



OPINION

Visual Standards for Civil Aviation

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Abstract

Standards for personnel licensing are established by the International Civil Aviation Organization. These standards and procedures are set without investigation concerning their validity and are revised occasionally. The procedures for the ophthalmic examination are often beyond the competence of the aviation medical examiner. Recommendations are made to develop new improved standards and procedures. A complete professional oculo-visual examination should be required on a regular basis for re-licensing civil pilots.

Abrégé

Les normes pour l'obtention d'un permis de vol dans l'aviation civile sont régies par l'Organisation Internationale pour l'Aviation Civile. Ces normes ont été établies sans enquête préliminaire de leur validité. Elles sont soumises à une révision à période irrégulière. Toutefois, les procédures d'un examen visuel complet dépassent la compétence du médecin examinateur. L'auteur propose l'établissement de nouvelles normes et procédures d'évaluation visuelle. Il recommande un examen visuel complet préalable au renouvellement du permis de vol des pilotes civils.

Aviation medical examiners and pilots are primarily concerned with general medical requirements, hearing, vision and colour perception in the process of licensing. Dr. Thomas Tredici, Chief of Ophthalmology at Brooks A.F.B., Texas states that "More than 80% of the information necessary to accomplish the flying task is gathered by the visual sense. A thorough eye examination and the visual standards screen out ocular pathology and visual problems felt to be incompatible with flying."¹ The purpose of this paper is to examine the origin and procedures for establishment of civil aviation visual standards and to provoke discussion of new concepts and medical devices as they may relate to these standards.

Standards for licensing civil aviation personnel are usually adopted from the Manual of Civil Aviation Medicine published by the International Civil Aviation Organization (I.C.A.O.)². Air Marshal Sir G. Dhenin in *Aviation Medicine* states that "in formulating these standards, I.C.A.O. must compromise in order that developing nations can meet these minimum standards and agree to their adoption."³

Origins for Establishment of Civil Aviation Medical Standards

I.C.A.O. Standards and recommended practices for Personnel licensing were first adopted by the I.C.A.O. Council on April 14, 1948 and designated as Annex 1 to the convention.

The first Hearing and Vision Committee met on April 25, 1955. It included twenty consultants to civil and/or military aviation administrations from

member nations, as well as representatives from five international agencies concerned with air transport and health.

The Ophthalmology section of the Manual was prepared by Drs. J. Boissin, France and V. Dreyer, Denmark. I.C.A.O. is presently revising the original Manual of Civil Aviation Medicine, which was first prepared in 1974. Revised at approximately five year intervals, it is not a legally binding document.

The Manual serves as a guide and "is not intended to have any regulatory implication, its main purpose is to aid in the implementation of Personnel licensing (Annex 1) provisions. The aim is to achieve a measure of international uniformity of procedures and comparable results in the assessment of both normal and borderline licensing cases."⁴ How valid are these "principles of ophthalmic examination techniques and assessment of visual functions in relation to aviation duties."⁴

Procedures for Eye Examination

The vision examination consists of a case history, assessment of visual acuity, refraction, corrective lenses including contact lenses, visual fields, ocular muscle balance, intra-ocular tension, ocular pathology assessment and a test for colour vision; in other words, a complete oculo-visual assessment. I.C.A.O. recommends a six-month report of medical fitness for airline pilots, but no frequency for a *complete* eye examination is suggested in the Manual.

The case history deals primarily with asthenopia. Little attention is paid to vision symptoms associated with flying, i.e. the ability to read navigation charts at night, the ability to see landing lights or to judge distances. A clinical examination is recom-

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mended following the case history, commencing with an external ocular examination.

The Manual states that "Applicants with such findings (pericorneal congestion, severe pain, photophobia, blepharospasm and lacrimation or irregular pupils) should be referred to an ophthalmologist, as fully reliable diagnosis presupposes training in the use of the slit-lamp and ophthalmoscope". Hopefully, the aviation medical examiner has been trained to use a penlight to test pupillary responses and an ophthalmoscope to examine the eye.

Visual acuity is measured using the Landolt ring or Snellen acuity chart at six meters and the "Times Roman" type print is used at 30-50 and 100 centimetres respectively. The minimum visual acuity to perform cockpit duties safely is unknown but has been established empirically.

A great deal of material is presented in this document on a discussion of presbyopia and its appropriate correction. The Manual makes some recommendations regarding the amplitude of accommodation required but, unfortunately, this is variable and must be taken into account in clinical measurements and in prescribing corrective lenses.⁵

Under the subject of binocular vision, heterophoria, but not fusional ranges, is discussed. Little attention is paid to fusion, stereopsis, saccadic and pursuit eye movements. Earlsberg and Rubin⁶ state that with a stereothreshold of two seconds the limit of stereopsis is four miles and "accordingly, it seems appropriate to assess the aviator's stereothreshold". This leads to the problem of the monocular pilot. Morris Fraser, at the University of Waterloo, conducted a study for the Canadian Minister of Transport and found that monocular pilots could fly safely. In light of this study, stereoacuity and monocular vision must be reconciled.

Colour vision testing is recommended utilizing the Ishihara test plates or American Optical H.R.R. test. Unfortunately, the former test does not reveal Yellow-Blue colour deficiencies and the latter is no longer available. Monocular testing is not recommended in the Manual nor is the effect of medication and ocular and systemic diseases on colour vision considered.

Recommendations

Standards

Few clinical studies have been performed and standards are empirical. Many aspiring pilots rejected by licensing authorities may, in fact, be very skilled and competent to fly safely and pilots are often retired prematurely, which is very costly to their employers.

The present standards could be improved by an interdisciplinary review committee. Steneck⁷ reported "the fact that relatively few persons, with similar points of view, made most of the early decisions

about the development of research and policy on the biological effects of microwave radiation obviously minimized and may even have eliminated input from other perspectives. When science becomes involved too deeply in the procedures of standard setting, it runs the risk of being diverted from its primary objective of understanding nature. To set a standard, one simply needs to know at what level, for whatever reasons, harmful effects appear. So not only must different points of view be integrated into planning ... They must be integrated in ways that are appropriate." Research projects should be sponsored by various agencies to develop safe norms. An interdisciplinary standing committee, sponsored by various aviation and health care agencies, should constantly review standards for the cockpit environment and for a pilot's medical fitness to perform his duties well and safely.

Examination

The applicant must demonstrate normal visual fields and no active pathology at re-licensing. Colour perception is a requirement to *obtain* a license, but is not usually verified thereafter. Some countries require an assessment of ocular motility, the prescription of corrective ophthalmic lenses, and the type of correction for presbyopia. This is beyond the competence of a general medical aviation examiner to evaluate. A complete, professional oculo-visual examination should be required on a regular annual basis for re-licensing civil pilots. More frequent examination should be performed, if necessary, when progressive vision anomalies are present.

New examination techniques such as automated refraction and visual field screeners should be evaluated. Should these devices be operated by a technician, or aviation medical examiner, and should it replace a complete professional examination? The cover test is an inexpensive and objective test for evaluation of heterophorias. An excellent subjective test would be fixation disparity measurements at distance and near vision. Stereopsis fusion and ocular motility should be evaluated.

Treatment

Various types of spectacle and contact lenses may be employed to correct vision. Studies on lenses for pilots, such as that performed by Smith and Backman,⁸ could provide useful information in evaluating the form of spectacle therapy. The use of contact lenses has been permitted in many countries but problems such as air bubbles due to pressurization changes, deposits on lenses which reduce visibility and produce light-scattering glare, as well as orthokeratology, must be evaluated for pilots.

New drug delivery systems, and their side-effects, need to be considered. New surgical procedures, such as surgery for refractive errors, laser therapy

and ocular implants require study. Unfortunately, little attention is paid to ocular pathology in this medical manual and many new and controversial forms of treatment are in effect which may actually interfere with the performance of flying duties.

Conclusion

The principles for the establishment of civil aviation standards and procedures for licensing personnel in the I.C.A.O. Manual of Civil Aviation Medicine have been reviewed. Vision is a most complex and important sense in Aviation which cannot be simply screened in a general medical physical examination. The examination for licensing personnel, for example in Canada, requires specific knowledge and testing of vision, e.g. the degree of refractive error, which is beyond the capability of the aviation medical examiner.

W.M. McLeish, of the Canadian Ministry of Transport, in a forward to the Personnel Licensing Handbook notes that "many countries have, over the years, accumulated valuable funds of experience and information concerning this relationship (physical fitness to flight safety) from both operational and medical points of view."⁹ This has resulted in the establishment of empirical standards and procedures which need to be constantly revised.

Studies must be performed to provide the necessary scientific data to establish valid standards for licensing personnel. Examination and treatment procedures must regularly be evaluated by experts from various interdisciplinary agencies to ensure

that the pilot is able to maintain his medical and visual fitness to perform his duties at an optimum level.

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