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## Human Factors in Air Transportation - Occupational Health and Safety, by Dr. Ross A. McFarland

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## BOOK REVIEW

**HUMAN FACTORS IN AIR TRANSPORTATION — OCCUPATIONAL HEALTH AND SAFETY** by Dr. Ross A. McFarland, of the Department of Industrial Hygiene of the Harvard School of Public Health. 830 Pages, 151 Illustrations. McGraw-Hill Book Company, Inc., Health Education Department, 330 W. 42nd Street, New York 36, N.Y. \$13.00

This comprehensive and significant work covers a wide range of information of interest to those engaged in nearly all phases of aviation. The pattern of culture and civilization throughout history has closely paralleled the physiological and psychological development of man. The effects of disease, famine, and pestilence upon the course of world affairs have been a direct resultant of their effects upon individual humans. In the 17th century Pascal recognized the importance of human factors on history by writing the following: "Cromwell was about to ravage all Christendom; the Royal family was undone, and his own forever established, save for a little grain of sand which formed in his ureter. Rome herself was trembling under him; but this small piece of gravel having formed there, he is dead, his family cast down, all is peaceful, and the king is restored." It is pertinent that a scientific analysis of human factors be available to those responsible for the conduct of affairs in the industrial world of today. Dr. McFarland's present book admirably develops a logical and reasoned approach to assist not only medical personnel, but also executives and all those who participate in the management of industrial organizations, based upon contemporary knowledge and experience.

The scope of the book is such that it covers matters of direct interest to the executive staffs of both civilian and military transport operations, as well as areas of concern to safety engineers, personnel managers, operations personnel, insurance experts, medical departments, and flight and ground personnel. In its broader applications, much of the information will be of value to the management of industrial concerns not engaged in air transportation. It should also prove of definite worth to governmental and international regulatory agencies in connection with the establishment of regulations and recommended practices and standards. Trade and popular magazines have recently featured numerous articles dealing with the limits of human tolerance of high altitude and high speed aircraft operations; not so widely recognized, however, are the more routine day-to-day problems encountered by the air transport operators and the military in maintaining health and efficiency of their personnel under varying conditions over the air transport routes of the world. (Part I.)

A part of the book dealing with the selection and training of flight personnel, provides comprehensive coverage of psychological factors in the selection of airmen, and the role of the physical examination in initially selecting flight crews, as well as the increasing importance of proper indoctrination and training of flight crews. (Part II.) The maintenance of health and efficiency of flight personnel is stressed, and much valuable material in regard to the advantages of periodic health examinations for airmen is included in this section. Chapter Six, which covers the maintenance of physical and psychological fitness in air crews, contains information in regard to the effects of alcohol and tobacco on a pilot's physiological attitude and critical judgment. A rather complete analysis of some of the more important variables effecting physical and psychological fitness in air crews is contained in this chapter. (Part III.)

The importance of controlling operational fatigue is pointed out and

specific suggestions are made as to how they may influence the safe and efficient use of equipment. Those agencies responsible for developing regulations in connection with flight time limitations will find this chapter of particular interest, as will the Air Line Pilots Association and airline management. The military services may also find this of value in connection with mobilization planning for the maximum use of aircraft during time of war or national emergency.

The implications of aging of pilots as related to the maintenance of safety and to efficiency and probable length of service of airmen is, of course, of prime interest to the pilots themselves. The chapter dealing with this subject should also be of value to airline management and insurance experts in planning long-range programs. Emphasis has been placed on the prolongation of the useful lives of older pilots, as the effective utilization of their judgment and experience can be of definite benefit, not only to the pilot himself, but also the airline and the industry in general. The chapter includes discussion of the advantages of retirement programs for both pilots and management, and an optimum age with a maturation of such plans is suggested. (Part III.)

The chapters dealing with the selection, placement, and maintenance of health of ground personnel are of interest to all industrial organizations, the military services, and certain government agencies. The value of pre-placement physicals from an economic standpoint alone can be material. Specific cases are cited, demonstrating that unnecessary expenses may be incurred by failure to conduct such preplacement physical examinations, as illustrated by one company which had certain job progressions requiring normal color vision for advanced stages of work. These positions were not obtained by employees until they had acquired considerable experience and training. Unfortunately, the company involved had not included color vision tests in its preplacement program. As a result, individuals who had been employed, trained, and promoted to advanced jobs, because of their visual limitation performed poorly, and their performance reflected a deterioration of the quality of output. Sufficient instances of misplacement occurred to convince the company of the need of a good color vision test at the time of hiring. Preplacement physicals also enable maximum utilization of physically handicapped individuals, which is an item of particular importance in the aviation industry, particularly in time of war. There is an interesting treatment of the causes and control of absenteeism among airline ground employees, which can be readily applied to many other organizations. Throughout the text the author emphasizes that the cost of sickness and accidents is greater than the price of health and safety. Periodic health examinations can do much to maintain the efficiency of trained personnel for longer periods of time, and, of course, prove beneficial both to the individual and the company. Nutrition, industrial hygiene, prevention of occupational diseases, control of the working environment, and the influences of individual and group adjustments on efficiency and morale are also covered. The military services, foreign carriers, and organizations with overseas-based personnel will find the material dealing with the rotation of services and selection of overseas personnel of considerable interest. (Part IV.)

A relatively neglected field which constitutes an important element in the safety and efficiency of operations, is that of industrial accidents in airline ground operations. An analysis of this problem has been made, and emphasis placed on the need for a well-rounded safety program, including control of materials, equipment, working methods, and operating personnel.

A matter of continuing interest to the industry, government, and the International Civil Aviation Organization, is that of survival and rescue in aircraft accidents. There is included a discussion of what are considered to be the basic facilities for search and rescue and the desirability of more

complete cooperation by the various organizations and government agencies in solving these safety problems. Human tolerances to impact forces is treated in light of recently developed information, and methods of survival outlined. (Part V.)

As air transport routes now embrace a wide diversity of climates and geographical areas, including many where standards of health are low and diseases prevalent, effective sanitary control of airports and ground facilities becomes imperative to any air transport operation, whether military or civilian. Chapter Thirteen focusses attention on various sanitary problems which may be encountered, and discusses factors governing selection of airport sites, climatological influences, and health hazards and sanitary difficulties relating to sewage disposal, food supplies, and water. Information is presented in connection with the geographical distribution of disease, desirability of frequent sanitary surveys of the operating bases, and adequate administrative control.

Health and quarantine regulations in air travel have been under active consideration in the International Civil Aviation Organizations and by its various government members. The desirability of simplifying all such regulations as much as practicable is an obvious objective in air transportation, which is itself designed to save time in transit of travelers and cargo. Dr. McFarland indicates that health and quarantine procedures that are now in use were originally developed for the control of infected passengers and commodities in maritime traffic. Quarantine regulations bear a direct relationship to the incubation period of various contagious diseases, and the speed of transit by aircraft is such that passengers can be transported from an infected to an uninfected area during the incubation period of a communicable disease, or disease vectors such as insects could themselves be transported, thus posing problems not presented on as broad a scale to the slower surface transportation methods. To date no serious epidemics attributable to aviation have occurred. The author points out the success of immunization procedures, modern methods of disinsectization, and other public health measures that have been responsible for this enviable record. It is important that this record be maintained so that restrictive regulations will not be imposed on international air routes. Adequate health and quarantine measures are consequently of material importance to international air transport from an economic standpoint, and also vital from the point of view of safeguarding the health of citizens of the various nations. Traffic and operating personnel should be cognizant of the problems involved, and an adequate program developed in conjunction with the public health services of all countries engaged or served by international air transportation. The author indicates various procedures for the control of contagious diseases in air transportation, by the use of epidemiological information, immunological procedures, insecticides, and other public health measures. The hazards to agriculture, as well as public health, are recognized and the approach to the problem is realistic. (Part VI.)

The passenger service and traffic departments of the air carriers should find the chapters dealing with care and contentment of passengers of especial interest. In an earlier volume, entitled "Human Factors in Air Transport Design," the author considered this subject in detail from the standpoint of the engineer and manufacturer, and for those with direct responsibility in this field, it will prove an invaluable source of information and assistance. In the present book the effects of sound, vibration, oxygen want, ventilation, pressure changes, and air sickness are carefully discussed and methods of controlling or counteracting various physical factors influencing comfort in flight are suggested.

The transportation of patients by air has become of increasing importance, not only to the military, but also to the general public. Chapter

Sixteen contains a survey of the problems involved in the transportation of patients by air, and of those conditions associated with flight which might be expected to influence adversely patients with certain illnesses. A short history of the development of air ambulance services in both military and civilian operation is presented, and the flying doctor service of Australia is discussed. There is a discussion of the general medico-legal responsibility of the airlines, which appears to parallel that of any common carrier, although there are certain specific exceptions arising from the peculiarities of aircraft and of air travel. With the increase in general air transportation, more patients may be expected to fly, and the airlines by providing service for them, can make a contribution to public health and safety by providing pertinent information to those for whom flight may not be advisable, and by taking adequate medical precautions for those patients who are permitted to fly. (Part VII.)

The concluding chapter deals with the organization and functions of air transport medical programs, and covers in general the scope which these programs should encompass. (Part VIII.)

"Human Factors in Air Transportation" proposes certain major objectives which would lead to the increase of safety and efficiency in air transport operations. It is written in language readily understandable to a person not specifically trained in medicine or a technical specialty, and illustrates its point through examples of actual cases encountered in industry and elsewhere. The work is well documented, and an excellent bibliography follows each chapter. There is also an alphabetical index providing easy reference to specific subjects or authors. Because human factors are basic to almost any undertaking and extend into all fields of endeavor, the book should not be regarded as of interest to only the medical profession, but, as has been stated above, its broad scope and conclusions make it applicable to the daily problems encountered in air transport operation. It is ideally suited for use as a text for courses in aviation, and in industrial medicine and safety, at the university-level, and also in connection with specific corporate or institutional programs. As a source of reference material and basic data, it is unsurpassed in its field.

The reviewer has been handicapped in presenting a complete outline of the matters treated because of the broad scope of the work, and difficulty in selecting items of importance in true perspective—each separate area will assume major stature to those directly engaged in it. Because of the many applications of health to aviation covered in the book, its usefulness to management, military personnel, governmental and international organizations, insurance experts, personnel managers, and airline operating and traffic personnel will be great. The reader can best judge its applicability to specific problems by reading the summaries following each chapter, which give in brief form the essential information presented. The broad principles of public health and safety which are so comprehensively covered in Dr. McFarland's book, should prove of immense value, not only in their application to air transportation, but also to numerous other industries. "Human Factors in Air Transportation" deserves the careful study of all engaged in aviation, and provides guidance to them in the carrying out of their responsibilities to the public.

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