

**TRANSACTIONS OF SOCIETY OF ACTUARIES
1960 REPORTS**

REPORT OF THE COMMITTEE ON AVIATION

AVIATION STATISTICS

THIS report is confined to a summary of such data as add to or materially change conclusions reached in previous reports. Since this procedure has now been used for several years, the following index is given of the most recent information on various classes.

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SCHEDULED AIRLINES

United States Airlines

This category includes all flying by airlines holding certificates of public convenience and necessity issued by the Civil Aeronautic Board to conduct services over specified routes. It includes certain nonscheduled or charter operations by these carriers. In addition to passenger operations, the statistics in this section cover cargo operations of passenger-cargo scheduled airlines, but do not include the operations of all-cargo airlines. Intra-Alaska carriers are also excluded from this report.

The number of fatal accidents on United States scheduled airlines was about the same in the last five years of the 1950's (29) as in the first five years of the decade (28). The fatal accident rate per million plane miles decreased with increasing plane mileage flown until 1958. The 1959 fatal accident rate of .009 per million plane miles (based on 8 fatal accidents) was nearly double the average rate for the preceding three years. In 1960, the rate is estimated at .012 per million plane miles.

Table 1 shows the recent trend of passenger and pilot fatality rates on

† In present Report.

United States scheduled airlines. These rates showed no improvement in domestic flying during the 1950's. They reached their lowest level during 1954-57, increased from 1957 to 1958 and again in 1959. Preliminary estimates indicate that the fatality rates for both passengers and pilots were about 50 percent higher in 1960 than in 1959. Although the exposure has been steadily increasing in recent years, substantial fluctuations in fatal-

TABLE 1
UNITED STATES SCHEDULED AIRLINES AVIATION DEATH RATES

Period	Passenger Death Rate per 1,000 Passenger Hours	Death Rate of First Pilots in Scheduled Flights per 1,000 Airplane Hours	Death Rate of All Pilots Employed in Scheduled Flying per Life Year of Exposure	Death Rate of Other Crew Members Employed in Scheduled Flying per Life Year of Exposure
Domestic				
1959.....	.0015	.0019	.0014	.0017
1952-1955.....	.0010†	.0014†	.0011†	.0009†
1953-1956.....	.0012†	.0013†	.0010†	.0011†
1954-1957.....	.0009†	.0010†	.0008†	.0008†
1955-1958.....	.0011†	.0010†	.0009†	.0008†
1956-1959.....	.0010†	.0010	.0008	.0009
International				
1959.....	.0022	.0032*	.0024*	.0038
1952-1955.....	.0015	.0005*	.0007	.0011
1953-1956.....	.0001*	.0000*	.0001*	.0001*
1954-1957.....	.0005	.0004*	.0004*	.0007
1955-1958.....	.0005	.0004*	.0004*	.0007
1956-1959.....	.0011	.0012*	.0008	.0015
Total				
1959.....	.0016	.0021	.0015	.0020
1952-1955.....	.0011†	.0013†	.0010†	.0010†
1953-1956.....	.0010†	.0011†	.0009†	.0008†
1954-1957.....	.0009†	.0009†	.0007†	.0007†
1955-1958.....	.0010†	.0010†	.0008†	.0008†
1956-1959.....	.0010†	.0010	.0008	.0010

* Based on less than 5 deaths.

† Includes deaths caused by a bomb placed in an airplane.

ity rates can still result from the loss of lives in a single accident. This is particularly true of international flying, which represents only about one sixth of the total exposure.

The columns headed "Death Rate of All Pilots Employed in Scheduled Flying" and "Death Rate of Other Crew Members Employed in Scheduled Flying" both include those who do less than the normal amount of flying on account of having some supervisory duties or for some other reasons, as well as the deaths in nonscheduled flights operated by scheduled airlines, such as test or charter flights. The hazard of the normal airline pilot probably lies between the figures in the second and third columns of rates. This difference has not been great in recent years.

Pilots engaged in scheduled flying may not, under government regulations, fly more than 85 hours per month in domestic operations, nor more than 255 hours per quarter in international flying. In actual practice, they average between 72 and 82 hours flying time a month, with 15 to 35 hours per month spent in ground duties before and after their flights.

An attempt was made to match the deaths with the proper exposures in a more precise manner, beginning with 1952, than had heretofore been possible. The result has been several minor changes in the rates given in Table 1 compared with the corresponding rates in last year's version of the table. These changes are due primarily to the exclusion of deaths on the all-cargo carriers, necessitated by the fact that the exposures used do not contain all-cargo experience.

During the four years 1956-59, there were 17,670,000 passenger miles flown by helicopters in scheduled airline service. While there were four accidents reported, none of them involved any fatalities. In 1960, however, one accident took the lives of 11 passengers, the pilot, and a crew member.

Airlines of Countries Other than United States

The International Air Transport Association has furnished the Committee with the experience of most of its members. By deducting the experience of United States scheduled airlines and by making reasonable assumptions as to average speed in the years for which it was not specifically given, the passenger fatality rates per 1,000 hours for airlines of countries other than the United States were derived and are shown in Table 2; these are compared with the corresponding rates of United States scheduled airlines (whether or not they are members of the International Air Transport Association) taken from Table 1.

It is noteworthy that in 1959, for the first time, the record of scheduled airlines of countries other than the United States was comparable with that of United States scheduled lines.

Separate figures available for Canada show that in domestic and international operations of Canadian scheduled airlines during the period 1951-1959, the aviation death rate was .0026 per 1,000 passenger hours for passengers and .0027 per 1,000 airplane hours for pilots. The former rate is based on 150 passenger deaths, the latter rate on only 6 first-pilot deaths. The corresponding passenger death rate for the period 1956-1959 was .0025, based on 87 passenger deaths.

The 1958 death rate for airlines of countries other than the United States was erroneously given in the 1959 Report as .0029. It should have been .0036, and the rate for 1955-58 has been corrected to .0035.

SUPPLEMENTAL AIRLINES

This category consists of those airlines, formerly called "irregular carriers," which have been awarded certificates of public convenience and

TABLE 2
SCHEDULED AIRLINES OF UNITED STATES
AND OTHER COUNTRIES
PASSENGER AVIATION DEATH RATE
PER 1,000 PASSENGER HOURS

Period	Airlines of Countries Other than U.S. Reporting to I.A.T.A.	All U.S. Airlines
1959.....	.0015	.0016
1952-1955.....	.0040*	.0011*
1953-1956.....	.0043*	.0010*
1954-1957.....	.0039*	.0009*
1955-1958.....	.0035*	.0010*
1956-1959.....	.0031	.0010*

* Includes deaths caused by sabotage or attack.

necessity allowing limited scheduled service, as well as nonscheduled cargo and passenger service. Also included are those irregular carriers operating on a temporary authorization pending final decision on their application for certificate as supplemental air carrier.

The figures shown in Table 3 for this category are based on mileage reports to the Civil Aeronautics Board and on the assumption of an average speed of 200 miles per hour from take-off to landing. This assumption has been tested recently and found still to be valid. Because there was only one passenger fatality in the period 1956 through 1959, death rates for the recent periods have declined very sharply.

All-Cargo Carriers

These carriers are primarily engaged in the transportation of freight and express. In recent years, approximately 40 percent of their services have been on a scheduled basis. Their nonscheduled services include military contract operations which often involve the carrying of troops as well as cargo. The first pilot fatality rate computed for the scheduled services of the all-cargo carriers on the assumption of an average speed of 200 miles per hour was .007 per 1,000 airplane hours for the period 1952-1959. However, this rate was based on only 5 deaths.

TABLE 3
SUPPLEMENTAL CARRIERS OPERATING AIRCRAFT OF
MORE THAN 12,500 POUNDS GROSS WEIGHT

PERIOD	PASSENGER		FIRST PILOT*	
	Deaths	Rate per 1,000 Passenger Hours	Deaths	Rate per 1,000 Airplane Hours
1953-1956.....	177	.007	8	.010
1954-1957.....	36	.002	3	.004
1955-1958.....	27	.001	2	.003
1956-1959.....	1	.000	1	.001

* Nonpassenger operations excluded in 1953 and subsequent years.

GENERAL AVIATION FLYING

All civil flying except that performed by the public air carriers (scheduled and supplemental) is considered as general aviation activity. Flight time accumulated annually in general aviation is more than three times the utilization of the domestic airline transports in scheduled service.¹ The number of hours flown is an estimate based on annual surveys of aircraft use. Application of the figures in Table 4 depends on the average annual hours of the individual pilot under consideration, as well as on the kind(s) of flying in which he engages.

Commercial flying is a subdivision of general aviation flying and includes the transportation of passengers and cargo for hire, survey and patrol activities, and aerial application activities (crop control).¹ This category accounts for about one fifth of all general aviation flying. The largest

¹ *FAA Statistical Handbook of Aviation*, 1960 Edition, pages 44-46.

portion, crop control, was covered in the 1959 Report. Miscellaneous flying includes search and rescue work, Civil Air Patrol, etc.

The instructional flying category covers flight training of civilians, both dual instruction and solo flying, under an instructor's supervision. Included are the deaths of the instructor or the student, whoever was acting as pilot when the accident occurred. The hours of instructional flying have been increasing since 1953 and now represent about one sixth of the total. Single-engine planes are used almost exclusively for this pur-

TABLE 4
GENERAL AVIATION FLYING BY KINDS—PILOT AVIATION
DEATH RATES PER 1,000 HOURS

Period	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate
	Instruction			Commercial (excluding Crop Control) and Miscellaneous		
1956.....	1,500†	35	.023	1,200†	21	.018
1957.....	1,864	49	.026	1,235	35	.028
1958.....	2,000†	40	.020	1,300†	46	.035
1956-1958....	5,364	124	.023	3,735	102	.027
	Pleasure			Other Noncommercial		
1956.....	2,100†	175	.08	4,600†	53	.012
1957.....	2,109	202	.10	4,864	68	.014
1958.....	2,200†	181	.08	5,300†	55	.010
1956-1958....	6,409	558	.09	14,764	176	.012

* 000 omitted.

† Data estimated from trend, since no formal survey conducted.

pose.² The fatality rates in this and in commercial flying were somewhat lower in 1956-58 than they were in 1951-54.

The remainder of general aviation flying is termed "Noncommercial" and consists of:

1. Pleasure flying, which accounts for about one fifth of the total hours in general aviation. Included are local flights for sightseeing, proficiency or other purposes, and crosscountry trips for vacation, recreation and air tours.²
2. Business flying by individuals in their own, company-owned, borrowed, or rented aircraft, in connection with their occupation or company business (not flown by professional pilot).

² *Ibid.*

3. Corporate flying in company-owned or company-operated aircraft for the transportation of their own personnel (and/or for other company business) and flown by professional pilots hired for the transportation.
4. Public flying, which consists of all flying in furtherance of federal, state or municipal activities.
5. Other noncommercial activities such as hunting, ferry or test flights, trapping, etc.³

The fatality rate for other noncommercial flying in 1956-58 was about the same as that shown in Table 5 of the 1956 Report for all noncommercial business flying in 1951-54.

Because of growing interest in business and corporate flying, an attempt has been made to estimate fatality rates for fixed-wing aircraft weighing over 12,500 pounds used in "corporate operations." Using statistics from Civil Aeronautic Board publications, it appears that the death rate for pilots in the period 1951-59 was about .008 per 1,000 pilot hours, and for passengers about .011 per 1,000 passenger hours, without any clear-cut trend during this period. In each case, about 40 deaths were involved. During 1956-59, the corresponding rate for pilots was .009 per 1,000 pilot hours, and for passengers .014 per 1,000 passenger hours. In calculating these rates, it was assumed (based on some statistical evidence) that one plane hour was equivalent to 2 pilot hours and 1.75 passenger hours.

The use of helicopters in general civilian aviation continues to rise. At the end of 1959, there were about one and one-half times the number of helicopters registered in active use as at the end of 1957. In the three-year period 1957-59, there were 185 accidents involving helicopters in general civilian aviation in continental United States, excluding Alaska, resulting in 47 fatalities, 18 of them pilots. The corresponding fatality rate for pilots has been estimated at .04 per 1,000 hours flown, and for all persons at .11 per 1,000 hours flown in helicopters.

CANADIAN CIVIL FLYING

The fatality rates of Canadian civil pilots during 1954-59, as furnished by the Canadian Department of Transport, are shown in Table 5. In comparison with the fatality rates for the period 1953-58, the rate for pilots with airline transport licenses remained unchanged. That for pilots with senior commercial licenses and private licenses decreased slightly and that for pilots with regular commercial licenses increased. It should be

³ *General Aviation Accidents (Non-Air Carrier)—A Statistical Analysis*, 1958 Edition, Federal Aviation Agency.

noted that holders of airline transport licenses may engage in all types of flying, and are not necessarily engaged in scheduled airline flying.

Excluded from the above were persons holding glider licenses only, of whom there were 354 in 1959, with one fatality.

TABLE 5
CANADIAN CIVIL PILOTS BY CLASS OF LICENSE
1954-1959

Class of License	Life Years of Exposure	Aviation Deaths	Rate per 1,000 Life Years of Exposure
Airline Transport	5,148	24	4.7
Senior Commercial	2,254	13*	5.8
Commercial	12,673	72*	5.7
Private (excluding students)	40,902	73†	1.8

* Includes one missing, presumed dead.
† Includes one death as Glider Pilot in each year 1958 and 1959.

UNITED STATES AIR FORCE

Pilots and Other Rated Officers—By Age

Table 6 shows for the period 1956-59 the aviation death rates for all rated pilots of the Air Force and for other rated officers by age. The average death rates for rated pilots in this period were generally lower than the corresponding rates in 1955-58. The reduction was greatest under age 30, with the result that the variation in death rates by age has narrowed. During the more recent four-year period, the aviation death rates for pilots under 30 (about 7.5 per 1,000) have been about double those for pilots aged 30 and over. Aircraft hours per pilot continue to average about 140 per year. It should be noted that this figure is not the same as the average number of flying hours per pilot, which is believed to be about double this figure. In the computation of the average number of aircraft hours, hours flown are counted but once regardless of the number of pilots who may be in the aircraft.

The average death rates for nonpilot rated officers were slightly lower in 1956-59 than in 1955-58. The variation in these rates by age is less than that for pilots. During the more recent four-year period, the death rates for officers under 30 (about 4.5 per 1,000) have been only moderately higher than for pilots aged 30 and over.

Attention is called to the very favorable 1959 experience for both pilots and other rated officers.

An Air Force pilot with 20 years experience may be placed in a restricted category which excuses him from active flight requirements although he receives flight pay. However, he is not prohibited from performing flight duties, and every Air Force officer who is entitled to flight pay may be directed to perform aerial flights in other than passenger status at any time and upon reasonably short notice. About 3,000 officers have been so relieved from proficiency flying requirements in fiscal year 1961. It is be-

TABLE 6
UNITED STATES AIR FORCE ON ACTIVE DUTY, BY AGE
AVIATION DEATH RATES PER 1,000
LIFE YEARS OF EXPOSURE
Deaths Due to Enemy Action Excluded—Other Deaths
in Combat Missions Included

Age Group	1956	1957	1958	1959	1956- 1959
All Rated Pilots					
Under 25.....	8.3	7.1	8.1	4.2	7.2
25-29.....	11.9	9.3	7.3	5.3	8.2
30-34.....	4.4	3.9	5.4	4.1	4.4
35 and over....	3.5	3.2	3.8	1.9	3.1
All.....	6.1	5.3	5.3	3.2	5.0
Nonpilot Rated Officers					
Under 25.....	5.3	4.0	4.5	2.0	4.1
25-29.....	5.3	6.3	4.5	3.5	4.8
30-34.....	3.1	4.8	4.2	1.7*	3.5
35 and over....	3.4	5.3	3.8	1.9	3.6
All.....	4.3	5.1	4.2	2.4	4.1

* Based on less than 5 deaths.

lieved, nevertheless, that only a small proportion of these officers are likely to be ordered to resume flying as pilots.

Pilots and Other Rated Officers—By Rank

Aviation death rates for pilots and other rated officers according to rank are shown in Table 7. Inasmuch as increase in rank is associated with advance in age, there is a high correlation between the mortality experience by rank and that by age. The average rates for pilots were somewhat lower in 1956-59 than in 1955-58.

Student Pilots

As Table 8 indicates, death rates of undergraduate student pilots were slightly higher in 1956-59 than in 1955-58. Rates for individual years show no definite trend. Students in the advanced course are rated pilots, and hence are included in Tables 6 and 7.

TABLE 7
 UNITED STATES AIR FORCE ON ACTIVE DUTY, BY RANK
 AVIATION DEATH RATES PER 1,000
 LIFE YEARS OF EXPOSURE
 Deaths Due to Enemy Action Excluded—Other Deaths
 in Combat Missions Included

Rank	1956	1957	1958	1959	1956-1959
All Rated Pilots					
2nd Lieutenant.....	9.1	7.4	8.5	6.2	8.3
1st Lieutenant.....	10.8	8.2	7.7	5.4	8.0
Captain.....	4.8	4.2	5.4	3.2	4.4
Major.....	3.4	3.1	2.7	1.4	2.6
Lt. Col. and higher...	2.0	3.3	2.9	1.5	2.4
All.....	6.1	5.3	5.3	3.2	5.0
Nonpilot Rated Officers					
2nd Lieutenant.....	5.3	2.7	4.2	1.5*	3.7
1st Lieutenant.....	4.6	5.4	4.7	3.1	4.5
Captain.....	5.1	5.9	3.5	2.1	4.1
Major.....	0.9*	4.4	4.8	2.1*	3.1
Lt. Col. and higher...	1.8*	4.9*	1.6*	1.5*	2.0
All.....	4.3	5.1	4.2	2.4	4.1

* Based on less than 5 deaths.

TABLE 8
 UNITED STATES AIR FORCE STUDENT PILOTS
 AVIATION DEATH RATES PER 1,000 LIFE YEARS
 OF EXPOSURE

Course	1956	1957	1958	1959	1956-1959
Primary...	2.5	2.8	1.9	4.9	2.8
Basic.....	6.4	5.0	9.3	5.9	6.3

Duty Assignment

The death rates of rated pilots according to duty assignment are given in Table 9. Fatality rates for pilots assigned to helicopters, fighters, and bombers were markedly lower in 1959 than in prior years. The rate for reconnaissance pilots decreased to its former level after rising to the unexpectedly high rate commented upon in the 1959 Report.

The residual category "All Other" includes pilots whose primary duty is in some other capacity—*e.g.*, administration—but who do a minimum amount of flying to maintain proficiency and to qualify for flight pay.

TABLE 9
UNITED STATES AIR FORCE ON ACTIVE DUTY
BY DUTY ASSIGNMENT
AVIATION DEATH RATES PER 1,000
LIFE YEARS OF EXPOSURE

Duty Assignment	1956	1957	1958	1959	1956-1959
Pilot, Helicopter . . .	0.0*	5.2*	6.6*	2.9*	3.8
Pilot, Amphibian . . .	3.8*	0.0*	0.0*	0.0*	0.9*
Pilot, Transport . . .	4.2	1.8	3.8	2.0	2.9
Pilot, Troop Carrier . . .	4.1	0.0*	4.3	0.0	2.1
Pilot, Fighter	18.7	13.0	14.0	9.6	13.9
Pilot, Bomber	6.2	5.4	8.4	3.9	5.9
Pilot, Reconnaissance	8.9	6.8	15.8	8.2	9.6
Pilot, Tanker†			3.2	2.0	2.6§
Pilot, AOB‡	7.4	4.6			5.8#
Operations Officer	2.6	3.7	2.3	1.4	3.0
All Other	3.0	3.3	2.5	1.8	2.6

* Based on less than 5 deaths.

† Grouped in "All Other," 1956-1957.

‡ Pilot also qualified as bombardier and radar observer—included in "Pilot, Bomber," 1958-1959.

§ 2 year period, 1958-1959.

2 year period, 1956-1957.

Age Group and Duty Assignment

The Committee received for the first time data as to the distribution of officers on flying status by duty assignment and age. These are shown in Table 10.

As might have been anticipated, the figures show that fighter pilots are concentrated at the younger ages, and that pilots in transports, bombers, tankers, and reconnaissance planes are distributed more evenly over a broader age range. It is of interest to note that, with the exception of fighter pilots, there were fewer pilots in the age group 30-34 than at ages 35-39. Fighter pilots, who have the highest fatality rate, were predominantly in the age group 25-29.

Military Air Transport Service

In 1956-59, the passenger fatality rate in the Military Air Transport Service was 2.4 per 100,000,000 passenger miles, compared with a rate of 0.5 for all United States scheduled airlines. There were no passenger fatalities during 1959 in the MATS.

Aviation death rates of flying personnel in the MATS are shown in Table 11.

TABLE 10
UNITED STATES AIR FORCE
DISTRIBUTION OF OFFICERS BY DUTY ASSIGNMENT AND AGE

DUTY ASSIGNMENT	AGE				
	Under 25	25-29	30-34	35-39	40 and over
Pilot, Helicopter.....	21.3%	53.0%	10.2%	12.4%	3.1%
Pilot, Amphibian.....	8.5	33.1	18.2	28.9	11.3
Pilot, Transport.....	7.0	37.6	14.3	29.4	11.7
Pilot, Troop Carrier....	5.8	46.1	16.6	23.1	8.4
Pilot, Fighter.....	19.2	54.1	15.8	9.2	1.7
Pilot, Bomber.....	11.8	34.0	17.9	30.0	6.3
Pilot, Reconnaissance..	6.2	39.1	21.7	24.2	8.8
Pilot, Tanker.....	11.1	41.1	13.8	24.4	9.6
Operations Officer.....	0.5	6.1	13.7	53.2	26.5
All Other.....	1.1	10.4	13.6	39.7	35.2
All.....	6.8%	25.7%	14.8%	32.8%	19.9%

TABLE 11
MILITARY AIR TRANSPORT SERVICE
AVIATION DEATH RATES PER 1,000 LIFE YEARS
OF EXPOSURE

	7/1/56- 6/30/57	7/1/57- 6/30/58	7/1/58- 6/30/59	7/1/59- 6/30/60	7/1/56- 6/30/60
<i>Pilots</i>					
Transport units	7.8	2.4*	3.9	0.9*	3.3
Other units....	3.2	2.6	1.3	1.4*	2.2
All.....	4.4	2.6	2.4	1.2	2.6
<i>Other Crew</i>					
Transport units	10.9	2.2	4.1	1.7	3.9
Other units....	6.8	5.2	5.2	1.3*	5.3
All.....	8.2	3.9	4.4	1.6	4.5

* Based on less than 5 deaths.

Air National Guard

The fatality rate among Air National Guard pilots not federally activated was 6.0 per 1,000 life years of exposure in 1959 and 6.9 in 1956-59. This compares with rates of 6.2 in 1958 and 8.0 in 1955-58.

There is some indication that the character of the Air National Guard flying may change in the future; this is foreshadowed by the fact that a considerable number of Air National Guard pilots flying interceptor planes have been retrained and transferred early in 1960 to provide six Air National Guard transport plane squadrons to augment the MATS.

Flight Surgeons and Nurses

In 1956-59, the fatality rate among flight surgeons was 2.8 per 1,000 life years and among flight nurses 5.7 per 1,000, the latter representing a slight decrease from the period 1955-58. Fatality rates for flight nurses were erroneously reported to the Committee last year as 2.9 per 1,000 for 1955-58, instead of 5.8.

Graduates of Air Force Academy—Assignment to Aviation

The United States Air Force Academy graduated 228 students in 1960, of whom 8 were commissioned in the Marine Corps and the Navy, and virtually all the rest in the Air Force. Of the cadets commissioned in the Air Force, 87 percent entered pilot training, 7 percent elected navigation, 4 percent began training in missile technology, and the remaining 2 percent were accepted for graduate studies in astronautics at universities under the Air Force Institute of Technology program.

UNITED STATES ARMY

The fatality rates for United States Army pilots and crew members shown in Table 12 are somewhat lower in 1956-59 than in 1955-58.

The Committee obtained new information as to relative aviation hazards of fixed-wing and rotary-wing aircraft. The fatality rates per 1,000 aircraft hours for these two types of aircraft are shown in Table 13. Since

TABLE 12
UNITED STATES ARMY—ALL FLYING OPERATIONS 1956-1959
AVIATION DEATH RATES PER 1,000
LIFE YEARS OF EXPOSURE

	1956	1957	1958	1959	1956-1959
Pilots.....	3.1	6.6	5.3	4.2	4.9
Crew Members...	1.9*	7.1*	7.8	4.4*	5.3

* Based on less than 5 deaths.

the Army now does a substantially greater amount of helicopter flying than the Air Force, the Army's helicopter fatality rates probably provide a better indication of the hazard in military helicopters than the figures for the Air Force shown in Table 9. In the Army, the average number of aircraft hours per pilot in fixed-wing and rotary-wing craft combined is about 220 per year.

Graduates of Military Academy—Assignment to Aviation

The proportion of the graduating class of the United States Military Academy accepted for flight training by the Air Force decreased from 24 percent in 1958 to 5 percent in 1959. The United States Air Force Academy graduated its first class in 1959.

UNITED STATES NAVY

Pilots by Age

Table 14 shows the 1956-59 fatality rates by age for all Navy and Marine aviators (officers) on active duty.

TABLE 13
 UNITED STATES ARMY—ROTARY VERSUS FIXED WING AIRCRAFT
 1957-59
 AVIATION DEATHS PER 1,000 AIRCRAFT HOURS OF EXPOSURE

	1957	1958	1959	1957-1959
Fixed Wing Aircraft.....	.0229	.0177	.0162	.0184
Rotary Wing Aircraft.....	.0271	.0332	.0253	.0285
All.....	.0234	.0236	.0197	.0222

TABLE 14
 UNITED STATES NAVY ON ACTIVE DUTY BY AGE
 ALL NAVAL AVIATORS (OFFICERS)
 AVIATION DEATH RATE PER 1,000 LIFE YEARS OF EXPOSURE
 Deaths Due to Enemy Action Excluded—Other Deaths in Combat
 Missions Included

Age Group	1956	1957	1958	1959	1956-1959
Under 25...	25.2	17.6	18.5	8.2	16.9
25-29.....	15.0	11.2	11.9	10.8	12.2
30-34.....	8.2	4.8	5.6	7.2	6.5
35 and over..	2.6	3.1	3.4	2.6	2.9
All.....	10.1	8.5	8.4	6.3	8.3

These fatality rates show a marked decrease at ages under 25, a somewhat smaller decrease at ages 25-29, and little change at ages 30 and over. *Naval Aviation News* reports that "Naval Aviators set a new safety record of 1.94 accidents per 10,000 hours of flight in fiscal 1960, reducing the previous year's rate by 43 percent in carrier operations and 25 percent in total operations." While new devices for low level pilot ejection are a factor in this record, the Navy attributes the improvement primarily to pilot training programs now in effect.

Navy pilots over age 45 with more than 20 years flying are no longer required to fly a minimum number of hours to maintain proficiency, even though they may continue to receive flight pay.

The average number of flight hours per pilot has been decreasing steadily, as shown below:

1956.....	283
1957.....	277
1958.....	266
1959.....	259

Pilots by Rank

Table 15 shows fatality rates for Navy and Marine aviators by rank in 1956-59. The lowest group (Ensign, etc.) continued to show a down-

TABLE 15
UNITED STATES NAVY ON ACTIVE DUTY BY RANK
ALL NAVAL AVIATORS (OFFICERS)
AVIATION DEATH RATES PER 1,000 LIFE YEARS OF EXPOSURE

Rank	1956	1957	1958	1959	1956-1959
Ensign, 2nd Lt., Chief Warrant Officer and Warrant Officer.....	15.7	12.8	9.7	3.2	11.1
Lt. (j.g.) and 1st Lt.....	19.3	15.9	17.2	12.8	16.4
Lt. (Navy) and Captain (M.C.).....	7.3	6.7	7.2	7.1	7.1
Lt. Commander and Major.....	4.8	2.9	3.5	3.1	3.5
Commander, Lt. Colonel, and higher.	3.0	3.5	3.9	2.8	3.3
All.....	10.1	8.5	8.4	6.3	8.3

ward trend in 1959, based on a relatively small number of fatalities. Rates for all other ranks have remained practically unchanged in recent years.

Student Pilots

Fatality rates of Navy and Marine student pilots are shown in Table 16. Although the rate in the advanced course increased for 1959, the number of fatalities was small.

Inactive Reservists

The fatality rate for inactive reserve pilots in drill pay status has remained at about the same level in recent years. The rates for 1956-59 were 3.5 per 1,000 life years of exposure at ages under 30 and 1.5 at ages 30 and over.

Graduates of Naval Academy—Assignment to Aviation

Of the 1960 graduating class of the United States Naval Academy, 26 percent will undergo flight training in the Navy and 6 percent in the Air Force. Those commissioned in the Marine Corps are not immediately eligible for flight training.

UNITED STATES COAST GUARD

The figures in Table 17 have been derived from information supplied by United States Coast Guard headquarters. There were no aviation fatalities in the Coast Guard in 1959.

TABLE 16
UNITED STATES NAVY STUDENT PILOTS
AVIATION DEATH RATES PER 1,000 LIFE YEARS OF EXPOSURE

Course	1956	1957	1958	1959	1956-1959
Basic.....	6.3	3.4	3.5	2.7	4.1
Advanced.....	20.0	7.8	4.8*	10.2	11.2

* Based on less than 5 deaths.

TABLE 17
UNITED STATES COAST GUARD PERSONNEL
ON FLIGHT ORDERS
1953-59

Class	Life Years of Exposure	Aviation Deaths	Rate per 1,000 Life Years of Exposure
Pilots.....	2,380	9	3.8
Student Pilots.....	254	1	*
Observers.....	105	1	*
Crew Members.....	6,849	17	2.5

* Death rates not shown in classes with less than 5 deaths.

ROYAL CANADIAN AIR FORCE

Table 18 shows the 1955-59 fatality rates for pilots of the RCAF and of the RCAF Auxiliary (Reserve personnel who undergo weekly training in organized squadrons). The over-all death rate for pilots on active duty has shown a further substantial decrease to 8.7 per 1,000 life years, compared with 10.9 for the years 1954-58. The fatality rate for the RCAF Auxiliary has been reduced by about half, to 6.3 per 1,000 life years, reflecting the reduced exposure to flying in jet aircraft.

A comparison of the fatality rates by functional formation for the periods 1955-59, 1954-58, and 1953-57 indicates a substantial improvement for the categories "Fighter," "Training," and "Other." It will be noted that the category "Tactical" has been merged with "Other."

RCAF pilot air fatalities per 1,000 pilot flying hours for the years 1956-59 averaged .0506 for pilots flying jet aircraft and .0079 for pilots

TABLE 18
ROYAL CANADIAN AIR FORCE PILOTS
AVIATION DEATH RATES
PER 1,000 LIFE YEARS OF EXPOSURE

	Regular 1955-1959	Auxiliary 1955-1959
<i>Age Group</i>		
Under 25.....	11.7	7.8*
25-29.....	13.6	8.2*
30-34.....	8.0	2.4*
35-39.....	3.5	7.3*
40 and over.....	2.4	0.0*
All.....	8.7	6.3
<i>Rank</i>		
Flight Cadet and Pilot Officer.....	5.4	7.5*
Flying Officer.....	13.2	5.6
Flight Lieutenant.....	5.5	12.3*
Squadron Leader.....	2.9	0.0*
Wing Commander and Higher Ranks..	3.5	0.0*
All.....	8.7	6.3
<i>Function</i>		
Fighter.....	18.4
Training.....	6.6
Transport.....	0.7*
Maritime.....	0.0*
Other.....	1.8*
All.....	8.7

* Based on 5 deaths or less.

flying other aircraft. The approximate number of flight hours in 1959 per pilot was 296 for the RCAF and 100 for the RCAF Auxiliary.

It has been ascertained that at present 8.6 percent of the RCAF (Regular) aircrew strength are personnel who were ground crew prior to becoming aircrew. Of the aircrew trainees who graduated and were commissioned in aircrew during the past five years, the percentages who were formerly groundcrew were as follows:

1955.	16.7%
1956.	18.1%
1957.	13.9%
1958.	3.3%
1959.	1.8%

INTERCOMPANY EXPERIENCE

Tables 19 and 20 show the experience, through December 31, 1959, among certain classes of pilots and military crew members on policies issued with an aviation extra premium since January 1, 1946 by the 32 contributing companies. The experience is by number of policies and the classification of pilots is that according to the status at the time of application for insurance. Exposure in the "Issued with Aviation Extra Premium" category is terminated when the extra premium is discontinued. If discontinuance is due to a liberalization of underwriting practice, companies are encouraged to transfer the exposure to the "Insured at Standard Rates" classification. Not all companies have been able to do so, and consequently the experience among such policies shown in Table 21 includes only a portion of such cases.

The fatality rate among scheduled airline pilots insured with an aviation extra premium has been rising in the past few years. The practice of accepting scheduled airline pilots at standard premium rates has resulted in the transfer of policies on many such pilots out of the exposure to a standard classification and has served to decrease markedly the number of new lives entering the exposure with an extra premium. Those who remain and those who are insured with an extra premium may include some who are also engaged in more hazardous activities.

Fatality rates among pilots of commercial planes, other than of scheduled airlines, have also been increasing during the last few years. Rates for other civilian pilots flying only for pleasure or personal business have remained at about the level shown in last year's report.

Insured Army and Air Force pilots also experienced about the same fatality rates as those shown in the report last year. These rates continue

TABLE 19

INTERCOMPANY EXPERIENCE ON CIVILIAN PILOTS AND CREW
MEMBERS INSURED WITH AVIATION EXTRA PREMIUM†
Issued since January 1, 1946, unless Otherwise Stated—By Policies

Status at Issue and Exposure Period	Years of Exposure	Aviation Deaths	Rate per 1,000
Employed as scheduled airline pilot			
1946-1959.....	35,165	80	2.3
1949-1959.....	32,235	67	2.1
1952-1959.....	24,081	47	2.0
1955-1959.....	11,984	35	2.9
1958-1959.....	2,865	15	5.2
Others having commercial or transport certificate and flying for hire			
1946-1959.....	24,431	140	5.7
1949-1959.....	22,631	127	5.6
1952-1959.....	18,775	103	5.5
1955-1959.....	13,987	88	6.3
1958-1959.....	6,125	44	7.2
Having commercial or transport certificate but flying only for pleasure or personal business (not for hire), or having private certificate and 100 or more solo hours (or solo hours not stated)			
Less than 50 hours in preceding 12 months‡			
1946-1959.....	40,050	38	.9
1949-1959.....	38,012	33	.9
1952-1959.....	31,522	29	.9
1955-1959.....	21,726	16	.7
1958-1959.....	9,283	8	.9
50-99 hours in preceding 12 months‡			
1946-1959.....	24,465	37	1.5
1949-1959.....	23,055	32	1.4
1952-1959.....	18,599	24	1.3
1955-1959.....	12,699	15	1.2
1958-1959.....	5,649	11	1.9
Less than 100 hours in preceding 12 months§			
1946-1959.....	70,674	83	1.2
1949-1959.....	67,226	73	1.1
1952-1959.....	56,280	61	1.1
1955-1959.....	40,584	39	1.0
1958-1959.....	18,148	23	1.3
100-199 hours in preceding 12 months			
1946-1959.....	33,451	89	2.7
1955-1959.....	18,430	47	2.6
1958-1959.....	7,797	25	3.2
200-299 hours in preceding 12 months			
1946-1959.....	11,152	50	4.5
1955-1959.....	6,538	29	4.4
1958-1959.....	2,733	7	2.6

* Death rates not shown in classes with less than 5 deaths.

† Exposure is terminated on discontinuance of extra premium.

‡ Excludes experience of one company which was unable to subdivide less than 100 flying hours.

§ Includes all companies.

TABLE 19—Continued

Status at Issue and Exposure Period	Years of Exposure	Aviation Deaths	Rate per 1,000
300 or more hours in preceding 12 months			
1946-1959.....	9,207	39	4.2
1955-1959.....	5,245	18	3.4
1958-1959.....	2,397	8	3.3
100 or more hours in preceding 12 months			
1946-1959.....	53,810	178	3.3
1949-1959.....	51,180	167	3.3
1952-1959.....	42,120	131	3.1
1955-1959.....	30,213	94	3.1
1958-1959.....	12,927	40	3.1
Hours in preceding 12 months not stated			
1946-1959.....	6,779	16	2.4
1949-1959.....	5,156	12	2.3
1952-1959.....	4,620	11	2.4
1955-1959.....	3,158	5	1.6
1958-1959.....	1,265	3	*

TABLE 20

INTERCOMPANY EXPERIENCE ON MILITARY PILOTS AND CREW MEMBERS ISSUED WITH AVIATION EXTRA PREMIUM†
Deaths in Combat Missions Included, Whether or Not Resulting from Enemy Action‡

STATUS AT ISSUE AND YEARS OF ISSUE	ATTAINED INSURANCE AGE AT BEGINNING OF CALENDAR YEAR OF EXPOSURE, AND SOLO HOURS AT ISSUE	EXPOSURE 1953-1959‡			EXPOSURE 1956-1959		
		Years of Exposure	Aviation Deaths	Rate per 1,000	Years of Exposure	Aviation Deaths	Rate per 1,000
U.S. Air Force or Army rated pilots on full-time duty							
Issues of 1946-1959.....	{ Under 25						
	800+hours	1,137	5	4.4	968	4	*
	Others	1,889	7(1)	3.7[3.2]	1,556	5	3.2
	{ 25-29						
Issues of 1953-1959	800+hours	12,212	61	5.0	8,508	39	4.6
	Others	5,978	26	4.3	4,179	17	4.1
	30-34	54,532	182(1)	3.3[3.3]	28,384	88	3.1
	35 and over	110,384	322(4)	2.9[2.9]	85,100	235	2.8
40-150 hours in 12 months preceding issue.....	{ 30-34	9,281	17	1.8	Not Available		
	35 and over	20,581	59	2.9	Not Available		
Over 150 hours in 12 months preceding issue.....	{ 30-34	17,983	68	3.8	Not Available		
	35 and over	23,426	82	3.5	Not Available		

* Death rates not shown in classes with less than 5 deaths.

† Exposure is terminated on discontinuance of extra premium.

‡ Figures in parentheses indicate included deaths from enemy action. Figures in brackets indicate aviation death rates with deaths from enemy action excluded.

§ For classes covering issues of 1946-1959 exposure period begins July 1, 1953.

Includes Marine Corps but not Coast Guard.

TABLE 20— *Continued*

STATUS AT ISSUE AND YEARS OF ISSUE	ATTAINED INSURANCE AGE AT BEGINNING OF CALENDAR YEAR OF EXPOSURE, AND SOLO HOURS AT ISSUE	EXPOSURE 1953-1959‡			EXPOSURE 1956-1959		
		Years of Exposure	Aviation Deaths	Rate per 1,000	Years of Exposure	Aviation Deaths	Rate per 1,000
U.S. Navy# rated pilots on full-time duty							
Issues of 1946-1959.....	{ Under 25						
	800+hours	738	10	13.6	481	8	16.6
	Others	1,378	12	8.7	1,077	9	8.4
	{ 25-29						
	800+hours	7,534	50	6.6	4,731	37	7.8
Issues of 1953-1959	Others	3,924	45	11.5	2,707	35	12.9
	{ 30-34	28,133	160	5.7	15,394	81	5.3
	{ 35 and over	45,305	156	3.4	34,887	115	3.3
40-150 hours in 12 months preceding issue.....	{ 30-34	3,976	24	6.0	Not Available		
	{ 35 and over	7,483	25	3.3	Not Available		
Over 150 hours in 12 months preceding issue.....	{ 30-34	8,088	61	7.5	Not Available		
	{ 35 and over	8,605	39	4.5	Not Available		
U.S. Air Force or Army crew members							
Issues of 1946-1959.....	{ Under 25	6,825	17	2.5	Not Available		
	25-29	11,651	42(1)	3.6[3.5]	Not Available		
	30-34	12,699	40	3.1	Not Available		
	35 and over	20,031	62	3.1	Not Available		
	All Ages	51,206	161(1)	3.1[3.1]	Not Available		

to be lower than those for all Army or Air Force pilots shown in Tables 6 and 12. Similarly, intercompany experience on Naval aviators continues to be better than for the Navy as a whole, except at ages 35 and over.

Table 21 presents the experience on policies issued at standard premium rates or on policies where the extra premium has been removed. The addition of another year's experience has produced a marked increase in the fatality rates, although the number of deaths is still rather small.

TABLE 21
INTERCOMPANY EXPERIENCE ON PILOTS APPARENTLY
ACTIVE AT TIME OF ISSUE—INSURED AT STANDARD RATES†
Issues since 1955‡ exposed to December 31, 1959

	Years of Exposure	Aviation Deaths	Rate per 1,000
Employed as scheduled airline pilot . . .	9,163	16	1.7
Having commercial or transport certificate but flying only for pleasure or personal business (not for hire), or having private certificate and 100 or more solo hours (or solo hours not stated)	24,544	27	1.1
Others having commercial or transport certificate and employed as nonairline pilot (exposed 1955-1959)	1,104	3	*

* Death rates not shown in classes with less than 5 deaths.

† Issued standard or reduced to standard because of a liberalization in companies' underwriting rules.

‡ Some earlier issues may be included.