The Cambridge Club

ORGANIZED IN 1879
REORGANIZED IN 1881

Cambridge, Mass., February 1, 1973

Mar 19 Apr 23

The February meeting of The Cambridge Club will be held on Monday, **FEBRUARY 12, 1973,** at the HARVARD FACULTY CLUB. Cocktails will be served at 6:00 P.M. and dinner will begin at 6:45 P.M.

ROSS A. McFARLAND
will speak on
"The Impact of the Space Program on American Industry and Modern Life"

Ross A. McFarland, Guggenheim Professor of Aerospace Health and Safety, Emeritus, graduated from Michigan (BA) and Harvard University (PhD). He began his experiments on the effects of high altitude on RAF pilots at Cambridge University in 1928-30, and continued extensive investigations on high altitude as related to pilots and passengers at Columbia University. The first regulations of the Bureau of Air Commerce concerning the use of oxygen at high altitude were based on these studies.

During 1935 he was a member of the Harvard Fatigue Laboratory expedition in the Chilean Andes, where studies were made on men and animals during fairly prolonged periods of acclimatization up to 21,000 feet altitude. In 1936-37 he gave tests which resulted in the most definitive establishment of the effects of altitude on pilots during the opening of the air routes over the Pacific and later the Atlantic Oceans. His laboratory studies were continued through the years as a member of the Harvard Fatigue Laboratory.

During the past 15 years Professor McFarland has held the Guggenheim Chair of Aerospace Health and Safety at the Harvard School of Public Health. He has helped to train more than 200 physicians and engineers. Many of them have assisted in the medical aspects of the space program, and others are employed in various aircraft manufacturing and air transport companies and research institutions.

Among his many honors are the John Jeffries Award of the AIAA and the Godfrey L. Cabot Award of the Aero Club of New England for significant contributions to aviation through medical research. In 1969 he received the Exceptional Service Award of the U. S. Air Force for "his unique contribution to the United States Air Force during the period 1937 through 1969 in aerospace health and safety, and related fields of human factors engineering". He was one of the founders of the Human Factors Society, and last year he served as its President.

In accordance with the by-laws, four proposals for Membership are enclosed.

W. L. Payson, Jr.
Secretary

HE BOSTON HERALD AMERICAN, MONDAY, NOVEMBER 8, 1976

OBITUARIES

Dr. Ross McFarland former professor

Services are being planned for Dr. Ross A. McFarland, 75, of Cambridge, retired Harvard professor and noted expert on the health and safety aspects of aviation and highway transportation.

He died Saturday at his summer home in Dublin, N.H.

Born in Denver, Colo., he was graduated from the University of Michigan in 1923 and received his doctorate at Harvard in 1928.

He also received honorary degrees from Trinity College, Cambridge, England, and Yale.

Dr. McFarland served as an instructor of psychology at Columbia University from 1928 to 1937, and professor of environmental health and safety at Harvard from 1957 until 1972.

In 1962, he was named Daniel and Florence Guggenheim Professor of Aerospace and Health and Safety at Harvard.

From 1963 to 1966, he was employed as an adviser by the National Aviation and Space Administration (NASA) and also served as an adviser to the U.S. National Health Survey.

He was the author of numerous books on aviation with his latest entitled "Human Factors in Air."

He leaves his wife, Emily (Frelinghuysen).

Ross Armstrong McFarland

Biographical Sketch

from

Modern Men of Science

McGraw-Hill Book Co., N.Y.

Volume II, Pages 358–360, 1968

★ McFARLAND, Ross Armstrong

American physiological psychologist and aerospace scientist
Born July 18, 1901, Denver, Colo., U.S.A.

IN AN attempt to obtain a better understanding of the relationship between human performance and the underlying physiological mechanisms, McFarland began a series of investigations in physiological psychology during 1927–28 at Cambridge University, England, in collaboration with Joseph Barcroft and Frederic Bartlett. The primary objective of this and his subsequent research was to analyze the adjustments of the mind and body to the stresses of the environment.

Early in his academic career McFarland was impressed by the dramatic changes in sensory and mental functions resulting from oxygen want at high altitude observed by Paul Bert and the early balloonists and mountaineers. He became interested in making precise measurements of the deterioration in sense perception and mental functions while exposed to various environmental stresses, and at the same time in determining the blood gases or other relevant biochemical or physiological measurements. Special attention was given to the effects of high altitude, extremes of environmental temperature, and to variations in blood sugar. Thus he provided quantitative data for the earlier prediction of Claude Bernard that the development of the central nervous system is completely dependent upon the constancy of the internal environment. In the studies at Cambridge University on RAF student pilots he showed how the lack of oxygen during simulated flights can impair complex reaction times and mental functions, leading to impaired behavior, lack of insight, and loss of judgment. These findings and subsequent studies had direct implications for understanding not only aviation accidents resulting from lack of oxygen but also fatigue, certain forms of mental illness, and the aging process.

From 1929 to 1937, in the department of psychology and the College of Physicians and Surgeons at Columbia University, he continued to investigate the ways in which the central nervous system is completely dependent upon a normal supply of oxygen, glucose, and other organic constants. In one investigation for the federal government on the effects of high altitude, a large number of subjects from 16 to 60 years old were studied individually in low-oxygen chambers at simulated altitudes of 10,000 to 18,000 ft. In other studies, using visual tests of differential light sensitivity, McFarland demonstrated for the first time that impairment may be present at altitudes as low as 4000 ft in unacclimatized subjects. The novelty of the approach was the development of nomograms from which the combined effects of altitude and other variables such as carbon monoxide (as from engine exhaust or cigarette smoke) can be precisely estimated or predicted. In this way simultaneous data from the visual mechanism and from the blood gases were used to determine a subject's true *physiological* altitude as contrasted with the effects of one variable such as pressure altitude. These and other findings led to regulations for the use of oxygen by pilots in civil aviation and by military pilots during night combat. McFarland also contributed significant physiological data in the development of pressurized cabins for air transports.

As a member of the International High Altitude Expedition sponsored by the Harvard Fatigue Laboratory in 1935, he was able to extend his psychophysiological observations on the effects of oxygen want on acclimatized subjects. On this expedition the members were compared with natives of Chile and Peru who lived at altitudes up to 20,000 ft, the highest permanent mining camps being at about 18,500 ft. In 1937 McFarland became a member of the Fatigue Laboratory at Harvard University, where he worked with physiologists L. J. Henderson, D. B. Dill, and W. H. Forbes. A wide variety of stressful conditions on human performance were studied, sometimes in the laboratory and at other times on expeditions to mountainous or desert areas, on flights to high altitudes, or in diverse industrial situations.

During the initial flights in the opening of air routes over the Pacific and Atlantic oceans in 1937 and 1939, McFarland was asked to make studies of the fatiguing effects of these long flights. For the first time the results of sensory and mental tests were correlated with blood gases and other biochemical determinations obtained in flight. In 1940 he was an advisor to Pan American Airways in opening air routes across Africa, and he served as an operations analyst, 13th Air Force, in the Solomon Islands campaign (1943–44), studying combat fatigue in the air and ground forces. During these investigations he became interested in the problems of designing equipment to meet human capabilities. His work in the field of human factors engineering formed the background for additional studies relating to the more effective integration of men and machines in World War II. He was one of the leaders in developing this field as a new discipline and wrote one of the first textbooks on the subject for engineers, *Human Factors in Air Transport Design* (1946). A volume for physicians, *Human Factors in Air Transportation: Occupational Health and Safety* (1953), aided greatly in the development of health and safety standards in civil aviation. His latest book, *The Human Body in Equipment Design*, with A. Damon and H. W. Stoudt (1966), is being widely used by engineers and industrial designers.

With the outbreak of World War II it was apparent that many older persons would be required to work in industry. Through experimental studies of the aging process, McFarland was able to show that with proper supervision and placement men and women can work productively much longer than originally believed. Qualitative studies of sensory and mental functions of older subjects brought out the close relationship between skill and age. The necessity for job reassignment with increasing age is now generally accepted, especially where time-complexity stresses are involved. He also pointed out the close relationship between the oxidative processes and certain functions of the central nervous system. These relationships were revealed to be closely parallel in tests of light sensitivity, immediate memory, and the loss of insight. Other studies during the war concerned the visual problems of fire control and fatigue. In the former studies it was shown that the human eye is capable of great accuracy in making visual judgments and that the range finder itself was accurate, but when the eyes were coupled to the instrument, the errors were great. This led to the redesign of various types of instruments to meet human requirements.

During 1939–40 McFarland became interested in pilot selection and the development of better tests for predicting success or failure. Because of the high failure rates in the military services, McFarland and a group of his colleagues at Harvard were asked to make a comprehensive analysis of this problem. Their efforts resulted in the "Pensacola Study of Naval Aviators." Follow-up studies were begun 25 years later of the 1000 Naval aviators in the original group and of other pilots studied during the war period. The results are proving to be of use not only in selection but also in a better understanding of the aging processes.

In 1947 McFarland became a member of the faculty of the Harvard School of Public Health. Here it was possible to develop a new approach to some of the increasingly difficult problems of health and safety not only on the ground but also in the air and outside the Earth's atmosphere, including the complex human factors of space flight. He was one of the first to emphasize the multiple causes of accidents and to apply the methods of epidemiology in the study of highway injuries and fatalities. Thus, what had been learned in aviation and aircraft design was applied to automotive design and safety. If accident preventive measures are to be effective, he and his colleagues demonstrated through many investigations not only that attention must be given to the control of human behavior, but also that the mechanical forces reaching the body must not exceed the threshold of resistance to injury. Many of the principles advocated are beginning to be incorporated into federal regulations relating to air and highway safety. This new approach attracted many young physicians and engineers for advanced study at the Harvard School of Public Health under his direction. He served as a technical adviser to many governmental agencies, most recently participating in a research project with NASA on the environmental parameters for astronauts in the Apollo mission.

In 1962 the Guggenheim Foundation endowed a teaching and research center at Harvard, with McFarland becoming the first to occupy the Daniel and Florence Guggenheim Chair of Aerospace Health and Safety. More than 200 young scientists trained by McFarland and his colleagues at the Harvard School of Public Health became leaders in the fields of aerospace medicine, occupational health, and highway safety.

McFarland received his A.B. from the University of Michigan in 1923 and his Ph.D. from Harvard University in 1928. He taught at Columbia University from 1928 to 1937, when he moved to Harvard. Besides three honorary degrees, McFarland received the Longacre Award of the Aero Medical Association in 1947; the Flight Safety Foundation Award in 1953; the John Jeffries Award of the Institute of Aeronautical Sciences in 1956; and the Walter M. Boothby Award of the Aerospace Medical Association in 1962. He was elected to the American Academy of Arts and Sciences in 1953.

For background information *see* DECOMPRESSION ILLNESS; GERONTOLOGY; RESPIRATION; SPACE BIOLOGY in the McGraw-Hill Encyclopedia of Science and Technology. □