

**TRANSACTIONS OF SOCIETY OF ACTUARIES  
1956 REPORTS**

**REPORT OF THE COMMITTEE ON AVIATION**

**AVIATION STATISTICS**

**T**HIS report is confined to a brief summary of such new 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 FLYING

*United States*

Table 1 shows the recent trend of fatality rates on United States scheduled airlines. Since pilots engaged in scheduled flying are limited by government regulations to a maximum of 1,000 hours a year, the death rates per 1,000 hours form an upper limit to the annual death rate of pilots

TABLE 1  
UNITED STATES SCHEDULED AIRLINES AVIATION DEATHS

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				
1955 . . . . .	.0020*	.0024*	.0022*	.0018*
1948-51 . . . . .	.0023	.0027	.0022	.0021
1949-52 . . . . .	.0018	.0024	.0020	.0016
1950-53 . . . . .	.0015	.0022	.0020	.0015
1951-54 . . . . .	.0010	.0018	.0017	.0011
1952-55 . . . . .	.0010*	.0016*	.0015*	.0010*
International				
1955 . . . . .	.0001	.0000	.0005	.0017
1948-51 . . . . .	.0023	.0016	.0019	.0028
1949-52 . . . . .	.0037	.0016	.0013	.0027
1950-53 . . . . .	.0033	.0017	.0013	.0027
1951-54 . . . . .	.0022	.0011	.0009	.0019
1952-55 . . . . .	.0015	.0005	.0007	.0015
Total				
1955 . . . . .	.0017*	.0020*	.0019*	.0018*
1948-51 . . . . .	.0023	.0025	.0021	.0024
1949-52 . . . . .	.0021	.0023	.0018	.0019
1950-53 . . . . .	.0018	.0021	.0019	.0019
1951-54 . . . . .	.0012	.0017	.0015	.0013
1952-55 . . . . .	.0011*	.0014*	.0014*	.0011*

\* Includes deaths caused by a bomb placed in an airplane.

engaged full time in such flying. The columns headed "Death Rate of All Pilots Employed in Scheduled Flying" and "Death Rate of Other Crew Members Employed in Scheduled Flying" include, on the one hand, those who do less than the normal amount of flying on account of having some supervisory duties or for some other reasons, and include, on the other hand, 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. The difference in recent years is not great.

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

Period	Airlines of Countries Other Than U.S. Reporting to I.A.T.A.	All U.S. Airlines
1954.....	.0056	.0002
1955.....	.0026*	.0017*
1948-51.....	.0078	.0023
1949-52.....	.0058	.0021
1950-53.....	.0046	.0018
1951-54.....	.0046	.0012
1952-55.....	.0040*	.0011*

\* The 1955 figures become .0016 and .0013, and the 1952-1955 figures become .0037 and .0010, if deaths caused by deliberate human intent—sabotage or attack—including the accident on November 1, 1955, at Longmont, Colorado, caused by a bomb which had been placed in the airplane, are omitted.

As was suggested in *TSA 1955 Reports*, 25, the very favorable experience of 1954 now appears to have been a fluctuation. Nevertheless the average rate for the period 1952-1955 was lower than for 1951-1954 on each of the bases shown.

*Outside of United States*

The International Air Transport Association has furnished to the Committee the experience of most of its member companies. By deducting the included experience of United States scheduled airlines and making reasonable assumption as to average speed in the years for which it was not specifically given, the passenger fatality rates per 1,000 hours shown in Table 2 were derived and compared with the rates from Table 1

for all flying of United States scheduled airlines (whether or not they are members of the International Air Transport Association).

The International Air Transport Association does not give out the number of deaths for individual airlines or countries. However, from a publication *Accident Trends of Individual Airlines*, compiled by Aviation Studies (International), Ltd., London, England, the Committee has been able to derive passenger death rates per 1,000 passenger hours for various countries or groups of countries, as shown in Table 3. These figures bring

TABLE 3  
SCHEDULED AIRLINES BY COUNTRIES OR GROUPS OF COUNTRIES  
PASSENGER AVIATION DEATH RATES PER 1,000 PASSENGER HOURS  
1950-1955

Airlines	Passenger Miles (millions)	Passenger Deaths	Passenger Death Rate per 1,000 Passenger Hours†
United States*	105,875	758	.0015
Canadian	4,930	63	.0022
United Kingdom	7,557	207	.0048
Other European	20,066	568	.0050
All Other	17,276	511	.0052

\* CAA figures.

† Based on an average speed of 175 miles per hour.

out no important differences between countries outside the United States and Canada.

#### NONSCHEDULED ("IRREGULAR") CARRIER FLYING

The figures in Table 4 for "large" irregular air carriers—those operating aircraft of more than 12,500 pounds gross weight—are based on reports of their mileage to the Civil Aeronautics Board, and the assumption of an average speed of 200 miles per hour from take-off to landing. For the years 1953-1955 the Committee was able to study figures divided between the public services of these carriers and the contract services furnished to the armed forces. The differences in death rates between the two kinds of service do not appear significant.

Beginning with 1956 most but not all of these carriers were admitted to a new classification called "supplemental air carriers," with extended privileges, including unlimited domestic passenger and cargo charter operations and maximum of ten scheduled flights a month in one direction between any pair of points, but with only cargo operations permitted in

international flying. These rules apply only to the public services of these carriers, their military contract services not being under the jurisdiction of the Civil Aeronautics Board.

OTHER NONSCHEDULED FLYING

Table 5 shows fatality rates of first pilots per 1,000 airplane hours by kind of nonscheduled civil flying. Certain nonscheduled air carriers are excluded, as shown in a footnote to the table.

The exposure is an estimate of airplane hours by the Civil Aeronautics Administration, based on a sampling survey of aircraft owners. There may

TABLE 4  
NONSCHEDULED CARRIERS OPERATING AIRCRAFT OF  
MORE THAN 12,500 POUNDS GROSS WEIGHT\*

Period	Passenger Deaths	Rate per 1,000 Passenger Hours	First Pilot Deaths	Rate per 1,000 Airplane Hours
1954.....	9	.001	1	.006
1955.....	27	.004	2	.010
1948-51.....	301	.021	15	.023
1949-52.....	237	.013	11	.014
1950-53.....	274	.013	11	.012
1951-54.....	254	.011	11	.012
1952-55.....	203	.008	10	.012

\* Nonpassenger operations excluded in 1953.

be a tendency to understatement of the use of individual aircraft, with consequent overstatement of the death rates. On the other hand, it is likely that some of the deaths listed under "All Other" should have been thrown into one of the specific classes. The classes "Noncommercial Business—Other" and "Pleasure" probably overlap, and some of the exposure shown in the former perhaps belongs in the latter. The chief value of the table lies in showing *relative* rates for the various classes.

The table indicates a general, although irregular, improvement in death rates over the period covered.

With perhaps the exceptions of crop control and instruction, it is probable that the kinds of flying listed are far from homogeneous, and the death rates shown merely represent average conditions within each class.

The class of noncommercial business flying covers all flying in connection with the business of the owner of the aircraft except where the flight

TABLE 5—NONSCHEDULED FLYING BY KINDS—FIRST PILOT AVIATION DEATH RATE PER 1,000 HOURS

PERIOD	COMMERCIAL (EXCLUDING INSTRUCTION† AND MISCELLANEOUS‡)														
	Crop Control			Patrol, Survey, and Other Industrial			Passenger and Cargo			All Other			Total		
	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate
1954.....	672	40	.06	573	15	.03	509	11	.02	47	17	.36	1,801	83	.05
1947-49, 1951.....													5,158	385	.07
1948-49, 1951-52.....													5,663	405	.07
1949, 1951-53.....	2,564	182	.07										6,263	396	.06
1951-54.....	2,786	186	.07	1,484	38	.03	1,867	39	.02	547	127	.23	6,684	390	.06

  

PERIOD	NONCOMMERCIAL BUSINESS									PLEASURE			INSTRUCTION		
	Company-Owned§			Other			Total								
	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate	Hours*	Aviation Deaths	Rate
1954.....	2,425	15	.006	1,450	19	.013	3,875	34	.009	1,920	172	.09	1,292	57	.044
1947-49, 1951†.....							10,107	237	.023	9,834	1,308	.13	25,143	568	.023
1948-49, 1951-52†.....							11,265	208	.018	8,847	1,078	.12	16,293	364	.022
1949, 1951-53†.....							12,315	172	.014	8,087	841	.10	8,840	226	.026
1951-54.....							13,575	151	.011	7,275	727	.10	5,945	197	.033
1952-54.....	6,214	42	.007	4,411	80	.018	10,625	122	.011	5,395	520	.10	4,043	141	.035

\* 000 omitted.

† Excluding all "irregular" carriers in 1947 and "large irregular" carriers (those operating aircraft of more than 12,500 pounds gross weight) in other years.

‡ No figures available for 1950.

§ Companies, corporations, partnerships, and governments.

is made for hire. The subdivision of company-owned aircraft includes both flight in aircraft piloted by a professional pilot employed for the purpose, and flight in aircraft piloted by an officer, employee, or other person having other primary duties.

Application of the figures in Table 5 depends upon the average annual hours of the individual pilot under consideration, and whether he engages in more than one kind of flying. However, recent reports of the Civil Aeronautics Administration, based respectively on 1953 and 1954 flying, classify aircraft according to their principal use, and in some of these principal uses there is reason to believe that the number of pilots engaged mainly in the kind of flying in question does not differ materially from the number of aircraft engaged mainly in that kind of flying. This is particularly true of agricultural flying, where another CAA survey shows that the number of pilots taking part in each of several activities within that kind of flying closely approximated the number of aircraft taking part in those activities. It also seems reasonable to assume that the number of pilots whose principal flying is as pilot of aircraft used principally for business purposes will approximate the number of such aircraft. While undoubtedly there were some deaths in the course of other flying in aircraft whose major use was one of these kinds, nevertheless the percentages of flying which was in the major usage were respectively 95% and 92% in 1953 in these two classes. For these classes of flying the Committee has computed fatality rates per 1,000 life years of exposure according to two methods which are described in detail in *TSA 1955 Reports*, 26. The results of the two sets of rates are in fairly close agreement. For the period 1953-1954 the pilot aviation death rates thus derived are about 10.5 per 1,000 life years of exposure for crop control and 1.6 for noncommercial business or personal transportation in company-owned aircraft.

#### UNITED STATES AIR FORCE

##### *Duty Assignment*

Pilot death rates per 1,000 life years of exposure classified according to duty assignment have been furnished to the Committee for 1954 and for 1953-1954 combined. These correspond to the figures for 1951 to 1953 shown in *TSA 1955 Reports*, 30. The present figures do not distinguish between jet and nonjet fighters or between jet and nonjet bombers. It is understood that conversion of fighter units to jet planes was largely completed by 1954, but that that of bomber units was less nearly complete. The death rates are as shown in Table 6.

The classification "All Other" includes the so-called proficiency pilots, whose primary duty is in some capacity other than as pilot—*e.g.*, adminis-



tration—but who do a minimum amount of flying to maintain proficiency and qualify for flight pay. Included among these are officers with a pilot rating who have received special engineering training at the Air Force Institute of Technology or at selected colleges and then are assigned to the Air Materiel Command or the Research and Development Command with engineering duties. These pilots not only carry on the required proficiency flying in addition to their engineering duties but are required to serve in a squadron at least every six years for a period of one year to acquire proficiency in the newer first line airplanes.

TABLE 6  
AVIATION DEATH RATES BY DUTY ASSIGNMENT  
UNITED STATES AIR FORCE ON ACTIVE DUTY

DUTY ASSIGNMENT	DEATH RATE PER 1,000 LIFE YEARS OF EXPOSURE		
	1954	1953-1954	1951-1954
Pilot, Helicopter.....	19.0	19.4	17.9
Pilot, Amphibian.....	3.1*	9.0	6.7
Pilot, Transport.....	1.7	2.1	3.0 <sup>+</sup>
Pilot, Troop Carrier.....	12.0	9.1	11.1 <sup>‡</sup>
Pilot, Fighter.....	26.0	27.2	27.4
Pilot, Bomber.....	6.3	6.5	7.6
Pilot, Reconnaissance.....	7.2	8.3	7.3
Pilot, AOB†.....	4.3	7.9	11.0
Operations Officer.....	1.8	2.9	3.9
All Other.....	3.4	2.9	4.0

\* Based on less than 5 deaths.

† Pilot qualified also as a bombardier and a radar observer.

‡ July 1952—December 1954.

#### *Military Air Transport Service*

Aviation death rates of flying personnel of the MATS per 1,000 life years of exposure have been obtained as shown in Table 7.

#### *Duty Assignment and Specialty*

The Committee has made some interesting deductions from two Air Force reports entitled, respectively, "Studies of Aircraft Accident Causation Utilizing the Index of Accident Exposure" and "Age and Experience in Relation to Aircraft Accidents." One section of the former report studies the differences in accident rates for the period August to November, 1952, among four classes of pilots. Certain figures relative to these four classes which have been derived from the report are shown in Table 8.

Duty assignment refers to the officer's primary duty at the time of ob-

servation while specialty refers to the assignment for which he is best qualified and which presumably he fills during the major part of his career, although he may from time to time be given a duty assignment as pilot. Those with current duty assignment as nonpilot are officers who are currently flying only to maintain proficiency. Those whose specialty

TABLE 7  
MILITARY AIR TRANSPORT SERVICE

PERIOD	AVIATION DEATH RATE PER 1,000 LIFE YEARS OF EXPOSURE	
	Pilots	Other Crew
July 1, 1954—June 30, 1956		
Transports units.....	3.7	5.2
Other units.....	2.4	2.1
Total.....	2.7	3.2
July 1, 1953—June 30, 1956		
Total.....	2.7	3.0

TABLE 8  
UNITED STATES AIR FORCE  
ACCIDENT RATES BY DUTY ASSIGNMENT AND SPECIALTY

Duty Assignment	Specialty	Average Hours per Pilot per 4 Months	Accident Rate per 1,000 Pilots per 4 Months
Pilot	Pilot	104	31
Pilot	Nonpilot	82	15
Nonpilot	Pilot	51	22
Nonpilot	Nonpilot	44	12
Pilot	All	.....	29
Nonpilot	All	.....	15
All	Pilot	.....	29
All	Nonpilot	.....	12
All	All	.....	22

is other than pilot include what are commonly spoken of as proficiency fliers. At a given time a small proportion of them may have duty assignment as pilot but most of the time they have a nonpilot assignment and flying is only incidental to the duties of their specialty. At the time of this study about 40% of all pilots had a nonpilot specialty.

The accident rates for officers with specialty as pilot and for those with specialty as nonpilot may reflect the average hazard of such pilots, taking into account the periods when they have a duty assignment as pilot as well as the periods when they are assigned to their specialty. It is interesting to note that the accident rate among those with pilot specialty is about one-third greater than the average of all pilots, while that for those with a nonpilot specialty is only 55% of the average rate. The Committee has no information whether fatality rates would be in the same ratio.

As between the two most important classes, those with duty and specialty as pilot and those with duty and specialty as nonpilot, the table shows that the respective accident rates are roughly proportionate to the amount of flying.

TABLE 9  
INDEX OF ACCIDENT EXPOSURE

Aircraft Group	Condition	Weight
Group I. (Fighters and Jet Bombers)	Hours of Day Contact Flying	10
	Hours of Night Contact Flying	15
	Hours of Instrument Flying	30
	Number of Landings	5
Group II. (All models not in Groups I or III)	Hours of Day Contact Flying	4
	Hours of Night Contact Flying	4
	Hours of Instrument Flying	12
	Number of Landings	1.5
Group III. B-25 C-74 T-28 C-47 C-97 T-29 C-54 C-121	Hours of Day Contact Flying	1
	Hours of Night Contact Flying	1
	Hours of Instrument Flying	5
	Number of Landings	1

In a further comparison of these two classes the report indicates that those with duty and specialty as nonpilot exceed those with duty and specialty as pilot by about three years in both age and length of time since receiving pilot rating. Both groups had at the time of study about the same average total flying hours. The average hours per year since becoming a pilot exceeds the current annual average for those with duty and specialty as nonpilot, and is lower than for those with duty and specialty as pilot. This suggests that there has been some interchange of duty assignments from time to time.

The report also compares the actual number of accidents in each of the four classes with "expected" accidents based on the Index of Accident Exposure. The index is a series of weights based on aircraft flown, flying conditions, and relation between hours and number of landings, as shown in Table 9.

When this index is applied to the various classes of pilots to obtain their "expected" accidents, the ratio of actual to "expected" is about 60% greater for those with duty and specialty as nonpilot than for those with duty and specialty as pilot. In other words, if the former class were flying under the same average conditions as the latter, their accident rate per hour would be 60% greater, presumably as a result of lower proficiency. Since the observed accident rates per hour were about equal, as stated above, it appears that the greater exposure to the more hazardous types of aircraft on the part of the officers with duty and specialty as pilot closely offsets the reduced proficiency of those with duty and specialty as nonpilot.

TABLE 10  
 PROPORTION OF PILOTS FLYING, AND AVERAGE FIRST PILOT HOURS,  
 IN EACH TYPE OF AIRCRAFT  
 BY AGE GROUP

AIRCRAFT TYPE	AGE GROUP, AND PROPORTION OF TOTAL PILOTS					
	21-29 47.3%		30-39 49.3%		40-60 3.4%	
	A*	B†	A*	B†	A*	B†
Bomber.....	48.8%	34	57.9%	25	61.7%	16
Cargo.....	73.0	34	86.3	30	93.0	26
Fighter.....	26.8	61	16.1	33	7.0	9
Trainer.....	44.3	18	32.4	14	17.4	10
Other.....	7.1	22	6.8	17	7.0	6
All Types.....	67		51		36	

\* A: Proportion of pilots in this age group who did some flying in the aircraft type indicated.

† B: Average first pilot hours in this aircraft type.

*Type of Aircraft*

The study "Age and Experience in Relation to Aircraft Accidents" yields some interesting information about flying in different types of Air Force aircraft during the period July to December, 1950. Table 10 shows by age group the proportion of pilots who did some flying in each type of aircraft, and the average first pilot hours in each type.

It is seen that in this period and in each age group the average number of types flown per pilot was close to 2. In each age group the proportion of pilots who did some flying in cargo planes was very high. These two facts together suggest that most pilots who did some flying in cargo planes also flew in some other type.

In the age group under 30 the high average hours per pilot in fighter aircraft, and the fact that it was close to the average hours per pilot in this age group in all aircraft, suggests that the younger pilots who flew in fighter planes flew them almost exclusively.

In the higher age groups, however, the smaller average hours per pilot in fighter planes suggests that some, at least, of this flying was done by proficiency pilots.

Table 11, derived from the same study, shows by age group the average number of accidents in all aircraft in this 6-month period per 100,000 hours, and per 1,000 pilots; and the average number of accidents in fighter

TABLE 11  
ACCIDENT RATE PER SIX MONTHS, FOR FLYING IN ALL  
AIRCRAFT AND IN FIGHTER AIRCRAFT

Age Group	Type of Aircraft	Accidents per 100,000 Hours Flown in Such Aircraft	Accident Rates in Such Aircraft per 1,000 Pilots Doing Some Flying in Such Aircraft
21-24.....	All	76	80
	Fighter	183	147
25-29.....	All	46	28
	Fighter	96	54
30-39.....	All	39	20
	Fighter	136	45
40 and over...	All	36	13
	Fighter	133	13

aircraft<sup>r</sup> per 100,000 hours flown in such aircraft and per 1,000 pilots who did some flying in fighter planes. The last mentioned rate is, of course, not the entire accident rate of the pilots concerned, to the extent that they did some flying in other types of aircraft.

One striking fact in this table is that pilots in the age group 30-39 who do some flying in fighter planes have an accident rate in those planes alone over twice as great as the average rate for all pilots of that age group in all planes. The rate is also nearly as great as the accident rate in fighter planes per 1,000 pilots aged 25 to 29 who do some fighter flying. This suggests that for those pilots in the age group 30-39 who do some flying in fighter aircraft the accident rate, even if not all of their flying is in fighter planes, is considerably higher than for other pilots of the same age.

Another part of this second study yields accident rates per 100,000 airplane hours by age of the pilot, and similar rates adjusted to allow for differences in hazard of the plane types flown, by a process somewhat similar to the Index of Accident Exposure. The figures shown in Table 12 suggest that, except for the extreme age groups, age by itself has little influence on accident rates and that the type of aircraft flown is a much more important factor in producing differences in accident and fatality rates by age.

TABLE 12  
 UNITED STATES AIR FORCE AND  
 AIR NATIONAL GUARD  
 CONVENTIONAL AND ADJUSTED ACCI-  
 DENT RATES BY AGE GROUP  
 July to December, 1950

AGE GROUP OF FIRST PILOTS	ACCIDENT RATE PER 100,000 AIRPLANE HOURS	
	Actual	Adjusted*
21.....	120	76
22-23.....	75	44
24-25.....	63	59
26-27.....	48	42
28-29.....	45	47
30-31.....	43	52
32-34.....	45	48
35-39.....	22	29
40 and over.....	36	68

\* By multiplying the number of accidents by the ratio of the average accident rate in all plane types to the average accident rate in the respective plane types flown.

UNITED STATES NAVY

(Includes Marine Corps unless otherwise stated)

*Pilots by Age*

Table 13 shows fatality rates by age group for various periods, for all naval aviators (officers) on active duty.

It may be interesting to note that the fatality rate for all naval aviators aged 40 and over was 1.4 per 1,000 for 1947-1955 and 1.7 per 1,000 for 1951-1955.

In recent years the fatality rates in the age group 30-34 have been consistently higher than those for Air Force pilots of the same age group.

*Pilots by Rank*

Table 14 shows fatality rates for 1955 by rank.

*Student Pilots*

Fatality rates of student naval aviators are shown in Table 15 for various periods. The rate in advanced training, which had been increasing from a low point reached in 1952, leveled off in 1955. It is possible that

TABLE 13  
UNITED STATES NAVY ON ACTIVE DUTY BY AGE  
ALL NAVAL AVIATORS (OFFICERS)  
Deaths Due to Enemy Action Excluded—Other Deaths  
in Combat Missions Included

AGE GROUP	AVIATION DEATH RATES PER 1,000 LIFE YEARS OF EXPOSURE			
	1953	1954	1955	1952-1955
Under 25 . . . . .	41.7	27.9	26.8	30.4
25-29 . . . . .	9.0	13.0	13.5	12.0
30-34 . . . . .	8.1	9.1	6.3	8.3
35 and over . . . . .	3.6	3.2	3.0	3.7
All . . . . .	9.8	10.9	10.4	10.5

TABLE 14  
UNITED STATES NAVY ON ACTIVE DUTY BY RANK  
ALL NAVAL AVIATORS (OFFICERS)

Rank	Aviation Death Rates per 1,000 Life Years of Exposure —1955
Ensign, 2nd Lt., Chief Warrant Officer, and War- rant Officer . . . . .	27.18
Lt. (j.g.) and 1st Lt. . . . .	16.71
Lt. (Navy) and Captain (M.C.) . . . . .	7.27
Lt. Commander and Major . . . . .	3.83
Commander, Lt. Colonel, and Higher . . . . .	3.04

the increase was associated with the increasing proportion of jet flying in that stage of training, and that the proportion has now become stabilized.

*Inactive Reservists*

For inactive reserve pilots in drill pay status the fatality rates for the period 1952-1955 were 4.6 per 1,000 life years for ages under 30 and 1.7 for ages 30 and over.

For inactive reservists not receiving drill pay, the fatality rate in 1951-1955 for those who did some flying was 0.4 per 1,000 life years of exposure. These pilots are attached to volunteer aviation companies and do not receive pay for drills performed. As a general rule the only flying done by pilots in this group occurs during their 2-week periods of annual training duty.

Some of these reservists may do other flying as civilians, and it is possible that the hazard of those reservists who do no other flying than their reserve flying may be greater than the average figures given above, in which those pilots are also included whose experience is supplemented by civilian flying.

TABLE 15  
UNITED STATES NAVY  
STUDENT NAVAL AVIATORS

STAGE OF TRAINING	AVIATION DEATH RATES PER 1,000 LIFE YEARS OF EXPOSURE			
	1953	1954	1955	1952-1955
Basic.....	6.8	6.5	3.0	5.4
Advanced.....	13.4	18.4	17.3	12.7

*Nonpilot Personnel on Flying Duty*

The fatality rate of nonpilot personnel ordered to duty involving flying was 4.1 per 1,000 life years in 1952-1955. Flight surgeons and flight nurses are not included.

*Flight Surgeons*

The fatality rate of flight surgeons ordered to duty involving flying was 1.5 per 1,000 life years in 1952-1955, based on a very small number of deaths.

*Annual Flying Time*

The average number of flight hours per pilot on active duty in 1955, including students, was 289, and that for inactive reservists who did some flying was 76.

*Graduates of Naval Academy—Assignment to Aviation*

Of the 1956 graduating class of the United States Naval Academy who were commissioned in the Navy or Air Force, 26% have been ordered to flight training or are on the waiting list for flight training in the Navy, and 13% in the Air Force. Those commissioned in the Marine Corps are not yet eligible to apply for flight training.



## COMMITTEE ON AVIATION

## UNITED STATES COAST GUARD

The figures in Table 16 have been derived from information supplied by United States Coast Guard headquarters.

TABLE 16  
UNITED STATES COAST GUARD PERSONNEL  
ON FLIGHT ORDERS  
1952-1955

Class	Life Years of Exposure	Aviation Deaths	Rate per 1,000 Life Years of Exposure
Pilots.....	1,312	8	6.1
Student Pilots.....	72	1	13.9
Observers.....	72	1	13.9
Crew Members.....	3,782	16	4.2

TABLE 17  
ROYAL CANADIAN AIR FORCE PILOTS  
AVIATION DEATH RATE PER 1,000 LIFE  
YEARS OF EXPOSURE

	Regular 1951-55	Auxiliary 1951-55
<i>Age Group</i>		
Under 25.....	21.6	25.6
25-29.....	14.4	14.8
30-39.....	8.6	17.2
40 and over.....	0	0
All.....	13.1	18.9
<i>Rank</i>		
Pilot Officer and Flight Cadet.....	10.0	25.0
Flying Officer.....	18.7	20.1
Flight Lieutenant.....	8.5	13.3
Squadron Leader.....	2.7	13.8
Wing Commander and Higher Ranks.....	2.5	18.1
All.....	13.1	18.9

## ROYAL CANADIAN AIR FORCE

Table 17 gives fatality rates for the period 1951-1955 for pilots of the RCAF and of the RCAF Auxiliary (Reserve personnel who undergo weekly training in organized squadrons). The rates are not materially different from those for 1950-1954, shown in *TSA* 1955 Reports, 33.

INTERCOMPANY EXPERIENCE

Table 18 shows the experience of thirty-two companies on certain classes of pilots and military crew members for issues since January 1, 1946, observed through December 31, 1955 (in the case of some companies through June 30, 1956). Fatality rates are omitted in classes having less than five deaths.

The experience is by policies. Classification is by status at time of application for insurance. Only policies issued standard or with aviation extra premium were studied this year. The exposures on policies issued standard in the classes studied turn out to be insufficient to yield significant results.

TABLE 18  
 INTERCOMPANY EXPERIENCE ON PILOTS AND CREW MEMBERS  
 APPARENTLY ACTIVE AT TIME OF ISSUE  
 Issued Standard or with Aviation Extra Premium  
 By Policies

CIVILIAN PILOTS						
STATUS AT ISSUE AND EXPOSURE PERIOD*	ISSUED WITH AVIATION EXTRA PREMIUM			ISSUED STANDARD		
	Years of Ex- posure	Avia- tion Deaths	Rate per 1,000	Years of Ex- posure	Avia- tion Deaths	Rate per 1,000
Employed as scheduled airline pilot				no exposure prior to 1955		
1946-55.....	27,660	58	2.1			
1949-55.....	24,730	45	1.8			
1952-55.....	16,576	25	1.5			
1955.....	4,479	14	3.1	28	0	†
Having commercial or transport certificate, employed as nonairline pilot, with indication that at least half of flying time is as instructor						
1946-55.....	5,187	26	5.0	17	0	†
1949-55.....	4,299	21	4.9			
1952-55.....	2,573	8	3.1	not analyzed by year of exposure		
1955.....	775	5	6.5			
Others having commercial or transport certificate and employed as nonairline pilot						
1946-55.....	8,176	45	5.5	14	0	†
1949-55.....	7,264	37	5.1			
1952-55.....	5,134	26	5.1	not analyzed by year of exposure		
1955.....	2,144	14	6.5			

TABLE 18—Continued

STATUS AT ISSUE AND EXPOSURE PERIOD*	ISSUED WITH AVIATION EXTRA PREMIUM			ISSUED STANDARD		
	Years of Exposure	Aviation Deaths	Rate per 1,000	Years of Exposure	Aviation Deaths	Rate per 1,000
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 hrs. in preceding 12 months						
1946-55 .....	22,954	22	1.0			
1949-55 .....	20,916	17	0.8			
1952-55 .....	14,426	13	0.9			
1955 .....	4,630	0	†			
50-99 hrs. in preceding 12 months						
1946-55 .....	14,379	25	1.7	no aviation deaths— exposures not analyzed by period		
1949-55 .....	12,969	20	1.5			
1952-55 .....	8,513	12	1.4			
1955 .....	2,613	3	†			
100-199 hrs. in preceding 12 months						
1946-55 .....	18,989	49	2.6			
1955 .....	3,972	7	1.8			
200-299 hrs. in preceding 12 months						
1946-55 .....	6,018	26	4.3			
1955 .....	1,404	6	4.3			
300 or more hrs. in preceding 12 months						
1946-55 .....	4,805	22	4.6			
1955 .....	843	1	†			
100 or more hrs. in preceding 12 months (analysis of foregoing lines)						
Issues 1946-49, exposures 1946-55	16,305	51	3.1	20	0	†
Issues 1950-55, exposures 1950-55	13,507	46	3.4	141	0	†
Issues 1946-55, exposures as follows:						
1946-55 .....	29,812	97	3.3	no aviation deaths— exposures not analyzed by period		
1949-55 .....	27,182	86	3.2			
1952-55 .....	18,122	51	2.8			
1955 .....	6,219	14	2.3			
Hours in preceding 12 months not stated:						
1946-55 .....	4,363	13	3.0	1,475	0	†
1949-55 .....	2,740	5	1.8			
1952-55 .....	2,204	8	3.6	exposures not analyzed by period		
1955 .....	742	2	†			

\* Exposures end June 30, 1956 in some companies.

† Fatality rates not shown in classes with less than 5 deaths.

TABLE 18—Continued

MILITARY PERSONNEL ON FULL TIME DUTY Deaths in Combat Missions Included, Whether or Not Resulting from Enemy Action †			
EXPOSURE PERIOD, AND ATTAINED INSURANCE AGE AT BEGINNING OF CALENDAR YEAR OF EXPOSURE	ISSUED WITH AVIATION EXTRA PREMIUM		
	Years of Exposure	Aviation Deaths	Rate per 1,000
U. S. ARMY OR AIR FORCE			
Pilots, excluding Student Pilots			
<i>Prior to July 1, 1950</i>			
Under 25			
800 or more solo hours . . . . .	820.5	11	13.4
All other . . . . .	1,091.0	20	18.3
25-29			
800 or more solo hours . . . . .	8,994.5	53	5.9
All other . . . . .	1,997.5	20	10.0
30-34 . . . . .	9,465.0	47	5.0
35 and over . . . . .	2,522.0	1	†
<i>July 1, 1950 to June 30, 1953</i>			
Under 25			
800 or more solo hours . . . . .	283.0	7 (3)	24.7 [†]
All other . . . . .	748.0	25 (11)	33.4 [18.7]
25-29			
800 or more solo hours . . . . .	9,464.1	125 (54)	13.2 [7.5]
All other . . . . .	2,510.0	40 (16)	15.9 [9.6]
30-34 . . . . .	26,366.1	181 (57)	6.9 [4.7]
35 and over . . . . .	10,419.8	48 (11)	4.6 [3.6]
<i>July 1, 1953 and Later</i>			
Under 25			
800 or more solo hours . . . . .	167.5	1	†
All other . . . . .	323.5	2 (1)	† [†]
25-29			
800 or more solo hours . . . . .	3,680.7	22	6.0
All other . . . . .	1,785.4	9	5.0
30-34 . . . . .	26,080.9	94 (1)	3.6 [3.6]
35 and over . . . . .	25,250.1	87 (4)	3.4 [3.3]
Crew Members . . . . .	24,904.8	151 (30)	6.1 [4.9]

† Fatality rates not shown in classes with less than 5 deaths.

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

TABLE 18—Continued

MILITARY PILOTS ON FULL TIME DUTY, EXCLUDING STUDENT PILOTS Deaths in Combat Missions Included, Whether or Not Resulting from Enemy Action†			
EXPOSURE PERIOD, AND ATTAINED INSURANCE AGE AT BEGINNING OF CALENDAR YEAR OF EXPOSURE	ISSUED WITH AVIATION EXTRA PREMIUM		
	Years of Exposure	Aviation Deaths	Rate per 1,000
	U.S. Navy‡		
<i>Prior to July 1, 1950</i>			
Under 25			
800 or more solo hours.....	699.0	6	8.6
All other.....	944.0	7	7.4
25-29			
800 or more solo hours.....	4,926.5	28	5.7
All other.....	1,740.1	19	10.9
30-34.....	4,137.0	21	5.1
35 and over.....	1,379.5	2	†
<i>July 1, 1950 to June 30, 1953</i>			
Under 25			
800 or more solo hours.....	352.5	6 (1)	17.0 [14.2]
All other.....	644.0	18 (8)	28.0 [15.5]
25-29			
800 or more solo hours.....	5,584.2	80 (31)	14.3 [8.8]
All other.....	1,717.0	16 (4)	9.3 [7.0]
30-34.....	11,307.1	160 (53)	14.2 [9.5]
35 and over.....	4,918.2	36 (10)	7.3 [5.3]
<i>July 1, 1953 and Later</i>			
Under 25			
800 or more solo hours.....	255.9	2	†
All other.....	300.5	3	†
25-29			
800 or more solo hours.....	2,790.2	13	4.7
All other.....	1,215.3	10	8.2
30-34.....	12,728.9	79	6.2
35 and over.....	10,416.2	41	3.9

† Fatality rates not shown in classes with less than 5 deaths.

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

§ Includes Marine Corps but not Coast Guard.

TABLE 18—Continued

MILITARY PERSONNEL ON FULL TIME DUTY			
	ISSUED WITH AVIATION EXTRA PREMIUM		
	Years of Exposure	Aviation Deaths	Rate per 1,000
	STUDENT PILOTS—FIRST POLICY YEAR ONLY		
U.S. Army or Air Force.....	557.0	9	16.3
U.S. Navy§ .....	363.0	9	24.8
	PARATROOPS AND OTHER AIRBORNE TROOPS		
U.S. Army or Air Force.....	1,939.0	1	†

† Fatality rates not shown in classes with less than 5 deaths.

§ Includes Marine Corps but not Coast Guard.

The exposure on policies issued with extra premium is terminated upon discontinuance of the extra premium. The classification of deaths of military personnel as to combat was based on the remarks on the company death cards sent to the Committee. Cards which stated “killed (or missing) in action” or similar definite statements were counted as deaths from enemy action. All others were assumed noncombat.

For the scheduled airline pilot class, tabular deaths were computed by using as the tabular death rate for each calendar year rates corresponding to those in Table 1 under the heading “Death Rate of All Pilots Employed in Scheduled Flying.” The total tabular deaths were 48, giving a ratio of actual to tabular of 121%. Excess mortality among insured lives who were scheduled airline pilots at the time of application could indicate antiselection to the extent that there are differences in hazard among such pilots (e.g., a low proportion of applications from pilots in supervisory positions) or adverse effect from subsequent transfer to more hazardous kinds of flying. The observed excess mortality, however, is not great enough to be clearly significant.

Among other professional civilian pilots, the fatality rate in the period 1952-1955 was substantially lower among those who appeared to be devoting at least half of their flying time to flying instruction at the time of application than among the others. There were only 8 deaths in the

former class, however, and over a longer period the difference in fatality rates was not significant.

As between pilots having a private certificate and 100 or more solo hours and pilots having a commercial or transport certificate but flying only for pleasure or personal business, the difference in average fatality rates was small. Consequently, Table 18 presents figures for the total of the two classes. However, for those who had flown 100 or more hours in the twelve months preceding application, the average rate was somewhat higher for the latter class, especially on issues of 1950 and later, where the respective rates were 3.0 per 1,000 and 4.7 per 1,000.

In these classes, the issues of 1946-1949 were this year studied separately from the issues of 1950 and later because of the likelihood that a greater proportion of the former applicants would have received their flying training in military service, and the possibility that this might have some effect on their subsequent flying hazard. The study did not show any significant difference, however. As a further check, tabular deaths were computed for issues of 1950 and later, for the two classes combined, by using as the tabular death rate for each group of flying hours in the twelve months preceding application the rates for the corresponding classes among the issues of 1946-1949. The total tabular deaths were 79 against actual deaths of 70, which does not appear to be a significant difference.

The figures show a steady increase in fatality rate with increase in apparent annual flying time. While the flying time in a single 12-month period is not necessarily a guide to future annual flying time, there is some significance in the fact that this relation between fatality rate and apparent annual flying time continues to appear in an experience with exposure ranging up to 10 years from issue. It should be noted, however, that for the issues of 1946-1949 the fatality rate among those flying 300 or more hours in the twelve months preceding issue, namely, 3.0 per 1,000, based on 8 deaths, was lower than for those flying 200-299 hours, namely, 5.2 per 1,000 based on 17 deaths.

There were no aviation deaths in the classes of standard issues investigated. There would have been 5.8 tabular deaths if computed on the basis of the rates observed in the respective subgroups issued with aviation extra premium.

The combined experience in the first policy year on student pilots and on pilots having a private certificate but less than 100 solo hours gave 7 deaths on 6,152 years of exposure, a rate of 1.1 per 1,000, or about the same as the rate in all policy years for pilots having a commercial or transport certificate but flying only for pleasure or personal business, or

having a private certificate and 100 or more solo hours, and having flown less than 50 hours in the twelve months preceding application.

In the military classes the rates for exposures of July 1953 and later are, in general, slightly lower than for the earlier periods, even when deaths from enemy action are excluded. In the younger age groups there is a tendency for lower fatality rates among pilots who had 800 or more solo hours at time of application, but the differences are irregular.

In recent exposure years the fatality rates of insured military pilots under age 25 have tended to be lower than those for all such pilots in the same age group.

The fatality rate of military student pilots in the first policy year has averaged a little greater than the recent fatality rates of all military student pilots.