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AVIATION MEDICINE

The health and safety of more than 200,000,000 aircraft passengers, approximately 700,000 active civilian pilots and other civil aviation personnel are the concern of the Federal Aviation Administration's Office of Aviation Medicine.

In the civil aviation system, involving 155,000 aircraft, which accumulate 36,000,000 flying hours per year, there are numerous and varied opportunities to apply the principles of preventive medicine.

The Federal Air Surgeon, as Director of the Office of Aviation Medicine, manages the nationwide program which: establishes the standards of medical fitness for pilots, coordinates to the CSC on standards for air traffic controllers, and other personnel connected with civil aviation; provides a certification program which involves the periodic medical examination of these personnel; provides medical investigation for aircraft accidents; conducts medical research on a variety of subjects of importance to civil aviation safety; operates an occupational health program for the agency's 56,000 employees; and provides for the education of civil airmen on medical subjects of importance to safe flying.

Civil aviation activity has grown at a more rapid rate than predictions had indicated. Among other things, this has meant an estimated 7 percent average annual increase in the number of pilots medically examined over the most recent ten years.

MEDICAL CERTIFICATION

The key element of the program for periodic medical examinations and issuance of medical certificates to airmen is a group of private practicing physicians. These are the 8,000 designated Aviation Medical Examiners (AMEs). Each calendar year they are expected to examine over a half million airmen, including new applicants as well as renewal applicants. Fees for these examinations are paid directly to the physician by the airman. The AME has authority, delegated by the Federal Aviation Administration, to issue a medical certificate on completion of an examination. The AME also has authority to make a preliminary determination that the airman applicant is not qualified under the existing medical standards and to issue an official notice to this effect to the applicant, who then has the right of appeal. It is expected that approximately 1-1/2 percent of the airmen examined ultimately will be found medically disqualified. Denied airmen have several avenues of appeal. They may be reconsidered by the Federal Air Surgeon to determine if they clearly are not qualified under the medical standards of Federal Aviation Regulations Part 67, to see if a "waiver" or a grant of "exemption" is possible in the public interest and under certain operational or other limitations. Once the airman has exhausted his appeals within the FAA, he may petition the National Transportation Safety Board for a "rules-of-evidence" type of hearing. Airmen may use the U. S. Court of Appeals for further legal review of their rights. Lastly, any airman will be reconsidered at any future time when he is able to submit medical evidence of

a significant beneficial change in the condition which caused his prior denial.

Basically, any qualified physician may apply for designation as an AME. However, the agency requires that he demonstrate an interest in the program and agree to participate periodically in training seminars designed to enhance his effectiveness as an AME. Need for an AME in an area in which the physician is located is also a factor in the designation. In addition, the agency gives weight to current or prior familiarity with aviation or aviation medicine. Actual experience in aviation medicine, such as service as a former military flight surgeon, is given considerable weight. FAA likes to have AMEs who are themselves qualified pilots. There is also a preference for physicians whose type of practice is such that they would ordinarily be equipped to conduct a complete and comprehensive examination. Representation by specialties is approximately as follows: general practice, 58 percent; internal medicine, 15 percent; general surgery, 11 percent; aviation medicine, 3 percent; industrial medicine, 2 percent; psychiatry, 1 percent; ophthalmology, 5 percent; miscellaneous, 5 percent. Former flight surgeons are somewhat more likely to be ophthalmologists or to have had some post-graduate ophthalmological training. Examination of the eyes is still an important part of the pilot examination, and for this reason most general practitioners, internists, and general surgeons, upon accepting a designation as an AME, are required to purchase certain eye examination equipment which they ordinarily would not use in their practice.

To keep AMEs abreast on matters of importance to their service as FAA representatives, the Federal Air Surgeon uses a variety of instructional media. Each AME is given a set of the Federal Aviation Regulations which contains the medical standards by which he makes judgments of medical fitness. In addition, the Federal Air Surgeon has published a "Guide" which elaborates on the standards and informs the AME of the various procedural and administrative practices relating to his work. Periodically, the Federal Air Surgeon also issues a Medical Bulletin on the most recent developments of interest to AMEs in the field of aviation medicine.

Perhaps the most effective means of keeping AMEs informed is by training seminars. Each AME is required to attend a three-day seminar every five years.

When first established in 1961, the seminars were conducted at medical schools, using a combination of the post-graduate training faculties and FAA personnel. There has been a transition to seminars which are conducted wholly by the Office of Aviation Medicine with lecturers about equally divided among FAA staff, aviation industry medical specialists, and a select group of lecturers from a number of medical teaching institutions. Considering the fact that AMEs, in order to attend, must be absent from their practices for at least three days (for which they are not compensated), their response and enthusiastic participation in these seminars indicate their keen interest in aviation and making a contribution to its further safety. Seminars have been scheduled annually at metropolitan centers such as San Francisco, Dallas, Chicago, and Washington, D. C.

Among the results of these instructional efforts are improvements in the quality of AME decisions as to which pilots are certified as fit to fly. An equally important benefit is the improvement in the quality and completeness of medical reporting on pilot applicants. This contributes greatly to the value of the data which are taken from the reports and stored for future analytical studies.

When the AME has finished his examination, he sends his report to the Aeromedical Certification Branch at the FAA Aeronautical Center in Oklahoma City. There, all significant information relating to the examination is entered on computer tape. By using a set of preprogrammed reviewing criteria, the computer then proceeds to check on the quality and completeness of the AME's case report and the appropriateness of any action taken. Between five and six percent of the cases require some further action to bring them to proper completion.

The stored information provides a valuable data bank describing the status of medical fitness of all active civil airmen. Many special tabulations can be made periodically such as the number of active pilots by age, the number who wear glasses or contact lenses, the number who have no useful vision in one eye or who have had an amputation of one or more extremity.

From the preceding, it can be seen that some pilots with significant medical defects are permitted to fly. In many of these instances, certain limitations are placed on their certificates, restricting them to flying under certain specified conditions designed to protect the public as well as the airman.

MEDICAL STANDARDS

Three classes of medical standards have been established and are applied according to the level of airman responsibility.

These standards and related policies and procedures have been developed with reference to certain basic certification philosophies. For example, in FAA medical certification matters, concern for medical fitness extends only over the period during which an issued certificate will be valid -- six months for duties requiring an airline transport pilot certificate, one year for duties requiring a commercial pilot certificate, and two years for duties requiring a student or private pilot certificate. This contrasts with the concern of employers such as airlines, other private corporations and the military services, to measure and attempt to predict pilot fitness for extended periods -- the anticipated duration of employment of the individual.

Another basic consideration is that if at all possible, applicants should be permitted to fly if they can demonstrate an ability to perform airman duties safely, regardless of the presence of a physical defect. For the most part, This policy of special issuances applies to fixed or "static" defects such as those that are visual, auditory, or musculoskeletal. It does not apply

equally to organic or functional disorders that have a potential for sudden incapacitation, progression, or recurrence, or for which some form of continuing medical treatment is required. However, in certain circumstances where organic or functional disorders are present that would be otherwise disqualifying, certification of many individuals has been possible through the application of operational limitations and/or special medical surveillance. For example, because of the nature of the underlying medical condition, an applicant may be found eligible to perform the duties of a flight engineer, but not those of a required pilot flight crewmember.

Among the organic or functional disturbances that are specifically disqualifying for any class medical certificate is an established medical history or clinical diagnosis of (1) a myocardial infarction, (2) angina pectoris or other evidence of coronary heart disease that the Federal Air Surgeon finds may reasonably be expected to lead to myocardial infarction, (3) diabetes mellitus that requires insulin or any other hypoglycemic drug for control, (4) a personality disorder that is severe enough to have repeatedly manifested itself by overt acts, (5) a psychosis, (6) alcoholism, (7) drug dependence, (8) epilepsy, and (9) a disturbance of consciousness without satisfactory medical explanation of the cause. While individuals with such histories or conditions are not eligible for certification under the established medical standards, they may be considered for exemptions to the regulations. Exemptions are granted if it can be determined that the condition involved does not pose a threat to aviation safety and that the grant of exemption would be in the public interest. Many exemptions granted are subject to operational limitations and special followup medical evaluations.

In the development of medical regulations, procedures provide for public notice and opportunity for public comment on proposals for amendments. Due consideration of all comments, suggestions, and recommendations, as well as the opportunity to request the initiation of rule making, allows for full public participation in regulatory efforts.

Over the years, the medical regulations (Part 67 of the Federal Aviation Regulations) have undergone several changes. The last major revision of the explicit medical standards was in 1959. Since that time, several amendments have been issued that are principally of an organizational and procedural nature. Among others, these include authority for special issuances to applicants who do not meet the established medical standards, delegation of authority within the FAA to representatives of the Federal Air Surgeon to issue final denials in certain cases, and revision of the psychiatric terminology and definition of alcoholism and drug dependence. In addition, Part 11 of the Federal Aviation Regulations has been amended, delegating authority to the Federal Air Surgeon to grant or deny petitions for exemptions.

AEROMEDICAL RESEARCH

FAA medical research is conducted at the Civil Aeromedical Institute (CAMI) at the FAA Aeronautical Center, Oklahoma City, Oklahoma. It is supplemented by contract research let to other government or private institutions.

The program provides objective information regarding current and anticipated safety problems in civil aviation. The need for continuing research arises from the changing technological and environmental conditions which place different, and in many instances higher, demands on the airmen and other individuals involved in aviation activities. Specifically, the following

objectives have been established: identifying and eliminating insofar as possible, those factors which cause or contribute to aircraft accidents; updating the medical certification procedures of airmen, increasing the health and physical fitness of aviation personnel, and improving the working and safety conditions of all persons who are engaged in, or use the National Aviation System.

The work is done in several subject areas (Task Areas):

a. Aeromedical Factors in Systems and Operations

b. Aircrew and Passenger Protection

c. Personnel Performance and Efficiency

d. Aeromedical Factors in Flight Management

e. Public Acceptance of Aircraft Operations

The program operates on a budget of about $3 million.

MEDICAL INVESTIGATION OF AIRCRAFT ACCIDENTS

Since late 1959, there has been a complete medical investigation of all fatal air carrier (airline) accidents. In addition, beginning in 1960, fatal general aviation (non-air carrier) accidents have been medically investigated with increasing frequency. At the present time, approximately 60 percent of the general aviation fatal accidents receive some form of medical investigation.

Medical investigations are conducted for three basic reasons. First, the possibility of physical incapacity as the cause of the accident must be considered. Second, the mechanisms by which impact forces produce death and injury are studied for the determination of possible survivability factors. Third, medical evidence which is accumulated is added to the other evidence obtained during the investigation in order to attempt a reconstruction of the events leading to an accident.

Primary responsibility for accident investigation and determination of probable causes of aircraft accidents rests with the National Transportation Safety Board (NTSB), an agency separate from the FAA. However, the FAA Office of Aviation Medicine assists the NTSB in the medical aspects of the investigation.

In numerous air carrier accidents, a study of injury patterns, evacuation sequence, and the concentration of inhaled combustion products in the bodies of accident victims has led to a fuller understanding of factors which affect survival or escape following the occurrence of accidents. Information obtained from these investigations is used in the design of specific research studies to develop equipment or procedures which will increase the probability of survival and escape.

In general aviation (non-air carrier) flying, there are about 650 fatal accidents per year and approximately 1,300 fatalities. As previously stated, there is some form of medical investigation in about 60 percent of these accidents. For these investigations, the FAA Regional Flight Surgeons are assisted by AMEs. AMEs, because of their geographic distribution and acquaintance with local authorities and resources, are ideally

situated for the purpose of participating in the early phases of accident investigations. They are in a position to arrange for autopsies to be performed and toxicological studies to be conducted. In addition, the AME, where possible, visits the scene and documents the evidence of importance to the medical phase of the investigation.

From these investigations, case histories have been accumulated in which the probable cause of the accident was some medical deficiency on the part of the pilot. In others, it has often been determined that the accident could have been survivable had the pilot or passengers been properly restrained at the time of impact (by a shoulder harness, for example).

In addition, a new approach to the investigation of aviation accidents has been initiated, utilizing the psychological autopsy. This approach, the psychosocial reconstruction inventory, enables the development of a dynamic, retrospective portrait of the pilot-in-command subsequent to an accident. When routine accident investigation data are supplemented by a psychosocial or "lifestyle" reconstruction, a much deeper understanding of the cause of the accident often emerges. In addition to the traditional detailed explanation of what happened, it is often possible to determine why the pilot-in-command behaved in a fashion to produce the accident. By increasing pilot insight into the role of emotions and situational stress in accident causation, more effective accident prevention programs should result.

Prior to the initiation of the medical investigation program, very little information existed as to the magnitude of such problems as physical incapacity, fatalities in potentially survivable accidents, or the effects of alcohol consumption by pilots.

Studies will be made in an effort to determine if certain medical deficiencies, now considered disqualifying, are compatible with safe aircraft operation, perhaps under special conditions.

Where relationships of a type which indicate the need to alter present standards of medical fitness are found, changes in the standards will be made.

The findings of these investigations and studies should also help in identifying areas where improvements in the safety record could be attained through educating pilots on steps they can take to protect themselves against the possibility of accident or injury.

AEROMEDICAL EDUCATION

The FAA has a duty to inform airmen by educational means rather than by the regulatory approach, where its safety goals can be achieved by this mechanism.

The medical education of pilots is perhaps ideally provided in the military setting by the assignment of a flight surgeon to relatively

small groups of pilots in a manner which provides relatively close day-to-day contact. The large number of civilian pilots, their geographic distribution, and the unavailability of adequate numbers of medical officers make this approach impractical in civil aviation. Therefore, it is necessary to use other means of getting the word to the pilot.

Whenever it is possible, FAA medical officers meet with pilots and provide firsthand information in answer to questions at such pilot meetings as safety seminars, "hangar flying" sessions, and other gatherings. In order to extend the coverage which can be given by agency medical officers, a second program utilizes the services of designated AMEs, who are provided with prepared material such as films, slide presentations, or leaflets. AMEs address groups in local areas and make themselves available for answering questions on aviation medical matters, during visits to local airports or at local meetings of pilot groups. This kind of communication is enhanced, of course, if the AME is himself a pilot. The FAA is particularly grateful for this service from AMEs since the agency is not in a position to reimburse them for the time spent. This service is possible only because of the dedication and enthusiasm of individual AMEs.

A number of leaflets have been prepared for distribution to pilots through the offices of AMEs. Among them have been such titles as "Rx to Keep You Healthy in Flight," "IFR/VFR--Either Way Disorientation Can Be Fatal!" and "Disorientation." Since the AME is the only agency representative with whom all active pilots are required to make contact on a periodic basis (for their physical examinations), they are an ideal distribution point for such literature.

The Office of Aviation Medicine has also prepared slides and films dealing with the effects of a number of medical conditions on flight proficiency and flight safety. These films are available to FAA Safety Inspectors, Regional Flight Surgeons, AMEs, and other personnel for presentation to pilot groups. Pilots trained in the military are exposed to physiological training and chamber indoctrination. Civilian trainees also have the opportunity for this valuable training and experience at Oklahoma City and at several military bases scattered about the country. The Aeromedical Education Branch of the Civil Aeromedical Institute supports flight instructor revalidation clinics and also the Flight Standards Service in their accident prevention clinics through lectures dealing with aeromedical topics (medical facts for pilots, psychological aspects of flying, etc.).

The Office of Aviation Medicine also communicates with the aeromedical community and the aviation industry by means of technical reports based on research efforts. In addition, a Medical Handbook for Pilots is available containing key information on medical factors critical to flight. This handbook, publication number AC 67-2, is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

Medical education efforts do not stop with the airman or the aviation

industry. As previously discussed, a training program has been established for the AMEs. They are required to participate in three-day seminars--one every five years. In addition to the benefits previously discussed, these seminars present an opportunity for the agency medical staff to make personal contact with the AMEs. There is considerable benefit to the agency in obtaining the point of view of people who administer the certification, accident investigation and education programs in the field. AMEs gain from such firsthand exchanges a clearer understanding of their role as agency representatives.

An example of the apparent effect of specifically focused educational campaigns was the result of a letter from the Federal Air Surgeon to flying physicians. In anticipation of the ordinarily high accident rate over Labor Day weekends, the Federal Air Surgeon sent a letter to physicians who fly. He called their attention to the fact that the accident record for physicians appears to be significantly worse than that for pilots in general, flying similar aircraft. He listed certain precautions that might be taken and urged physicians to exercise the same sort of care in preparing for flying and in flying as they would in caring for patients in their respective practices. Analysis of data subsequently indicated that the number of accidents in this group over the next Labor Day weekend was approximately half that which was expected from prior years' experience.

OCCUPATIONAL HEALTH

Maintenance of good health among the Federal Aviation Administration employee population serves three principal objectives. First, the individual employees should be able to continue to work productively, be afforded the opportunity to progress in their careers and to provide for themselves and their families. Second, the investment made by the public in training and the experience gained by the employees are not wasted by the untimely loss of personnel due to health deterioration. Third, performance of duties by certain specific employees has direct and critical impact or influence upon the personal safety of large numbers of the public, and the presence of poor health among these employees could seriously compromise public safety.

Health maintenance efforts within FAA are directed toward the general employee work force in the form of on-the-job diagnostic and emergency treatment services; providing care prescribed by private physicians, such as allergy injections; providing selected immunizations; offering disease detection services, such as screening for diabetes, glaucoma, hypertension; and, counseling regarding possible alcohol or drug abuse. All of the above efforts, when available, are strictly voluntary on the part of the employee.

FAA now employs approximately 56,000 people with about half of the work force assigned duties as air traffic control specialists. The majority of air traffic controllers and large numbers of other employees are assigned to special facilities identified as terminals (airport towers), centers (Air Route Traffic Control Centers), and Flight Service Stations.

Occupational health clinics are provided by the FAA at the Headquarters, Washington, D. C.; Civil Aeromedical Institute, Oklahoma City, Oklahoma; National Aviation Facilities Experimental Center, Atlantic City, N. J.; nine of eleven Regional Headquarters, and the 20 major Air Route Traffic Control Centers (ARTCC). Unless terminals and flight service stations are physically located near one of the above, FAA medical care resources are not available. However, medical examinations required for continued employment, if not provided at FAA facilities, are provided at FAA expense and are accomplished by certain AMEs or by selected clinical specialty consultants. In addition, health units staffed by nurses are established at Washington National Airport and Dulles International Airport.

Special health and examination programs have been established for the following employee groups: Air traffic control specialists, FAA pilots, firefighters, police officers, mobile lounge operators, and certain motor vehicle operators.

The most extensive occupational health effort within FAA is the Air Traffic Controller Health Program. This program was initiated in December 1965 after several years of study. Air Traffic Control Specialists (ATCS) are responsible for the control, safe separation, and expeditious flow of both civilian and military air traffic. This critical responsibility requires that controllers be mentally and physically fit, be intelligent, display good judgment, and be minimally affected by the unique and peculiar aspects of these duties.

The initial program included a complete medical examination conducted by selected AMEs. In addition, certain ancillary examinations including EKG, chest X-ray, and audiogram were required. Initially, most of the ancillaries were obtained at other government facilities, such as the Department of Defense, U. S. Public Health Service, and the Veterans Administration. Due to the nature of the duties and responsibilities of controllers, a psychological screening test was administered to all ATCSs already employed, and since then, is administered to all applicants prior to employment.

A major effort completed in the early 1970's was the construction, equipping and staffing of 20 clinics in FAA's ARTCCs. Capability established included occupational health care, emergency care, and complete physical examinations, including exercise EKG, X-ray, audiogram and complete visual testing tonometry. A small laboratory was planned; however, almost all specimens are forwarded to local automated laboratories for analysis and reports. The medical officer at each center clinic is an Assistant Regional Flight Surgeon and is in direct line of authority to the Regional Flight Surgeon of each region.

The basis for the ATC Health Program is a set of standards developed by FAA and published by the Civil Service Commission as the medical requirements for employment and retention on duty in the GS-2152 series.

An immediate product of the program was the identification and documentation of existing medical problems among controllers, which were known to

the controllers, and some not previously known, including hypertension, diabetes, peptic ulcer, coronary artery disease, hearing loss, and pulmonary pathology.

An early positive action was the use of the individual special consideration provision which allowed returning controllers to duty despite the existence of medical problems. FAA, having knowledge of a problem, could medically monitor each individual and when it was determined that neither public safety nor employee health was jeopardized, could approve continued duty for such controllers. The individual thus continues a career and FAA retains a valuable resource.

There is growing medical evidence that many illnesses or disorders are related to the stresses and strains faced by human beings in our modern world. Stress may result from excessive or sustained mental or physical demands, or may be found in circumstances of pure boredom. Many occupations routinely involve alternating periods of intense activity and periods of almost no activity, such as firefighters, police officers, pilots and some ATC duties. Although there is no pure evidence that ATC duty, per se, causes illness, scientific in-depth studies are continuing. Regardless of the etiology or presence or absence of job relationships, the facts are that illnesses and disorders which are unacceptable within the air traffic system do occur among controllers.

The leading major diagnostic groups forming the basis for medical disqualification were found to be: psychiatric-psychological disorders, cardiovascular, and gastrointestinal, with medication a requirement in almost every case in each group. The presence of these conditions is not unusual in any population group, but the presence of these conditions in controllers results in termination of careers. In contrast, in most other careers, although complicated or altered by these illnesses, careers could continue because the safety of others was not threatened.

Medical data derived from the ATCS Health Program are maintained by the Office of Aviation Medicine, Regional Flight Surgeons, and in a computer bank at CAMI. Disease incidence, trends and comparative studies are planned, utilizing these data.

Changes in the operation and equipment used in the Air Traffic System, and experience gained since the implementation of the ATCS Health Program, have resulted in the need for revision and updating of the medical standards utilized in the program. In addition, new laws and administrative changes have resulted in the need for revision and updating of the basic order covering the conduct of the program.

ENVIRONMENTAL HEALTH

The Occupational Safety and Health Act of 1970 and Executive Order No. 11807 are aimed at providing a safe and healthful working environment for Federal employees.

The Environmental Health Program is designed to preserve the health and

well-being of agency employees through the continuing evaluation and control of health hazards in specific areas.

Industrial Hygienists, assigned to FAA Headquarters in Washington, D. C., and the Civil Aeromedical Institute in Oklahoma City, Oklahoma, provide the technical competence necessary to recognize health hazards in agency facilities and work places. Using as a guide standards promulgated or approved by the U. S. Department of Labor, these personnel survey agency facilities for the following specific problems:

1. Environmental health hazard evaluations.

    a. Noise, lighting, temperature, space, and humidity control.

    b. Radiation, vibration, contaminants (non-toxic and dust).

    c. Sanitation and pollution problems.

    d. Medical aspects of agency housing problems.

2. Medical consideration in:

    a. Disposal of garbage and industrial wastes.

    b. Water supply.

    c. Insect and rodent control (pesticides).

    d. Weed and foliage control (herbicides).

    e. Food supply and dispensing.

3. Toxicological problems - gases, liquids, fumes, dust, and biological, chemical and radiological control.

    a. In aircraft.

    b. In ground installations.

REGIONAL MEDICAL ACTIVITIES

To carry out the various aspects of the agency's medical programs, which are developed and supervised from the Washington Headquarters, there are eleven Regional Flight Surgeons and their staffs located in Boston, New York City, Atlanta, Ft. Worth, Kansas City, Chicago, Denver, Los Angeles, Seattle, Anchorage and Honolulu. There are Assistant Regional Flight Surgeons, each with a small staff, located in the 20 major air route traffic control centers, who provide medical services to center employees and personnel in other nearby agency field facilities. These clinics are extensions of the Regional Medical Divisions. The work of these field elements is predominantly in occupational health, involving air traffic controllers, with the balance of their efforts devoted to

(1) handling problem cases in pilot medical certification; (2) selecting and supervising Aviation Medical Examiners; (3) providing for the medical investigation of aircraft accidents which occur in their areas; and, (4) making personal presentations on the medical aspects of aviation safety to groups of pilots. These Assistant Regional Flight Surgeons are looked upon as FAA's field medical managers and its practitioners of aviation medicine.

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