

TRANSACTIONS OF SOCIETY OF ACTUARIES 1969 REPORTS

REPORT OF THE COMMITTEE ON AVIATION AVIATION STATISTICS

THIS report primarily presents new data which have become available during the past year. Data for earlier periods have been included for comparison and to indicate trends.

The Committee continues to encounter some problems in the collection of data on Military Aviation for both the United States and Canada for various reasons, and certain tables shown in some previous reports are not presented. The effect in death rates of fatalities due to enemy action is shown separately where data are available.

The addition of another year's data to the record for United States and Canadian civil aviation does not result in any marked change in the fatality rates already published. If any trend can be discerned, however, it tends to be downward. The international flying of United States scheduled airlines presents a more favorable experience than either United States domestic flying or the flying of the airlines of foreign countries.

In the review of the intercompany experience the lack of substantial difference between the experience of private pilots issued without aviation extra premium and of such pilots issued with an extra premium is remarkable. It will also be noted that the experience for all types of pilot certificates, when analyzed by attained ages, shows rates which are quite generally higher for ages 35 and over than for ages under 35.

UNITED STATES CIVIL AIR CARRIER FLEET

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 aircraft weighing over 12,500 lb. 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 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 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). Nevertheless, data regarding their activities are included under "Air Taxi" in the "General Aviation" section of this 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. In a recent issue of the CAB publication *Air Carrier Traffic Statistics* were listed 35 such passenger cargo air carriers (including 4 intra-Alaska, 2 intra-Hawaii, and 4 helicopter carriers) and 3 such all cargo air carriers.

"Domestic" operations are in general within the territory 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 United States points separated by foreign territory or major expanses of international waters. Operations between the United States mainland and Alaska, Hawaii, Puerto Rico, or other outlying areas of the United States are included in "International" operations, as are those parts of international flights which are over "domestic" territory.

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 fluctuations from year to year. However, such rates when taken in four-year periods have shown relatively little change since 1957, as indicated in Table 1.

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 either to 100 hours per month or 300 hours every 90 days, depending on the size of the flight crew. In actual practice, pilots average less hours monthly 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. These airlines flew approximately 178,000,000 passenger miles in scheduled passenger service during the ten years 1960-69. In this period five fatal accidents have resulted in a passenger death rate of 0.029 per 1,000 scheduled passenger hours. One of the accidents which occurred in 1969 involved an STOL craft rather than a helicopter but was operated by these airlines. The accident took the lives of 1 passenger and 2 crew.

TABLE 1

UNITED STATES CERTIFICATED ROUTE AIR CARRIER AVIATION DEATH RATES
(Number of Fatal Accidents in Parentheses)

	Passenger Rate per 1,000 Sched- uled Passenger Hours*	First-Pilot Rate per 1,000 Sched- uled Airplane Hours*	All Pilot and Copilot Rate per Life Year†	Other Crew Member Rate per Life Year†
Domestic Operations				
1957-60.....	.0013 (22)	.0015 (20)	.0012 (29)	.0012 (22)
1961-64.....	.0008 (18)	.0012 (15)	.0008 (22)	.0008 (16)
1965-68.....	.0008 (22)	.0013 (20)	.0007 (25)	.0005 (19)
1969‡.....	.0005 (5)	.0008 (4)	.0005 (6)	.0004 (4)
1957-69‡.....	.0009 (67)	.0013 (59)	.0008 (82)	.0007 (61)
International Operations				
1957-60.....	.0011 (6)	.0016 (4)	.0011 (4)	.0019 (4)
1961-64.....	.0014 (3)	.0011 (2)	.0011 (4)	.0018 (4)
1965-68.....	.0004 (3)	.0011 (3)	.0009 (4)	.0009 (5)
1969‡.....	.0000 (0)	.0000 (0)	.0000 (0)	.0000 (0)
1957-69‡.....	.0007 (12)	.0011 (9)	.0009 (12)	.0012 (13)
Domestic and International Operations				
1957-60.....	.0013 (28)	.0015 (24)	.0012 (33)	.0013 (26)
1961-64.....	.0009 (21)	.0012 (17)	.0008 (26)	.0009 (20)
1965-68.....	.0008 (25)	.0012 (23)	.0007 (29)	.0005 (24)
1969‡.....	.0004 (5)	.0007 (4)	.0005 (6)	.0003 (4)
1957-69‡.....	.0009 (79)	.0012 (68)	.0008 (94)	.0008 (74)

* Experience of helicopter air carriers is excluded.

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

‡ 1969 figures are preliminary.

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 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. The first-pilot fatality rates for scheduled services of All Cargo carriers have been less favorable than the rates for nonscheduled services. However, the volume of experience has been small.

TABLE 2
ALL CARGO CARRIERS AND SUPPLEMENTAL CARRIERS
FIRST-PILOT AVIATION DEATH RATES
PER 1,000 AIRPLANE HOURS
(Number of First-Pilot Deaths in Parentheses)

	All Cargo (All Operations)	Supplemental (All Operations)
1961-64 .....	.0068 (5)	.0045 (4)
1965-68 .....	.0055 (4)	.0031 (4)
1961-68 .....	.0061 (9)	.0037 (8)

Supplemental Carriers

These airlines are 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 waybilled cargo. There were 13 such air carriers listed in the *FAA Statistical Handbook*.

The figures shown in Table 2 include experience in operations under contracts with military authorities. As the figures show, there has been a steady improvement in the first-pilot fatality experience of Supplemental Air Carriers based on 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. These members carry 91 per

TABLE 3
SCHEDULED AIR CARRIERS OF
UNITED STATES AND OTHER COUNTRIES
PASSENGER AVIATION DEATH RATES
PER 1,000 SCHEDULED PASSENGER HOURS

PERIOD	MEMBERS REPORTING TO I.A.T.A.		ALL UNITED STATES AIR CARRIERS
	Countries Other than the United States	United States	
1957-60.....	.0028	.0011	.0013
1961-64.....	.0035	.0010	.0009
1965-68*.....	.0019	.0006	.0008
1968*.....	.0019	.0003	.0009
1957-68*.....	.0026	.0008	.0009

* I.A.T.A. figures are preliminary.

cent of the world's scheduled traffic. Some companies operate only within the border 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, the passenger fatality rates per 1,000 scheduled passenger hours were derived for the 86 I.A.T.A. members in countries other than the United States and the 12 United States members who operate scheduled passenger flights in fixed-wing aircraft. The fatality rates are compared in Table 3. The safety record of the scheduled services of the airlines of other countries has been improving but continues to be less favorable than that of United States scheduled air carriers.

About 55 per cent of the scheduled passenger hours reported to I.A.T.A. were flown by the 12 United States members. These 12 air

carriers account for approximately 85 per cent of the scheduled passenger hours flown by all United States Certificated Route Air Carriers. The combined international and domestic scheduled experience of all 35 United States Certificated Route Air Carriers is included in Table 3 for comparison.

UNITED STATES GENERAL AVIATION

General aviation flying includes all domestic civil flying except that performed by the United States Civil Air Carrier Fleet. The annual flying time of planes in general aviation totals more than five times the flying time of air carriers in their domestic flights. The number of hours flown by each aircraft in general aviation and the primary use of each aircraft are obtained at the time of FAA annual inspection of aircraft.

Death rates referred to in this section are expressed per 1,000 airplane hours. One of the many factors affecting pilot death rates is the number of hours flown in a year, and death rates per life year of exposure may be markedly lower than death rates per 1,000 airplane hours. However, such rates cannot be reliably estimated using the material from which this information has been taken.

Pleasure flying accounts for about 25 per cent of the total general aviation flying time in the most recent year but more than one-half the pilot fatalities. The death rate of pilots in pleasure flying has been the highest among the categories in general aviation shown in Table 4.

Flight training of civilians has presented a favorable record in recent years. Included is the death of the instructor or the student, whoever was acting as pilot when the accident occurred. The hours of instructional flying now represent about one-quarter of the total in general aviation. Practice flying when not under the supervision of an instructor, either in the air or from the ground, is not included in instructional flying.

The "Business" and "Corporate" categories, which account for about 30 per cent of total general aviation flying, are composed of nonprofessional pilots flying for business reasons (Business) and professional pilots receiving direct salary or compensation for piloting planes operated (not for public hire) by a corporation or business firm for the transportation of personnel or cargo in furtherance of the company's business (Corporate). There were 71 pilot deaths in 1968 in "Business" flying and 14 in "Corporate" flying. However, the number of flying hours is not available for these two categories separately for the years 1966-68. A subdivision between "Business" and "Corporate" flying for the years 1964-65 showed pilot aviation death rates per 1,000 aircraft hours of 0.021 for Business flying (149 deaths) and 0.005 for Corporate flying (21 deaths).

Air Taxi flying accounts for nearly 10 per cent of the total hours in general aviation. This type of flying includes scheduled and nonscheduled passenger and cargo flying by professional pilots (other than Corporate) that is not done by the United States Civil Air Carrier Fleet. In 1968 there were 9 pilot deaths in scheduled flying (5 passenger and 4 cargo) and 30 in nonscheduled flying (26 passenger and 4 cargo). The number of flying hours is not available for these categories separately.

The pilot fatality rates in Aerial Application, which accounts for about 5 per cent of general aviation flying, have been higher than those in other commercial activities. These figures include 287,000 hours flown during 1963-68 for such purposes by rotorcraft (helicopter) with 7 deaths, a fatality rate of 0.024 per 1,000 airplane hours. This compares with

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

Period	Hours* (000)	Aviation Deaths	Rate	Hours* (000)	Aviation Deaths	Rate
	Pleasure			Instruction		
1966.....	4,540	293	.065	5,674	34	.006
1967.....	5,173	282	.055	6,262	50	.008
1968.....	5,532	360	.065	6,494	61	.009
1966-68.	15,245	935	.061	18,430	145	.008
	Business and Corporate			Aerial Application		
1966.....	7,057	70	.010	1,039	40	.038
1967.....	6,578	99	.015	1,128	41	.036
1968.....	6,976	85	.012	1,282	38	.030
1966-68.	20,611	254	.012	3,449	119	.035
	Air Taxi					
1966.....	1,744	24	.014			
1967.....	1,766	28	.016			
1968.....	1,999	39	.020			
1966-68.	5,509	91	.017			

* FAA estimate based on 1962 survey of aircraft used in general aviation supplemented by information obtained on FAA annual inspection of such aircraft.

6,045,000 hours flown by other planes during the same period with 219 deaths and a fatality rate of 0.036 per 1,000 airplane hours. Aerial Application includes any form of flying in which chemicals are distributed from aircraft upon the land below, the usual form being crop-dusting. Fire control is not included in this category. The average annual flying time is believed to vary considerably among pilots who have a local business confined to a single growing season and those who move from area to area with the season.

There were 70 pilot deaths during 1968 in addition to the total of 583 deaths recorded in the categories in Table 4. Of this number, 16 deaths occurred in aircraft being used for commercial purposes other than those shown in Table 4, such as power and pipeline patrol, fire control, survey, advertising, and photography; 11 deaths were classified as "noncommercial-other," which consists primarily of practice flying and could have well been classified as pleasure flying; and 43 deaths were classified as "miscellaneous." The subdivision of these 43 pilot deaths is not available, but the related 45 fatal accidents in "miscellaneous" flying include 11 accidents in testing (including testing of homemade aircraft), 7 in ferrying, and 4 in demonstration. The remaining 23 fatal accidents referred to as "miscellaneous" include air-show participation, towing gliders, hunting, and unauthorized or unknown uses.

The 653 pilot deaths during 1968 in general aviation as reported by the National Transportation Safety Board included 610 in small fixed-wing aircraft (12,500 lb. or less), 5 in large fixed-wing aircraft (over 12,500 lb.), 32 in rotorcraft, 5 in gliders, and 1 in lighter-than-air craft. Among the 716 pilots involved in fatal accidents (which resulted in the 653 pilot deaths previously mentioned) were 69 holding student certificates, 344 with private certificates, 257 with commercial certificates, 27 with airline transport certificates, 10 with no certificate; the remaining 9 pilots are listed as unknown or unreported.

Data for "Commercial" are not shown in Table 4 as in past reports because most of these data are included under Aerial Application or Air Taxi; the aircraft hours for the balance cannot be accurately estimated.

It is quite possible that there is a significant amount of flying for pleasure on aircraft that is reported as Instruction or Business. Therefore, the true aviation death rate for Pleasure flying is probably somewhat lower than that given in Table 4, whereas the true rates for Instruction and Business are probably somewhat higher than those given in Table 4. A more refined system of reporting aircraft hours was introduced by the FAA in 1969, and it is expected that this will improve the accuracy of aircraft-hour estimates. However, the tendency of individuals to under-

report hours for Pleasure flying and overreport hours for other types of flying is unlikely to change.

It is also expected in future reports that aviation fatality rates by class of certificate will be available. Information on the number of hours flown in the prior six months is obtained at the time a certificate is issued or renewed through the required biennial medical examinations, and this information is now being tabulated by the FAA.

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 Dominion Bureau of Statistics are shown in Table 5.

TABLE 5
CANADIAN SCHEDULED AIRLINES
AVIATION FATALITY RATES
(Number of Fatal Accidents in Parentheses)

Years	Passenger Fatality Rate per 1,000 Passenger Hours	First-Pilot Fatality Rate per 1,000 Airplane Hours
1957-60.....	.0003 (1)	.0008 (1)
1961-64.....	.0024 (3)	.0015 (2)
1965-68.....	.0012 (3)	.0018 (3)
1957-68.....	.0014 (7)	.0014 (6)
1966-69 (est.).....	.0006 (2)	.0006 (2)

Comparable first-pilot aviation fatality rates for Canadian non-scheduled airlines have been estimated from the same sources and are shown in Table 6, compared with corresponding fatality rates in scheduled flying (domestic and international).

Data from similar sources have been used to estimate the passenger aviation fatality rates per 1,000 passenger hours in domestic nonscheduled operations of Canadian carriers, which are shown in Table 7.

Canadian scheduled airlines comprise air carriers which serve designated points in accordance with a definite service schedule. Nonscheduled airlines are those which 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 8, separately, for the periods 1961-64 and 1965-68, based on figures furnished by the Canadian Department of Transport. It should be noted that pilots holding airline transport licenses are not necessarily flying for scheduled airlines, since they may engage in other types of flying.

The 1965-68 fatality rates for airline transport and private pilots are slightly higher than those of the 1961-64 period. The fatality rate for

TABLE 6
CANADIAN NONSCHEDULED VERSUS
SCHEDULED AIRLINES
FIRST-PILOT FATALITY RATES PER
1,000 AIRPLANE HOURS
(Number of Fatal Accidents in Parentheses)

Years	Nonscheduled	Scheduled
1961-64	.0177 (24)	.0015 (2)
1965-68	.0174 (45)	.0018 (3)
1961-68	.0175 (69)	.0017 (5)

TABLE 7
CANADIAN NONSCHEDULED FLYING—
DOMESTIC OPERATIONS
AVIATION FATALITY RATES
(Number of Fatal Accidents in Parentheses)

Years	Passenger Fatality Rate per 1,000 Passenger Hours
1961-64	.0140 (24)
1965-68	.0173 (45)
1961-68	.0159 (69)

commercial pilots has been somewhat higher and that for senior commercial pilots somewhat lower in the more recent period.

Excluded from the experience in Table 8 were persons holding glider licenses only, of whom there have been a steadily increasing number—712 in 1964, 793 in 1965, 870 in 1966, 971 in 1967, and 1,100 in 1968, with 1 fatality in each of the years 1964 and 1965, 2 fatalities in 1967, and no fatalities in 1968.

UNITED STATES MILITARY

General

Whenever possible, aviation fatality rates have been shown including and excluding deaths due to hostile action, but the availability of necessary information has not been consistent among the armed services or with the availability in prior years.

Table 12 in the 1968 report (which corresponds to Table 11 in this report) was in error. The 1967 fatality rates including and excluding deaths due to hostile action for Navy Ensign and Warrant, including the

TABLE 8
CANADIAN CIVIL PILOTS BY CLASS OF LICENSE
1961-68 AVIATION FATALITY RATES

Class of License	Period	Life Years of Exposure	Aviation Fatalities	Rate per 1,000 Life Years of Exposure
Airline transport	{1961-64	5,333	7	1.3
	{1965-68	7,355	18	2.4
Senior commercial	{1961-64	1,540	9	5.8
	{1965-68	1,770	7	4.0
Commercial	{1961-64	9,291	39	4.2
	{1965-68	14,622	86	5.9
Private (excluding students)	{1961-64	61,848	89*	1.4
	{1965-68	74,886	127	1.7

* Includes 3 missing and presumed dead.

corresponding ranks in the Marine Corps, should have been 18.1 and 12.6, respectively, instead of 1.8 and 1.3 as shown.

Age

Table 9 shows aviation fatality rates by age group for Air Force pilots and nonpilot rated officers and for Navy and Marine aviators on active duty, for calendar year 1968 as well as for the four-year period 1965-68. Data have not been available to permit the completion of the table in full.

The four-year average trend of fatality rates among Air Force rated pilots, including deaths due to hostile action, continues upward. The fatality rates for 1968 at ages under 30 have returned to the level of former years after the rather low rates in 1967.

The fatality rate for Air Force nonpilot rated officers for ages under 25

is unusually low, but, as indicated in Table 9, the rates are based on relatively few deaths.

The lack of a distribution of 1968 deaths due to hostile action has curtailed the data presented for Navy and Marine Corps aviation fatality rates. The 1968 rates excluding hostile action are generally at the same level as the 1967 rate except for a lower rate at ages 30-34. The fatality rates for these flyers continue to be above that for the Air Force.

TABLE 9
UNITED STATES AIR FORCE, NAVY, AND MARINE CORPS FLYERS
AVIATION FATALITY RATES PER 1,000 LIFE YEARS, BY AGE
DEATHS DUE TO HOSTILE ACTION INCLUDED*

AGE GROUP	AIR FORCE RATED PILOTS		AIR FORCE NONPILOT RATED OFFICERS		NAVY AND MARINE CORPS PILOTS	
	1965-68	1968	1965-68	1968	1965-68	1968†
Under 25	7.8	8.2 [6.0]	3.0	0.8‡ [0.8]‡	N.A.§	N.A. [10.4]
25-29	8.0	7.7 [4.7]	2.5	2.1 [1.4]	N.A.	N.A. [8.4]
30-34	6.0	5.3 [3.3]	2.2	2.1 [1.5]	N.A.	N.A. [5.9]
35-39	5.1	5.1 [2.7]	1.4	2.0 [1.4]‡	N.A.	N.A. [4.6]
40 and over	1.8	2.5 [1.6]	1.0	2.1‡ [1.4]‡	N.A.	N.A. [0.8]‡
All	4.7	5.1 [3.2]	2.0	2.0 [1.4]	6.8	11.2 [6.0]

* Rates in brackets exclude deaths due to hostile action.

† A small proportion of total deaths due to nonhostile action were not identified by age.

‡ Based on 5 or fewer deaths.

§ N.A.=Not available.

Pilots and Other Rated Officers—by Rank

Aviation fatality rates according to rank are shown in Table 10 for Air Force pilots and other rated officers. Table 11 shows similar rates for Navy and Marine Corps aviators on active duty but, as is true of the analysis by age, the table is incomplete for lack of adequate information on deaths during 1968 due to hostile action.

The average rates of the four-year period 1965-68 for Air Force rated pilots show increases for all ranks except 2d Lieutenant, while the 1968 annual rates show increases for all ranks except Major. For nonpilot rated officer, 1968 rates are either less than or equal to the corresponding rates for 1967, except for the rank of Lieutenant Colonel. Most rates are based on a small number of deaths, so most changes from one year to the next are probably normal fluctuation.

Aviation fatality rates for Navy and Marine Corps pilots for 1968 based on deaths not due to hostile action are substantially lower for the

lowest rank, after correcting the 1967 rate from 1.3 to 12.6, as mentioned in the introductory section of the report. For the next-higher rank the 1968 fatality rate shows a sharp increase.

Hours of Flying

The average annual flying time for Navy and Marine Corps pilots during 1968 is estimated at slightly less than 250 hours. This figure is about the same as that reported for 1966 but greater than that for 1967.

TABLE 10
 UNITED STATES AIR FORCE ON ACTIVE DUTY, BY RANK
 AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE
 DEATHS DUE TO HOSTILE ACTION INCLUDED*

RANK	RATED PILOTS		NONPILOT RATED OFFICERS	
	1965-68	1968	1965-68	1968
2d Lieutenant.....	5.8	4.1† [3.3]†	1.6†	0.0† [0.0]†
1st Lieutenant.....	9.8	10.9 [7.6]	3.3	1.0† [1.0]†
Captain.....	7.1	7.1 [4.4]	2.3	2.7 [2.0]
Major.....	3.7	4.7 [2.6]	1.3	1.4 [0.7]†
Lieutenant Colonel.....	1.7	2.8 [1.8]	0.5†	1.7† [1.7]†
General and Colonel.....	0.8	1.3 [1.1]†	0.0†	0.0† [0.0]†
All.....	4.7	5.1 [3.2]	2.0	2.0 [1.4]

* Rates in brackets exclude deaths due to hostile action.
 † Based on 5 or fewer deaths.

TABLE 11
 UNITED STATES NAVY AND MARINE CORPS AVIATORS ON ACTIVE DUTY, BY RANK
 AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE
 DEATHS DUE TO HOSTILE ACTION INCLUDED*

RANK		1965-68	1968
Navy	Marine Corps		
Ensign and Warrant	2d Lieutenant and Warrant	N.A.†	N.A. [5.8]†
Lieutenant Junior Grade	1st Lieutenant	N.A.	N.A. [12.1]
Lieutenant	Captain	N.A.	N.A. [7.0]
Lieutenant Commander	Major	N.A.	N.A. [5.5]
Commander	Lieutenant Colonel	N.A.	N.A. [1.8]
Admiral and Captain	General and Colonel	N.A.	N.A. [1.1]†
All.....	.....	6.8	11.2 [6.0]

* Rates in brackets exclude deaths due to hostile action.
 † N.A.=Not available. ‡ Based on 5 or fewer deaths.

During 1968, pilots in the Inactive Naval Reserve and the Inactive Marine Reserve flew an average of 108 and 118 hours, respectively, about the same as during 1967. The separation by branch of service has become available for this report for the first time.

The average number of aircraft hours for Army pilots—in fixed-wing and rotary-wing craft combined—during 1968 was 336 hours. The averages have been on an increasing trend from an average value of 202 hours reported for the four-year period 1961–64.

The average number of aircraft hours for Air Force pilots is not available for 1968.

TABLE 12
MILITARY AIR COMMAND
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE
DEATHS DUE TO HOSTILE ACTION INCLUDED*

	7/1/61- 6/30/65	7/1/65- 6/30/69	7/1/68- 6/30/69
Pilots:			
Transport units...	2.3	0.9 [0.7]	0.0† [0.0]†
Other units.....	1.6	0.9 [0.3]	1.7† [0.0]†
All.....	2.1	0.9 [0.6]	0.6† [0.0]†
Crew members:			
Transport units...	3.0	1.1 [0.9]	0.0† [0.0]†
Other units.....	1.9	1.7 [0.3]	2.7 [0.0]†
All.....	2.7	1.3 [0.8]	0.7 [0.0]†

* Rates in brackets exclude deaths due to hostile action.

† Based on 5 or fewer deaths.

Military Air Command

There were no passenger fatalities in military carriers in MAC in 1968. The passenger fatality rate for the four-year period 1965–68 was 2.12 per 100,000,000 passenger miles. All these fatalities occurred in 1965.

Aviation fatality rates among pilots and crew members of MAC are shown in Table 12. All deaths for the year July, 1968, to June, 1969, were due to hostile action.

United States Army

Army data for 1968 are not available.

It was noted in last year's report that certain data underlying the Army fatality rates for 1967 had been received on a fiscal-year basis and adjusted by the Committee to a calendar-year basis. The Committee

has since received revised data for 1967. Tables 13 and 14 are included for the purpose of presenting 1967 fatality rates based on these new data. They correspond to Tables 14 and 15, respectively, in last year's report.

As a result of these changes, 1967 fatality rates for crew members are significantly higher than those shown in last year's report, and fatality rates for pilots of rotary-wing aircraft are somewhat lower.

TABLE 13
UNITED STATES ARMY—ALL FLYING OPERATIONS
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE
DEATHS DUE TO HOSTILE ACTION EXCLUDED*

	1964-67	1967	1968
Rated pilots.....	9.8 [15.7]	21.1 [30.6]	N.A.† [N.A.]
Crew members.....	8.8 [16.8]	9.5 [15.1]	N.A. [N.A.]

* Aviation fatality rates in brackets include deaths due to hostile action.
† N.A.=Not available.

TABLE 14
UNITED STATES ARMY—ROTARY- VERSUS FIXED-WING AIRCRAFT
PILOT FATALITY RATES PER 1,000 AIRCRAFT HOURS
DEATHS DUE TO HOSTILE ACTION EXCLUDED*

	1964-67	1967	1968
Fixed-wing aircraft....	.0221 [.0275]	.0343 [.0420]	N.A.† [N.A.]
Rotary-wing aircraft..	.0398 [.0694]	.0668 [.1033]	N.A. [N.A.]
All types of aircraft.	.0344 [.0567]	.0600 [.0904]	N.A. [N.A.]

* Aviation fatality rates in brackets include deaths due to hostile action.
† N.A.=Not available.

Student Pilots

Table 15 shows aviation fatality rates among student pilots in the military services. While the fatality rate among Army student pilots is not remarkably higher than that of the other services, it tends to be slightly higher than it was in last year's report, while the rates for Air Force, Navy, and Marine Corps students are generally lower.

Coast Guard

The aviation fatality rates among Coast Guard personnel on flight orders are shown in Table 16. There was one combat fatality among pilots during 1968, and there were no fatalities among crewmen. There have been no fatalities among student pilots or observers during the past twelve years.

Navy and Marine Corps Reservists

Table 17 shows the aviation fatality rates for Navy and Marine Corps inactive reservists on drill-pay status.

Air National Guard

The aviation fatality rates among Air National Guard pilots not federally activated were 1.6 per 1,000 life years of exposure during 1968 and

TABLE 15
UNITED STATES AIR FORCE, NAVY, AND MARINE
CORPS, AND ARMY STUDENT PILOTS
AVIATION FATALITY RATES PER 1,000 LIFE YEARS OF EXPOSURE

	1961-64	1965-68	1968
Air Force*	3.1	1.8	0.7†
Navy and Marine Corps:			
Basic course	2.8	2.9	3.1
Advanced course	8.7	9.0	8.7
Army	1.5	3.5	4.6

* Officers only.

† Based on 5 or fewer deaths.

TABLE 16
UNITED STATES COAST GUARD PERSONNEL
ON FLIGHT ORDERS
AVIATION FATALITY RATES PER 1,000
LIFE YEARS OF EXPOSURE

	1961-64	1965-68	1968
Pilots	4.1	2.4*	1.7*
Crewmen	1.1	0.9	0.0

* Based on 5 or fewer deaths.

TABLE 17
UNITED STATES NAVY AND MARINE CORPS INACTIVE
RESERVISTS ON DRILL-PAY STATUS
AVIATION FATALITY RATES BY AGE PER
1,000 LIFE YEARS OF EXPOSURE

	1961-64	1965-68	1968
Ages under 30	3.6	4.0	0.0*
Ages 30 and over	2.0	2.4	1.4*
All ages	2.4	2.7	1.2*

* Based on 5 or fewer deaths.

3.0 for the four-year period 1965-68. Both rates are lower than the corresponding rates in the last report.

Army National Guard and Army Reserves

There was 1 aviation death among crew members and none among pilots in the Army National Guard during 1968. The single death involved a rotary-wing aircraft. The number of aviation deaths of student pilots was not available. There were 2 aviation deaths in each of the years 1967 and 1968 among pilots and none among crew members in the Army Reserves.

Air Force Flight Surgeons and Nurses

The aviation fatality rate among flight surgeons was 3.4 per 1,000 life years for the four-year period 1965-68. The increase in this rate from 0.4 reported last year for the 1964-67 period resulted from the loss of eight lives during 1968 by accident not caused by hostile action.

There have been no fatalities among flight nurses during the past seven years.

Graduates of Academies—Assignment to Aviation

Supplementing the report of last year on the proportion of naval academy graduates accepted for flight training by the Air Force, 34 per cent of all academy graduates were designated as "Naval Aviators" and 4 per cent were designated as nonpilot "Naval Flight Officers."

ROYAL CANADIAN AIR FORCE

No data regarding aviation fatality rates among members of the Royal Canadian Air Force more recent than that published in the 1967 report have become available.

INTERCOMPANY EXPERIENCE

The form of submission of data to the Committee was simplified this year and changed to permit greater flexibility in the selection of classifications to be studied. When the experience of a few years has been accumulated, it is planned to present additional classifications of fatality rates by type of aircraft and by type of flying.

The years of issue which contribute data to an experience year have changed from time to time, as indicated in the footnotes to the tables. The number of contributing companies has diminished over the years, with twenty companies contributing to the 1968 experience.

Civilian Aviation

Tables 18 and 19 show the fatality rates experienced in recent years among civilian pilots. The experience is by numbers of policies, and the

classification of the insured is according to status at the time of application for insurance. Exposure in the "With Aviation Extra Premium" category is terminated when the extra premium is discontinued. If discontinuance is due to a liberalization of underwriting practices, companies have been encouraged to transfer the exposure to the "Without Aviation Extra Premium" classification. Not all companies have been

TABLE 18
INTERCOMPANY EXPERIENCE ON PILOTS IN CIVILIAN
AVIATION—BY POLICIES*

STATUS AT ISSUE AND HOURS FLOWN IN 12 MONTHS PRECEDING ISSUE	PERIOD	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 airline pilots	{1957-62	8,029	24	3.0	21,233	33	1.6
	{1963-68	2,013	7	3.5	23,383	39	1.7
Other commercial pilots flying for hire:							
Instructing (at least half-time).....	{1957-62	5,250	19	3.6			
	{1963-68	4,818	12	2.5			
Others.....	{1957-62	13,700	79	5.8	3,160	8	2.5
	{1963-68	13,212	70	5.3	7,259	10	1.4
Private pilots:§							
Less than 100 hours..	{1957-62	53,842	57	1.1	49,615	50	1.0
	{1963-68	30,901	43	1.4	119,110	119	1.0
100-199 hours.....	{1957-62	23,097	63	2.7	6,821	11	1.6
	{1963-68	13,543	24	1.8	31,234	69	2.2
200-299 hours.....	{1957-62	8,123	34	4.2	905	1	.....
	{1963-68	5,599	25	4.5	3,516	14	4.0
300 or more hours....	{1957-62	7,297	27	3.7	850	1	.....
	{1963-68	5,864	22	3.8	2,107	3	1.4||
Hours not stated.....	{1957-62	3,388	5	1.5§	1,318	1	.....
	{1963-68	1,322	4	3.0§	2,715	0	.....

* Exposure in "With Aviation Extra Premium" category is terminated on discontinuance of extra premium. Exposure in "Without Aviation Extra Premium" category is for pilots apparently active at time of issue who were issued standard (without aviation rider) or reduced to standard because of a liberalization in companies' underwriting rules.

† 1957-62 data include issues of 1946 and later years; 1963-67 data include issues of 1953 and later years only; 1968 data include issues of 1959 and later years only.

‡ 1957-67 data include issues of 1955 and later years; 1968 data include issues of 1959 and later years only.

§ Pilots flying only for pleasure or personal business (not flying for hire). Includes pilots having commercial or transport certificate and pilots having private certificate and 100 or more solo hours (or solo hours not stated).

|| Based on 5 or fewer deaths.

able to do so, and consequently the experience for such policies shown in Table 18 includes only a portion of such cases.

The material in Table 18 compares the experience of 1957-62 with that of 1963-68, each period being shown separately, for cases with aviation extra premium and without aviation extra premium. For scheduled airline pilots accepted without aviation extra premium, the 1963-68

TABLE 19
 INTERCOMPANY EXPERIENCE ON PILOTS FLYING FOR
 PLEASURE OR PERSONAL BUSINESS*
 WITH AVIATION EXTRA PREMIUM †
 (1954-68 Experience on 1946 and Subsequent Issues ‡—by Policies)

HOURS FLOWN IN 12 MONTHS PRECEDING ISSUE	BY TYPE OF FLYING CERTIFICATE—ALL AGES					
	Commercial or Transport			Private (with 100 or More Solo Hours)		
	Years of Exposure	Aviation Fatalities	Rate per 1,000	Years of Exposure	Aviation Fatalities	Rate per 1,000
Less than 100 hours	17,011	32	1.9	80,548	80	1.0
100-199 hours	8,414	20	2.4	33,921	76	2.2
200-299 hours	5,891	19	3.2	10,606	47	4.4
300 or more hours	6,254	18	2.9	8,233	38	4.6
Hours not stated	907	3	3.3 §	4,457	9	2.0
Total	38,477	92	2.4	137,765	250	1.8
	BY ATTAINED AGES—ALL TYPES OF FLYING CERTIFICATES ||					
	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
Less than 100 hours	34,968	51	1.5	61,325	60	1.0
100-199 hours	13,576	24	1.8	28,212	70	2.5
200-299 hours	3,184	8	2.5	12,129	56	4.6
300 or more hours	2,967	9	3.0	11,338	47	4.1
Hours not stated	1,514	1	.....	3,830	11	2.9
Total	56,209	93	1.7	116,834	244	2.1

* Excludes pilots flying for hire. Includes pilots having commercial or transport certificate and pilots having private certificate and 100 or more solo hours (or solo hours not stated), flying only for pleasure or personal business.

† Exposure is terminated on discontinuance of extra premium.

‡ For exposure years 1963-67, issues of only 1953 and later years are included; for exposure year 1968, issues of only 1959 and later years are included.

§ Based on 5 or fewer deaths.

|| Excludes experience of those companies which were unable to subdivide experience by age.

aviation fatality rate was at about the same level as the corresponding 1957-62 rate. Private pilots with fewer than 100 hours flown in the twelve months preceding issue represent the major class by years of exposure. The aviation fatality rates for these pilots are higher for issues with an aviation extra premium. In contrast, for private pilots with 100-199 hours flown in the year preceding issue, the 1963-68 rate of 2.2 per 1,000 for issues without aviation extra premiums is approximately 30 per cent higher than both the corresponding 1957-62 rate and the 1963-68 rate for pilots charged aviation extra premiums. This differential has been decreasing each year as more experience is added. Since the 1963 and later experience year rates have been published, their trend has been slowly downward for policies without aviation extra premium and slowly upward for policies with aviation extra premium. Private pilots with 200-299 hours flown in the year preceding issue, and who are charged an extra premium, again show an increased fatality rate, as do those issued without aviation extra premium and those flying 300 or more hours in the year preceding issue.

Table 19 shows the experience during the period 1954-68, inclusive, among pilots flying only for pleasure or personal business but not for hire, (a) by type of flying certificate and (b) by attained age, in each case according to the hours flown in the twelve months preceding issue. Among the pilots with fewer than 100 hours flown in the year prior to issue, the experience has been distinctly more favorable for those pilots with private certificates than for those with commercial or transport certificates. For pilots with 100 or more hours in the twelve months prior to issue, the experience has been at about the same level or more favorable for holders of commercial or transport certificates. By attained ages, the mortality has been more favorable at ages 35 and over for the pilots with fewer than 100 hours in the year prior to issue and more favorable at ages under 35 for pilots with 100 or more hours.

Pilots who held a student license at time of application show a rate of 0.8 per 1,000 in 1968, based on 9,054 years of exposure and 7 aviation fatalities.

Military Aviation

Table 20 shows, for the companies which have contributed to the experience on military aviation, the aviation fatality rates separately for the years 1957-62 and 1963-68 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 according to his status at the time of application for insurance. Exposure was terminated when the extra premium was discontinued.

TABLE 20

INTERCOMPANY EXPERIENCE ON PILOTS AND CREW MEMBERS IN
MILITARY AVIATION—WITH AVIATION EXTRA PREMIUM*
FATALITIES IN COMBAT MISSIONS INCLUDED WHETHER
OR NOT RESULTING FROM ENEMY ACTION

(1957-62 Experience on 1946 and Subsequent Issues—by Policies;
1963-67 Experience on 1953 and Subsequent Issues—by Policies;
1968 Experience on 1959 and Subsequent Issues—by Policies)

STATUS AT ISSUE AND ATTAINED INSURANCE AGE	YEARS OF EXPOSURE		AVIATION FATALITIES		RATE PER 1,000	
	1957-62	1963-68	1957-62	1963-68	1957-62	1963-68
U.S. Air Force pilots:† ‡						
Under 25.....	2,476	750	9	3	3.6	4.0§
25-29.....	19,419	9,592	72	48	3.7	5.0
30-34.....	28,275	28,442	85	98	3.0	3.4
35 and over.....	103,513	76,127	218	124	2.1	1.6
Total.....	153,683	114,911	384	273	2.5	2.4
U.S. Army pilots:† ‡						
Under 25.....	225	492	1	10	.....	20.3
25-29.....	2,180	2,590	3	18	1.4§	6.9
30-34.....	3,664	5,305	19	27	5.2	5.1
35 and over.....	17,678	6,832	19	16	1.1	2.3
Total.....	23,747	15,219	42	71	1.8	4.7
U.S. Air Force and Army pilots:†						
Under 25.....	3,082	1,245	11	13	3.6	10.4
25-29.....	24,393	12,284	82	65	3.4	5.3
30-34.....	36,972	34,492	120	125	3.2	3.6
35 and over.....	152,691	86,517	304	146	2.0	1.7
Total.....	217,138	134,538	517	349	2.4	2.6
U.S. Air Force and Army crew members:†						
Under 25.....	9,079	3,556	17	11	1.9	3.1
25-29.....	22,873	17,679	55	51	2.4	2.9
30-34.....	14,184	27,370	32	55	2.3	2.0
35 and over.....	31,043	26,536	52	30	1.7	1.1
Total.....	77,179	75,141	156	147	2.0	2.0
U.S. Navy and Marine pilots:†						
Under 25.....	1,847	905	24	8	13.0	8.8
25-29.....	11,768	6,819	115	36	9.8	5.3
30-34.....	18,861	12,739	90	76	4.8	6.0
35 and over.....	61,848	30,765	172	99	2.8	3.2
Total.....	94,324	51,228	401	219	4.3	4.3
U.S. Air Force, Army, Navy, and Marine Reserve pilots.....	10,323	9,027	18	17	1.7	1.9
U.S. Air National Guard pilots.....	3,565	4,315	12	3	3.4	0.7§

* Exposure is terminated on discontinuance of extra premium.

† 1968 experience excludes pilots and crew members flying 40-150 hours in the 12 months preceding issue.

‡ Excludes experience of those companies which were unable to subdivide experience between Air Force and Army.

§ Based on 5 or fewer deaths.

Fatalities due to enemy action were not identified as such in the 1968 experience. Therefore, rates excluding fatalities due to enemy action are not shown for the 1963-68 experience. It is intended that this coding be reintroduced for the study of 1969 experience, retroactive to include the 1968 experience.

The 1963-68 fatality rates in Table 20 for United States Air Force pilots are lower at ages 35 and over than those for 1957-62. This is also

TABLE 21
INTERCOMPANY EXPERIENCE ON PILOTS IN MILITARY AVIATION
WITH AVIATION EXTRA PREMIUM*
FATALITIES IN COMBAT MISSIONS INCLUDED WHETHER
OR NOT RESULTING FROM ENEMY ACTION
(1957-67 Experience on 1953 and Subsequent Issues—by Policies;
1968 Experience on 1959 and Subsequent Issues—by Policies)

HOURS FLOWN IN 12 MONTHS PRECEDING ISSUE AND ATTAINED INSURANCE AGE	YEARS OF EXPOSURE		AVIATION FATALITIES		RATE PER 1,000	
	1957-62	1963-68	1957-62	1963-68	1957-62	1963-68
U.S. Air Force and Army						
40-150 hours:						
Ages 30-34.....	7,298	6,923	24	29	3.3	4.2
Ages 35 and over...	36,074	32,577	62	36	1.7	1.1
Total.....	43,372	39,500	86	65	2.0	1.6
Over 150 hours:						
Ages 30-34.....	22,349	27,139	76	98	3.4	3.6
Ages 35 and over...	46,429	53,130	121	111	2.6	2.1
Total.....	68,778	80,269	197	209	2.9	2.6
U.S. Navy and Marines						
40-150 hours:						
Ages 30-34.....	4,184	3,086	19	18	4.5	5.8
Ages 35 and over...	13,836	13,072	33	36	2.4	2.8
Total.....	18,020	16,158	52	54	2.9	3.3
Over 150 hours:						
Ages 30-34.....	10,112	9,535	45	56	4.5	5.9
Ages 35 and over...	16,904	17,598	55	62	3.3	3.5
Total.....	27,016	27,133	100	118	3.7	4.3

* Exposure is terminated on discontinuance of extra premium.

true for the combined Air Force and Army pilot data which include, for experience years prior to 1968, not only the data contributed separately for each service but also data for which the particular branch of service was not given.

The 1963-68 fatality rates for United States Air Force and Army crew members are lower at ages 30 and over than those for 1957-62. Although the crew member data are based on the combined experience of both Air

TABLE 22
 INTERCOMPANY EXPERIENCE ON PILOTS IN MILITARY AVIATION
 WITH AVIATION EXTRA PREMIUM*
 FATALITIES IN COMBAT MISSIONS INCLUDED WHETHER
 OR NOT RESULTING FROM ENEMY ACTION
 (1963-67 Experience on 1953 and Subsequent Issues—by Policies;
 1968 Experience on 1959 and Subsequent Issues—by Policies)

Status at Issue and Attained Insurance Age	Years of Exposure	Aviation Fatalities	Rate per 1,000
U.S. Air Force pilots:† ‡			
Ages 35-39.....	25,906	75	2.9
Ages 40 and over.....	50,221	49	1.0
Ages 35 and over.....	76,127	124	1.6
U.S. Army pilots:† ‡			
Ages 35-39.....	4,178	12	2.9
Ages 40 and over.....	2,654	4	1.5§
Ages 35 and over.....	6,832	16	2.3
U.S. Navy and Marine pilots:†			
Ages 35-39.....	12,262	72	5.9
Ages 40 and over.....	18,503	27	1.5
Ages 35 and over.....	30,765	99	3.2

* Exposure is terminated on discontinuance of extra premiums.
 † 1968 experience excludes pilots flying 40-150 hours in the 12 months preceding issue.
 ‡ Excludes experience of those companies which were unable to subdivide experience between Air Force and Army.
 § Based on 5 or fewer deaths.

Force and Army personnel, the Army experience is very limited, amounting to about 1 per cent of the exposure in the years 1964-68 and including one fatality.

The 1963-68 fatality rates for United States Navy and Marine Corps pilots are lower than the 1957-62 rates for ages below 30 and higher for ages 30 and over. The aggregate rate continues to be significantly higher than the rate for Air Force and Army pilots combined.

Table 21 shows a subdivision of the experience on pilots in military aviation at attained ages 30 and over according to the number of hours

flown in the twelve months preceding issue. Table 21 shows that for ages 35 and over aviation fatality rates are higher for pilots who flew more than 150 hours during the year preceding issue than for pilots who flew not more than 150 hours; aviation fatality rates have continued to be lower for those at attained ages 35 and over than for those at ages 30-34.

Beginning with the experience of 1963, the contributing companies have been asked to show separately their experience for pilots in military aviation at attained ages 35-39, as well as at ages 35 and over. A summary of the data is shown in Table 22. Table 22 indicates that for United States Air Force and United States Navy and Marine Corps pilots the aviation fatality rates at attained ages 40 and over are significantly lower than those at ages 35-39. The limited data for United States Army pilots are inconclusive.