

**REPORT OF THE COMMITTEE ON PILOT AGEING AND
ALLIED PROBLEMS**

**Twenty-Fifth Annual Meeting Of The
AERO MEDICAL ASSOCIATION**

**Hotel Statler
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The Committee on Pilot Ageing and Allied Problems was appointed by Dr. W. R. Stovall, President of the Aero Medical Association, at the Annual Meeting in Los Angeles in the Spring of 1953 and reappointed by President Bertram Groesbeck, Jr. early in 1954. The Committee has a large number of members so as to have representation from various academic disciplines, fields of study and aeronautical organizations. The names and addresses of the Committee are shown at the end of this report along with the fields of research and disciplines which they represent. Although the primary emphasis of the work of the Committee relates to the problems of ageing in civilian pilots, there has been representation from the various branches of the Armed Services. Two meetings have been held during the year, the last one on January 22, 1954, with an attendance of ten members from various parts of the country. Many informal discussions and exchange of ideas have taken place by correspondence. Each member of the Committee has indicated a specific area to which he is devoting special study, and the following report will give representative examples of the areas being covered.

The primary objectives of the Committee are as follows: (1) to compile the findings of various research studies which have both a direct and indirect bearing on the problem of pilot ageing; (2) to initiate research in this field so as to anticipate the problems which might be expected to arise in the near future; and (3) to suggest various practical procedures which might be developed to prolong the useful lives of pilots and to assist in making their eventual retirement a constructive and successful step in their careers. Possibly the most important problem to be investigated in the various aspects of the research program is to set up practical criteria for determining "when the psychological and physiological changes which are known to occur during the ageing process are no longer compensated for by skill, judgment, and experience."

One of the problems which is of interest to the Committee relates to the age distribution of civilian pilots at the present time, as well as, the changes which may be expected to occur over the next ten years. In Table I the age of airline pilots are shown for the years 1946, 1949 and 1950.

Table I - Age Distribution of Pilots in Airline Operations

Age group	First & Supervisory pilots, 1946		1946		1949		1950	
	No.	%	No.	%	No.	%	No.	%
24 and under	69	2.4	269	3.7	46	0.6	32	0.4
25-29	742	25.3	2,869	39.6	1,791	23.8	1,440	17.4
30-34	951	32.5	2,169	30.0	2,703	36.2	3,147	38.2
35-39	779	26.6	1,232	17.0	1,805	21.4	1,963	23.8
40-44	231	7.9	464	6.4	942	12.6	1,142	13.8
45-49	104	3.6	139	1.9	262	3.5	356	4.3
50 & over	53	1.8	95	1.4	139	1.9	175	2.1
Total	2,929	100.0	7,237	100.0	7,488	100.0	8,255	100.00

Source: From R. A. McFarland's Human Factors in Air Transportation - Occupational Health and Safety, pp. 373.

It is of interest to note the increasing number who are becoming 50 years of age and over. The Medical Department of the CAA is planning to bring this table up to date for the year 1954 and if possible to obtain the date of each pilot's birthday so that it will not be necessary to consult the original records each year except to locate those who have resigned or who have been disqualified.

It should be noted that airline pilots as a group differ radically from those of the total population since the majority are in the relatively younger age group. For example, the percentages shown in the table should be compared with those of employed males in the U. S. (1950 U. S. Census) of whom 50% are over 40 years of age, 37% over 45, and 28% over 50.

In Table II the estimated number of active pilots age 60 or older are shown in relation to the total number in each of the following classes: (1) student and private; (2) commercial; and (3) air transport as of September, 1953. Almost 1% of those holding student and private licenses are 60 years of age or older. One of the objectives of the Committee is to set up procedures to study the various problems of a psychological and medical nature which will be experienced by all classes of pilots especially those in the field of air transportation. Based upon such information, it might be possible to set up precautionary safety measures and to aid in the transition from one type of employment to another.

Table II - Estimated Number of Active Pilots Aged 60 or Older

Class of Pilot	No. of Active Pilots as of 7/1/52 (Gen. Safety Div.)	% Aged 60 or Older (Master Sample)	Number Aged 60 or More
Student & Private	230,347	0.85	1958
Commercial	71,435	0.14	100
Air Transport	9,387	0.22	21

Source: Biometrics Branch, Medical Division, CAA, Sept. 14, 1953.

An attempt is being made to compile a selected bibliography in the field of pilot ageing. One of the major reference sources in the general field of ageing has been arranged by Dr. Nathan W. Shock (A Classified Bibliography of Gerontology and Geriatrics. Stanford University Press, 1951). The various areas listed in this bibliography are kept up to date by Dr. Shock in each issue of the Journal of Gerontology. An extensive survey of the psychological literature has been brought together by Dr. Wayne Dennis, of the American Institute of Research, for the School of Aviation Medicine, Randolph Field, Texas, Project No. 21-0202-0005, Report No. 1, under the title "Age and Behavior." A subsequent study has been reported in this series (Report No. 3) from the School of Aviation Medicine entitled "Age and Behavior - A Study of the Effects of Aging on Aircrew Performance." (See also "Aging in Air Force Pilots" by W. R. Miles and B. M. Shriver, Journal of Gerontology, Vol. 8, No. 2, April, 1953) A specialized treatment of the

problems of air transport pilots may be found in Chapter 8 in a recent book by R. A. McFarland entitled Human Factors in Air Transportation-Occupational Health and Safety. A series of case studies involving problem medical cases among older pilots may be found in Chapter 5 of the above-mentioned book.

Extensive visual and ophthalmological measurements were made on 261 naval aviators ranging in age from 20 to 30 years by Dr. H. A. Imus. (See *Journal of Aviation Medicine*, 19, No. 2, April, 1948.) In collaboration with Dr. Richard Trumbull of the Office of Naval Research, Dr. Imus has recently made a further statistical analysis of these data. It was found that only one of the large number of visual tests used showed a significant correlation with age. This related to range of accommodation which gave a coefficient of correlation of 0.50 ± 0.05 , a value well above the one percent level of confidence. It is probable that this correlation would have been much higher if the sample had included a greater range of age. There is general agreement among the members of the Committee that a wide range of data on individual psychological and physiological tests should be tabulated for a representative sample of civilian and military pilots. Once reliable data on normal subjects have been collected it may be possible to establish useful reference points for the study of individual problem cases.

A study is being undertaken at the Harvard School of Public Health on changes with age in the light sensitivity at medium levels of illumination by Dr. M. Bruce Fisher, who is on sabbatical leave from Fresno State College. The visual function being studied is the flicker-fusion threshold as influenced by changes in the light-dark ratio. The development of a measure of one kind of "visual age" is a major objective of the investigation. If such a measure were found and could be standardized it could be applied in the assessment of aviators and of other "normal" groups, and might be of value in some clinical diagnostic situations as well.

The Committee has expressed great interest in the possibility of using the Dehmel Flight Simulator as a possible method of checking the abilities of pilots in the older age range. Such devices are being used by the United Air Lines (DC-6-B American Airlines (DC-7) and Pan American World Airways (DC-6-B and Boeing 377). These electronic devices are designed so that any flight problem can be simulated under very realistic conditions. These trainers reproduce the exact cockpit instrumentation and include motion and sound effects. It is obvious that any procedures which can be developed to appraise pilot ability on a more objective basis, both on the ground and in flight, will contribute to flight safety and to a more precise appraisal of changes involved in the ageing process.

The respiratory and metabolic aspects of pilot ageing are being studied by Dr. F. A. Hitchcock. The following tests are considered to be of possible significance in the evaluation of physiological age: (1) vital capacity; (2) timed vital capacity; (3) maximum breathing capacity; (4) residual volume. As an example of the application of such tests to age, Dr. Hitchcock believes that the formula for predicting maximum breathing capacity, as suggested by Motley and

Tomashefski, might be of considerable interest. For man this formula is $(97 - \frac{\text{age}}{2}) \times \text{BSA}$ in square meters. This equals the maximal breathing capacity and if one determined experimentally the maximum breathing capacity this formula might be used for determining physiological or at least respiratory age. The changes in the lungs that might be expected to occur with ageing are pulmonary emphysema and fibrosis with loss of elasticity and diffusing capacity. The above pulmonary function tests might give a measure of the degree to which these degenerative changes have taken place. Dr. Riley of the Johns Hopkins University is studying the diffusing capacity of the lungs in relation to age.

Attempts are being made to obtain more reliable information in regard to the psychiatric problems of older pilots through the assistance of Dr. Douglas D. Bond and other physicians who have had psychiatric training as well as experience with pilots. The paper which was read by Dr. John D. Moriarty on the "Psychiatric Problems of Ageing, With Reference to Aviation Medicine" at the last Annual Meeting of the Aero Medical Association in Los Angeles will be published in the near future. In this paper Dr. Moriarty brought out the importance of considering not only the chronological, physical, and mental ages of the pilots but also their emotional age. A number of cases were reported to illustrate this point of view.

In the field of cardiovascular disorders, follow-up studies of older airline pilots through a period of years should aid in determining not only the significance of minor abnormalities but also the influence of increasing age on the ECG. Such a study of 328 airmen aged 35 yr and over is being made by Mathewson and Sellers in the RCAF. A positive association between increasing age and the incidence of left axis deviation and low amplitude T-waves in lead I has been observed. (see "Electrocardiograms of Older Pilots." Journal of Aviation Medicine 17(3):207, 1946.) Similar follow-up studies are being made of the electrocardiograph changes in pilots by Captain Ashton Graybiel at Pensacola and by several members of the Committee who have examined air transport pilots at regular intervals, i. e., Dr. Dowd of Trans-Canada Airlines, Dr. Kidera of United Air Lines, Dr. Lederer of Capital Airlines, and Dr. Tillisch of Northwest Airlines. An extensive investigation is being carried out by Dr. John Smith of the CAA on cardiovascular changes with age by means of the ballistocardiographic technique.

A great deal of valuable information relating to ageing can be obtained from the medical records which have been collected on air transport pilots by the Medical Departments of the operating airlines. Since these examinations are repeated at regular intervals it should be possible to determine (1) what items appear to be most significant in relation to ageing; (2) what range of variation on any item might be considered within normal limits; and (3) what amounts of deviation might appear to be significant for the safe performance of a pilot's duties.

The Committee will welcome suggestions from the various members of the Aero Medical Association in regard to the best method of improving the effectiveness of the work of this research program.

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