 1971-74	12,641	30	2.4
	{ 1975-78	15,853	24	1.5
Senior commercial	{ 1971-74	3,223	11	3.4
	{ 1975-78	3,633	12	3.3
Commercial	{ 1971-74	21,631	72	3.3
	{ 1975-78	29,051	105	3.6
Private (excluding students)	{ 1971-74	109,477	117	1.1
	{ 1975-78	136,316	137	1.0
Glider	{ 1971-74	5,163	4	0.8
	{ 1975-78	9,733	5	0.5

All United States military aviation statistics are shown on a calendar-year basis.

Age and Rank

Table 9 shows aviation fatality rates by age group, while Table 10 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 the Air Force are those who have flying duties other than as a pilot (e.g., navigators and observers).

The fatality rates for Air Force pilots and nonpilot rated officers were higher in 1977 than in 1978 both in the aggregate and for most age and rank categories. For pilots the overall fatality rate in 1977 was higher than in 1974, 1975, 1976, and 1978. The overall fatality rate among nonpilot rated officers in 1977 was higher than in each year since 1973.

In the aggregate the 1978 fatality rate for Navy and Marine Corps pilots was the least favorable since 1970, a decline in fatality rates having ended in 1976.

Duty Assignments

Aviation fatality rates among Air Force pilots with full-time flying duties are shown according to duty assignment in Table 11. In contrast

to the exposures underlying Table 9 and 10, Air Force pilots who were not assigned to a specific flying duty but who flew chiefly to maintain proficiency were excluded from the experience. A very remarkable increase occurred in the rate for observation aircraft pilots during 1978.

For the Navy and Marine Corps, all pilots were included, since no exclusions of pilots flying chiefly to maintain proficiency was possible. Significant increases in the fatality rates for carrier-based aircraft assignments (excluding helicopters) were recorded from 1977 to 1978.

TABLE 9
 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	1969-73	1974-78	1977	1978
Air Force Pilots				
Under 25.....	2.4	2.5	1.6	3.0
25-29.....	3.0	1.8	2.2	2.0
30-34.....	2.7	1.6	3.1	1.6
35-39.....	1.4	1.1	0.5*	0.5*
40 and over.....	1.1	0.6	4.0*	0.8*
All.....	2.1	1.6	2.2	1.9
Air Force Nonpilot Rated Officers				
Under 25.....	0.8	1.9	3.0	2.5*
25-29.....	1.0	1.8	2.2	1.9
30-34.....	0.7	0.5*	1.0*	0.0*
35-39.....	0.7	1.2	2.4*	1.2*
40 and over.....	1.4	1.0*	4.7*	0.0*
All.....	0.9	1.5	2.4	1.7
Navy and Marine Corps Pilots				
Under 25.....	7.2	1.5	0.8*	0.8*
25-29.....	6.4	4.4	5.3	5.1
30-34.....	4.6	2.4	3.2	5.2
35-39.....	2.3	1.8	1.5*	4.0
40 and over.....	1.3	0.7	0.0*	0.3*
All.....	4.4†	2.6†	2.8†	3.6†

* Based on 5 or fewer deaths.

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

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.

Navy pilots flew an average of 145 hours in 1978 and an average of

TABLE 10

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)*	1969-73	1974-78	1977	1978
Air Force Pilots				
2d Lieutenant (O-1).....	4.1	2.5	0.0†	2.7†
1st Lieutenant (O-2).....	2.6	1.8	1.5†	1.9†
Captain (O-3).....	2.8	1.9	2.3	2.2
Major (O-4).....	2.1	1.4	2.4	1.6†
Lieutenant Colonel (O-5).....	1.1	0.9	2.7†	1.4†
General and Colonel (O-6 and up)	0.6	0.3†	3.1†	0.0†
All.....	2.1	1.6	2.2	1.9
Air Force Nonpilot Rated Officers				
2d Lieutenant (O-1).....	0.0†	0.8†	0.0†	0.0†
1st Lieutenant (O-2).....	1.8	1.4	1.5†	2.2†
Captain (O-3).....	0.9	1.7	2.7	2.0
Major (O-4).....	0.7	1.4	4.4†	1.1†
Lieutenant Colonel (O-5).....	1.7	1.0†	0.0†	0.0†
General and Colonel (O-6 and up)	0.0†	0.0†	0.0†	0.0†
All.....	0.9	1.5	2.4	1.7
Navy and Marine Corps Pilots				
Ensign (O-1).....	3.6†	0.8†	0.8†	1.6†
Lieutenant Junior Grade (O-2)...	8.2	5.0	5.3	6.4
Lieutenant (O-3).....	5.3	3.5	4.0	4.2
Lieutenant Commander (O-4)...	3.3	1.9	2.5	4.3
Commander (O-5).....	1.6	0.5	0.0†	1.0†
Admiral and Captain (O-6 and up)	0.0†	0.2†	0.0†	0.0†
All.....	4.4‡	2.6‡	2.8‡	3.6‡

* 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.

171 hours in 1977, which averages are similar to previous years except for the year 1976. Marine Corps pilots flew an average of 174 hours in 1977 and an average of 140 hours in 1978, much more than in 1975 or 1976. Naval Reserve pilots flew an average of 145 hours in 1977 and an average of 116 hours in 1978. Marine Corps Reserve pilots flew an average of 130 hours in 1978; the hours for 1977 are not available.

During 1977, nonstudent Army pilots who were qualified to fly fixed-

TABLE 11
 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	1974-78	1977	1978
Air Force Pilots*			
Search rescue.....	0.0†	0.0†	0.0†
Helicopter.....	2.3	0.0†	0.0†
Tanker.....	1.2	0.0†	0.0†
Bomber.....	1.4	2.1†	1.4†
Reconnaissance.....	1.5	5.1†	0.0†
Trainer.....	1.2	1.6	0.2†
Cargo.....	1.0	0.0†	2.8
Observation.....	3.8	2.0†	13.7
Fighter.....	3.7	5.2	3.2
Utility.....	0.0†	0.0†	0.0†
Liaison.....	0.0†	0.0†	0.0†
All.....	1.6	2.2	1.9
Navy and Marine Corps Pilots‡			
Navy carrier-based jet.....	3.6	3.0	5.3
Marine fighter/attack jet.....	5.0	6.2	3.7†
Navy carrier-based prop.....	1.7	1.0†	6.0†
Marine fighter/attack/OBS prop§.....	3.0†	0.0†	7.8†
Navy patrol/transport.....	0.9	2.6	2.7
Marine patrol/transport.....	1.8†	0.0†	0.0†
Navy helicopter.....	1.2	1.8†	1.9†
Marine helicopter.....	3.7	3.3	3.9
All.....	2.6	2.8	3.6

* 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.

wing aircraft flew an average of 24 hours in such aircraft, while those qualified for rotary-wing aircraft flew an average of 47 hours in that type of aircraft. Corresponding averages for 1978 were 32 hours in fixed-wing aircraft and 53 hours in rotary-wing 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 in 1977 and 60 hours in 1978.

The average number of aircraft hours for Air Force pilots was not available for 1977 or 1978. The average annual flying time for Air National Guard pilots on flying status was 125 hours in 1977; data for 1978 are not available. Army Reserve pilots and Army National Guard pilots flew an average of 65 and 67 hours in 1977, and 60 and 62 hours in 1978, respectively.

Military Air Command (MAC)

Aviation fatality rates among pilots and crew members of MAC, a branch of the Air Force, are shown in Table 12. For both pilots and crew members the fatality rates in 1978 were generally higher than they have been in previous years. There were no fatalities among pilots or crew members in 1977. The experience of MAC pilots was also included in Tables 9-11.

TABLE 12
MILITARY AIR COMMAND (MAC)
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE
DEATHS DUE TO HOSTILE ACTION EXCLUDED

	1969-73	1974-78	1977	1978
Pilots:				
Transport units.....	0.8	1.3	0.0*	2.0*
Other units.....	1.7	0.5*	0.0*	0.9*
All.....	1.1	1.0	0.0*	1.5
Crew members:				
Transport units.....	0.8	2.2	0.0*	3.1
Other units.....	1.8	0.9	0.0*	2.9*
All.....	1.1	1.9	0.0*	3.0

* Based on 5 or fewer deaths.

TABLE 13
 UNITED STATES ARMY—ALL FLYING OPERATIONS
 DEATHS DUE TO HOSTILE ACTION EXCLUDED

	1974-78	1977	1978
Aviation Fatality Rates per 1,000 Life Years of Exposure			
Pilots.....	1.0	0.7	1.5
Crew members.....	1.9	2.1	1.6
Pilot Fatality Rates per 1,000 Aircraft Hours			
Fixed-wing aircraft.....	.0210	.0435*	.0212*
Rotary-wing aircraft.....	.0153	.0088	.0248
All types of aircraft..	.0163	.0137	.0242

* Based on 5 or fewer deaths.

United States Army

Table 13 includes data for all flying operations among nonstudent Army pilots and crew members. Fixed-wing aircraft pilot fatality rates were lower during 1974-78 than during 1973-76. Rotary-wing aircraft pilot rates were slightly higher in 1974-78 than in 1973-76.

All the figures in Table 13 are based on nonstudent pilots only. In calculating the fatality rates per 1,000 aircraft hours for 1974-78, it was assumed that the ratio of nonstudent to student flying hours reported for 1975 (although not available for 1974) was also applicable for 1974.

Student Pilots

Table 14 presents aviation fatality rates for student pilots in the military services. Because of the small number of deaths each year, there is a wide fluctuation in rates from year to year.

Coast Guard

During the five-year period 1974-78 the aviation fatality rates per 1,000 life years of exposure for Coast Guard personnel on flight orders were 0.8 for pilots, 4.65 for observers, and 0.1 for crew members. There have been no aviation fatalities for Coast Guard student pilots for the last twenty-two years.

Active Reserves and National Guard

Table 15 shows the aviation fatality rates for Army pilots and for 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 weekend and/or short-term (usually two weeks) training duty. There was a sharp increase in fatality rates for Air National Guard pilots in 1977 and 1978.

Air Force Flight Surgeons and Nurses

There have been no fatalities among Air Force flight nurses in the last seventeen years. During the five-year period 1974-78, the aviation fatality rate per 1,000 life years of exposure for flight surgeons was 0.4.

TABLE 14
UNITED STATES AIR FORCE, NAVY, AND MARINE CORPS,
AND ARMY STUDENT PILOTS
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

	1969-73	1974-78	1977	1978
Air Force*	2.1	1.7	0.8†	1.6†
Navy and Marine Corps:*				
Basic course	2.2	1.8	0.0†	0.0†
Advanced course	7.3	2.4	1.9†	5.2†
Army	2.9	2.7‡	0.0†	6.3†

* Commissioned officers only.

† Rates based on 5 or fewer deaths.

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

TABLE 15
PILOTS IN THE ACTIVE RESERVES AND NATIONAL GUARD
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

	1969-73	1974-78	1977	1978
Navy and Marine Corps Reserves:				
Ages under 30	1.7	0.0*†	‡	0.0*
Ages 30 and over	1.4	0.8†	‡	1.3*
All ages	1.5	0.7†	‡	1.2*
Army Reserves	‡	0.3*	0.0*	0.0*
Air National Guard	2.0	2.3	2.7	3.5
Army National Guard	1.3	0.4	0.6*	0.6*

* Based on 5 or fewer deaths.

† Rate based on data excluding 1977, for which year data are not available.

‡ Not available.

CANADIAN MILITARY

Aviation fatality rates among Canadian regular military forces, excluding reserves, are shown in Table 16 by age, rank, and functional classification.

The average number of flying hours for all pilots combined has remained steady over the ten-year period at approximately 290 hours per year and shows little variation by age group. Crew members average 350 hours per year. There is some variation by functional classification, but this cannot be accurately determined because of duplicate counting

TABLE 16
CANADIAN REGULAR FORCES
1969-1978 AVIATION FATALITY RATES
PER 1,000 LIFE YEARS OF EXPOSURE*

	1969-1973		1974-1978		1969-1978	
	Pilots	Crew	Pilots	Crew	Pilots	Crew
Age group:						
Under 25.....	11.4 (13)	1.3 (1)	2.9 (3)	0.0 (0)	7.3 (16)	0.8 (1)
25-29.....	3.8 (11)	1.8 (4)	5.8 (10)	0.6 (1)	4.5 (21)	1.3 (5)
30-34.....	3.6 (7)	2.4 (5)	5.5 (12)	2.0 (4)	4.6 (19)	2.2 (9)
35-39.....	1.8 (3)	2.2 (5)	2.4 (4)	0.0 (0)	2.1 (7)	1.2 (5)
40 and over.....	0.5 (1)	0.6 (1)	1.5 (3)	1.5 (3)	1.0 (4)	1.1 (4)
All.....	3.6 (35)	1.8 (16)	3.7 (32)	1.0 (8)	3.7 (67)	1.4 (24)
Rank:						
Lieutenant and lower rank.....	7.7 (11)	2.2 (11)	2.9 (4)	1.6 (8)	5.3 (15)	1.9 (19)
Captain.....	3.6 (22)	1.5 (5)	5.5 (26)	0.0 (0)	4.5 (48)	0.9 (5)
Major.....	1.2 (2)	0.0 (0)	1.1 (2)	0.0 (0)	1.2 (4)	0.0 (0)
Lieutenant Colonel and higher rank.....	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
All.....	3.6 (35)	1.8 (16)	3.7 (32)	1.0 (8)	3.7 (67)	1.4 (24)
Functional classifications:†						
Fighter.....	5.0 (12)	4.7 (4)	6.2 (13)	0.0 (0)	5.5 (25)	2.6 (4)
Training.....	2.1 (11)	0.0 (0)	1.6 (7)	0.0 (0)	1.9 (18)	0.0 (0)
Transport.....	1.4 (4)	1.2 (5)	0.0 (0)	0.0 (0)	0.8 (4)	0.6 (5)
Maritime.....	2.9 (4)	1.1 (4)	3.1 (3)	0.8 (2)	3.0 (7)	1.0 (6)
Helicopter.....	1.4 (2)	2.1 (2)	3.1 (7)	3.3 (6)	2.4 (9)	2.9 (8)
Others.....	1.0 (2)	0.6 (1)	4.7 (2)	0.0 (0)	1.7 (4)	0.6 (1)
All.....	2.3 (35)	1.3 (16)	2.6 (32)	0.8 (8)	2.4 (67)	1.1 (24)

* Number of fatalities shown in parentheses.

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

in different functions. Pilots and crew members flying more than one type of aircraft are counted in each function in which flying is 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 is considerably higher than for those in the categories of fighter, training, and helicopter. The former group averages 350 hours per year and the latter approximately 150 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 occasionally fly to maintain proficiency.

INTERCOMPANY EXPERIENCE

This year's report and the data contained in Tables 17-19 were based on the 1975-78 calendar year experience for issues of 1967 and subsequent calendar years. The 1977-78 experience was combined with the 1975-76 experience, which was reported in the previous study to provide more meaningful statistics. Additionally, each of the tables shows the experience between 1971-74 for issues of 1967 and subsequent years for comparison purposes over the two periods.

All experience is by number of policies, and the insured is classified according to status at the time of application of insurance. Policies with an aviation exclusion clause are not included. Exposure for policies with aviation extra premium is terminated when the extra premium is discontinued. 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. Not all companies were able to do this, and consequently the experience for that category includes only a portion of such cases.

In analyzing the data, it should be kept in mind that the criteria by which the lives are classified are determined largely by the facts at time of issue. The older the issue, the greater the chance that the classification does not properly reflect current flying activity. The data used were submitted by fourteen companies, as compared with sixteen companies contributing to the study two years ago.

Civilian Aviation

Table 17 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. The "Charter and other airlines" classification comprises the charter air carriers and intrastate and foreign airlines, as well as air taxi operations. The "Others" classification includes corporate and charter pilots insured by companies unable to subdivide their 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).

TABLE 17
 INTERCOMPANY EXPERIENCE ON PILOTS IN CIVILIAN
 AVIATION BY POLICIES*
 (1971-74 and 1975-78 Experience on 1967 and Subsequent Issues)

STATUS AT ISSUE	YEARS	WITH AVIATION EXTRA PREMIUM			WITHOUT AVIATION EXTRA PREMIUM		
		Years of Exposure	Avia- tion Fatali- ties	Rate per 1,000	Years of Exposure	Avia- tion Fatali- ties	Rate per 1,000
Scheduled air line pilots....	{1971-74	625	1	1.6	1,842	6	3.3
	{1975-78	570	2	3.5	7,790	6	0.8
Other commercial pilots flying for hire:							
Instructing (at least half-time).....	{1971-74	3,664	10	2.7	231	1	4.3
	{1975-78	4,312	16	3.7	506	0	0.0
Corporate.....	{1971-74	1,881	2	1.1	3,064	1	0.3
	{1975-78	2,470	7	2.8	4,447	5	1.1
Charter and other airlines	{1971-74	2,765	10	3.6	521	1	1.9
	{1975-78	3,021	12	4.0	854	1	1.2
Others†.....	{1971-74	2,446	6	2.6	623	1	1.6
	{1975-78	3,174	12	3.8	838	0	0.0
Private pilots.....	{1971-74	22,275	24	1.1	85,101	87	1.0
	{1975-78	26,757	25	0.9	106,122	98	0.9
Student pilots.....	{1971-74	35,129	21	0.6	4,717	9	1.9
	{1975-78	39,055	14	0.4	8,450	0	0.0

* 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.

† Includes exposure of companies unable to subdivide data.

The 1975-78 experience in the "With Aviation Extra Premium" category was poorer than that for 1971-74 in all classifications with the exceptions of Private and Student pilots. The Private and Student pilot classifications continue to show better experience than the other classifications. The "Without Aviation Extra Premium" experience for 1975-78 was better than the 1971-74 experience except for Corporate pilots.

Table 18 covers the experience for various categories of private pilots for policies issued with and without aviation extra premiums. Subdivisions by hours flown, type of flying certificate, and attained age are shown. The exposure for issues without aviation extra premium includes an unknown proportion of lives who have discontinued their flying activities. The total 1975-78 experience showed slight decreases in fatality rates for both "With Aviation Extra Premium" and "Without Aviation Extra Premium" compared to the 1971-74 experience (0.9 versus 1.1 and 0.9 versus 1.0, respectively). The 1975-78 experience in the "With Aviation Extra Premium" category by hours flown was better than the 1971-74 experience with the exception of the "200-299" category. By type of flying certificate, "Commercial or transport" showed a slight increase in fatality rates, while "Private" flying showed a slight decrease compared to the experience of 1971-74. By attained age, the experience at ages 50 and over was poorer in 1975-78 than in 1971-74. With so few deaths in most classifications, any analysis of trends must be viewed with caution.

Policies in the "Without Aviation Extra Premium" category showed increases in fatality rates by number of hours flown in the "200-299" classification and the "100-199" classification. By type of flying certificate and attained age, all classifications exhibited equal or reduced rates compared to the earlier experience. The largest decrease occurred in the "Commercial or transport" classification, where the fatality rate decreased from 1.2 to 0.6.

Military Aviation

Table 19 shows aviation fatality rates for military aviation pilots with policies issued only with an aviation extra premium separately for operational and administrative pilots. Administrative pilots are defined as those flying 40-150 hours annually, whereas operational pilots are defined as those flying over 150 hours annually. Within the "Operational" category, where there are sufficient deaths to provide meaningful results, there has been a general improvement in the results for 1975-78 compared to the 1971-74 experience.

TABLE 18
 INTERCOMPANY EXPERIENCE ON PILOTS FLYING FOR
 PLEASURE OR PERSONAL BUSINESS--BY POLICIES*
 (1971-74 and 1975-78 Experience on 1967 and Subsequent Issues)

	YEARS	WITH AVIATION EXTRA PREMIUM			WITHOUT AVIATION EXTRA PREMIUM		
		Years of Exposure	Avia- tion Fatali- ties	Rate per 1,000	Years of Exposure	Avia- tion Fatali- ties	Rate per 1,000
By hours flown:†	1971-74	11,966	8	0.7	55,081	37	0.7
	1975-78	14,706	7	0.5	68,685	38	0.6
Under 100.....	1971-74	5,429	5	0.9	24,138	42	1.7
	1975-78	6,149	5	0.8	28,802	54	1.9
100-199.....	1971-74	2,309	3	1.3	2,745	2	0.7
	1975-78	2,521	6	2.4	3,597	4	1.1
200-299.....	1971-74	2,187	6	2.7	1,350	2	1.5
	1975-78	2,810	5	1.8	2,434	1	0.4
300 or more.....	1971-74	5,982	6	1.0	17,239	20	1.2
	1975-78	7,103	8	1.1	22,432	13	0.6
By type of flying certificate:	1971-74	16,293	18	1.1	67,862	67	1.0
	1975-78	19,654	17	0.9	83,690	85	1.0
Commercial or transport.	1971-74	14,069	11	0.8	19,134	18	0.9
	1975-78	16,929	8	0.5	19,577	10	0.5
Private.....	1971-74	6,198	12	1.9	50,507	49	1.0
	1975-78	6,856	11	1.6	60,573	56	0.9
By attained age:	1971-74	2,008	1	0.5	15,460	20	1.3
	1975-78	2,972	6	2.0	25,972	32	1.2
Under 35.....	1971-74	22,275	24	1.1	85,101	87	1.0
	1975-78	26,757	25	0.9	106,122	98	0.9
35-49.....	1971-74						
	1975-78						
50 and over.....	1971-74						
	1975-78						
Total.....	1971-74						
	1975-78						

* 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.

† Omits data where hours are not stated.

TABLE 19

INTERCOMPANY EXPERIENCE ON MILITARY PILOTS BY BRANCH
OF SERVICE AND FLYING DUTIES--WITH AVIATION EXTRA PREMIUM*
(1971-74 and 1975-78 Experience on 1967 and Subsequent Issues--by Policies)

STATUS AT ISSUE AND ATTAINED INSURANCE AGE	YEARS	OPERATIONAL			ADMINISTRATIVE		
		Years of Exposure	Avia- tion Fatali- ties	Rate per 1,000	Years of Exposure	Avia- tion Fatali- ties	Rate per 1,000
U.S. Air Force: Under 35.....	{1971-74	5,228	8	1.5	486	2	4.1
	{1975-78	3,546	3	0.8	469	0	0.0
35 and over.....	{1971-74	3,369	5	1.5	1,726	3	1.7
	{1975-78	2,957	3	1.0	1,180	1	0.8
Total.....	{1971-74	8,597	13	1.5	2,212	5	2.3
	{1975-78	6,503	6	0.9	1,649	1	0.6
U.S. Army: Under 35.....	{1971-74	3,830	11	2.9	2,436	2	0.8
	{1975-78	3,367	6	1.8	1,810	0	0.0
35 and over.....	{1971-74	783	1	1.3	1,172	2	1.7
	{1975-78	1,208	4	3.3	1,351	1	0.7
Total.....	{1971-74	4,613	12	2.6	3,608	4	1.1
	{1975-78	4,575	10	2.2	3,161	1	0.3
U.S. Navy.....	{1971-74	2,337	3	1.3	1,128	0	0.0
	{1975-78	1,788	2	1.1	846	1	1.2
U.S. Marine Corps.....	{1971-74	737	0	0.0	380	0	0.0
	{1975-78	758	3	4.0	344	1	2.9
U.S. Air Force, Army, Navy, and Marine Corps Reserve.....	{1971-74	.....	.....	.....	926	2	2.2
	{1975-78	.....	.....	.....	656	1	1.5
U.S. Air National Guard.....	{1971-74	.....	.....	.....	877	2	2.3
	{1975-78	.....	.....	.....	1,185	0	0.0

* Exposure is terminated on discontinuance of extra premium.