PART V

AVIATION MEDICAL TRAINING

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Chapter 1

AEROMEDICAL TRAINING FOR
MEDICAL EXAMINERS

1.1   INTRODUCTION

Medical examiner. A physician with training in aviation medicine and practical knowledge and experience of the aviation environment, who is designated by the Licensing Authority to conduct medical examinations of fitness of applicants for licences or ratings for which medical requirements are prescribed.

….

> 1.2.4.5   Contracting States shall designate medical examiners, qualified and licensed in the practice of medicine, to conduct medical examinations of fitness of applicants for the issue or renewal of the licences or ratings specified in Chapters 2 and 3, and of the appropriate licences specified in Chapter 4.

> 1.2.4.5.1   Medical examiners shall have received training in aviation medicine and shall receive refresher training at regular intervals. Before designation, medical examiners shall demonstrate adequate competency in aviation medicine.

> 1.2.4.5.2   Medical examiners shall have practical knowledge and experience of the conditions in which the holders of licences and ratings carry out their duties.

> *Note.— Examples of practical knowledge and experience are flight experience, simulator experience, on-site observation or any other hands-on experience deemed by the Licensing Authority to meet this requirement*."

1.1.1   A designated medical examiner as specified in Annex 1, 1.2.4.5 (see above), is a physician who is authorized by the appropriate national authority to carry out clinical examinations as required for issue of aviation-related licences. Usually such physicians are engaged primarily in some other field of medical practice in the course of which they also act as designated medical examiners on request. They may occasionally be part- or full-time employees of an airline or of a Civil Aviation Administration.

1.1.2   Aviation medical examiners should understand the importance of the authority and responsibility vested in them. Incompetence in the medical fitness evaluation of an applicant might permit a physically or mentally unfit person to exercise the privileges of a licence which can have serious implications for flight safety, for the Administration and indeed also for the examiner himself. However, an overly stringent approach by the examiner should be avoided, since this is likely to adversely affect the relationship between examiner and applicant. As most conditions of relevance to flight safety will be elicited from the history, a relationship of trust must be fostered by the examiner. Adequate aeromedical training for potential examiners and recurrent training for those designated as medical examiners is necessary but the examiner must also develop the skills needed to conduct a thorough examination in an atmosphere of trust.

1.1.3   The appropriate environment for the medical examination can be facilitated by the medical department of the Licensing Authority, which should strive for a certification process that is transparent and based as far as possible on scientific evidence. Applicants are more likely to be forthcoming with personal information if they believe that, should they declare a condition that could have aeromedical significance, they will be treated fairly by the Authority, and that efforts to keep the applicant operating will be made wherever possible by those having decision-making authority over the issuance of Medical Assessments.

1.1.4   A need for special post-graduate aviation medical training has been recognized by responsible authorities in most countries with significant civil aviation activities. No basic medical curriculum or post-graduate training in a speciality other than aviation medicine provides the specific instruction desirable for a designated medical examiner. Improving the quality of aviation medical examinations in a State will result in a more rational and uniform application of the medical provisions of Annex 1. This in turn may not only positively affect the general flight safety level within the country, but may also be expected to favour increased international recognition and reciprocity with regard to medical fitness requirements of personnel licences.

1.1.5   In some Contracting States medical examiners are encouraged to become involved in the medical aspects of aircraft accident investigation. However, for examiners to function effectively in this role, it is desirable that they receive formal instruction on fundamental procedures. Whilst such training may be included in an aviation medical examiner training course curriculum, normally additional, specific training is required.

1.1.6   In addition to ICAO-sponsored seminars, several Contracting States offer post-graduate programmes in aviation medicine. Information on some of these programmes can be found in the ICAO Training Directory, available at www.icao.int.

1.2   COMPETENCY-BASED TRAINING FOR MEDICAL EXAMINERS

1.2.1   The objective of this section is to provide guidance for implementation of competency-based training of medical examiners applying for designation by a Licensing Authority. It contains guidance for providers of training as well as for States who are implementing such training or assessing it. The aim is to encourage States to adopt a systematic approach to aeromedical training so that medical examiners attain an appropriate and harmonized level of expertise.

1.2.2   The competency-based approach to training has been adopted by ICAO in a number of areas, including the multi-crew pilot licence and the training of government safety inspectors; it is designed to achieve consistent and standardized outcomes from training. As stated in the *Procedures for Air Navigation Services — Training* (ICAO Doc 9868), Chapter 2, paragraph 2.2:

> "The development of competency-based training and assessment shall be based on a systematic approach whereby competencies and their standards are defined, training is based on the competencies identified, and assessments are developed to determine whether these competencies have been achieved."

The ICAO document further states that competency-based approaches to training and assessment shall include at least the following features:

a)   the justification of a training need through a systematic analysis and the identification of indicators for evaluation;

b)   the use of a job and task analysis to determine performance standards, the conditions under which the job is carried out, the criticality of tasks, and the inventory of skills, knowledge and attitudes;

c)   the identification of the characteristics of the trainee population;

d)   the derivation of training objectives from the task analysis and their formulation in an observable and measurable fashion;

e)   the development of **criterion-referenced**, valid, reliable and performance-oriented tests;

f)   the development of a curriculum based on adult learning principles and with a view to achieving an optimal path to the attainment of competencies;

g)   the development of **material-dependent** training; and

h)   the use of a continuous evaluation process to ensure the effectiveness of training and its relevance to line operations.

Note.— A detailed description of the ICAO course development methodology, a competency-based approach to training and assessment and an example of an ISD methodology, can be found in the Attachment to Chapter 2.

1.2.3   In a competency-based training approach:

- training is outcome-oriented. It is what trainees can do and how well they can do it that matters (rather than their level of knowledge about a particular subject);

- training materials clearly state what is expected of trainees in terms of performance, under given conditions, and to what standards;

- training is material-dependent as opposed to trainer-dependent;

- assessment during and after training measures the performance of the trainee against a specified standard in a valid and reliable fashion; and

- trainees are provided with regular and immediate feedback during training.

Scope

1.2.4   This chapter relates primarily to examiners of professional pilots (ICAO Class 1 Medical Assessment). Accordingly, the discussion which follows will refer primarily to this group and their work environment. However, most of the principles are also applicable to the other categories of applicant. Comments on Class 2 and Class 3 applicants follow.

1.2.5   ICAO Class 2 (primarily private pilots): Mostly the same principles as for Class 1 apply, although a lower overall level of fitness is required and greater flexibility is likely to be applied by Medical Assessors. In some States, the process for medical certification for Class 2 applicants differs from other classes in that there may be greater authority delegated to examiners of Class 2 applicants. However, the processes undertaken by examiners are broadly similar, although the requirements of the regulator in terms of training and competency for designated medical examiners (DMEs) examining only Class 2 applicants may be less stringent than those examining Class 1 (or Class 3).

1.2.6   ICAO Class 3 (air traffic controllers): While there may be differences in Standards and application of flexibility for Class 3 applicants as compared to Class 1, air traffic controllers are professionals within the same aviation system. Most of the medical considerations for Class 1 also apply to Class 3, and therefore the same core set of competencies is likely to be required of their medical examiners. The guidance given in this chapter is also applicable to medical examiners designated to examine Class 3 applicants.

1.2.7   In addition to the three ICAO classes of Medical Assessment, some States medically evaluate other aviation personnel, such as recreational pilots, tandem parachute instructors, pilots of microlight and ultralight aircraft and cabin crew, all operating under licences that are not necessarily compliant with ICAO Standards. For these groups the level of legislation varies greatly from State to State, and the training of medical examiners designated to determine their medical fitness is outside the purview of ICAO.

Development of the guidance material

1.2.8   A survey of several contracting States was undertaken concerning existing training programmes and required competencies and tasks of aviation medical examiners. The States that responded to the survey represented a variety of geographical regions and regulatory approaches. The responses were highly diverse.

1.2.9   In some States all examiners were directly employed by the State. In some, the examiners were entitled or required to issue the Medical Assessment (even if only as a temporary Medical Assessment) while in others the examiner only performed examinations and the Assessment was issued centrally, based on examination findings.

1.2.10   Few States had formal competencies established for their medical examiners, although many had established goals and objectives for training. In terms of prerequisites to undergo training, some States required only basic medical qualifications, while others required additional qualifications, skills or experience. In some States, completion of the training allowed the doctor to commence working as a medical examiner but in others, further requirements were added, sometimes including a probation period. In about half the States, there was an established process for review or audit of examiner performance.

1.2.11   All responding States conducted medical examiner training, but the variation in size, duration and frequency of training courses was wide. In some States the Licensing Authority itself provided the training, and in others this was done by external organizations. The principal training method was by lectures, often with clinical demonstrations and sometimes practical visits (to altitude chambers or aviation worksites, for example). Computer-based training was mentioned by some States. A variety of written reference material was used including textbooks, on-line resources and regulatory documents.

1.2.12   In terms of assessment at the end of training, written examination was the commonest method, but other methods included practical or oral examination, or none at all. The experience or training required of trainers also varied greatly, but in general there were few explicit requirements.

1.2.13   The wide variety of approach to DME training confirmed the need to harmonize the training programmes while considering the different regulatory contexts in which the medical examiners practice and the different training environments in which they learn. The successful implementation of competency-based training for medical examiners should take into account the variety of State-specific parameters while at the same time ensuring that internationally agreed competency standards are met.

1.2.14   Formulation of the competency framework was achieved by an ICAO Medical Provisions Study Group (MPSG), composed of representatives from 12 States along with other invited participants (including the European Aviation Safety Agency, the International Federation of Airline Pilots' Associations, the International Air Transport Association, the International Academy of Aviation and Space Medicine, and the Aerospace Medical Association) and external consultants, who corresponded initially by e-mail. The MPSG met over a three-day period in 2009 and consulted further by e-mail to agree on the framework content.

1.2.15   The competency units and elements were derived from an analysis of the processes which occur during a medical examination. Although the framework lists those units and elements sequentially, in reality they do not necessarily occur in a specific order or as individual units, as many functions are conducted concurrently or iteratively.

1.2.16   The processes were grouped into three broad sections (units):

- facilitating communication;
- gathering and processing medical information; and
- utilizing that information to facilitate a Medical Assessment.

      Note.— The medical examination is part of a wider process of medical evaluation for fitness, the other aspects of which may be conducted by individual(s) who have not been personally involved in the conduct of the medical examination. The purpose of the examination is to facilitate the decision concerning fitness for issuance of a Medical Assessment, and the two parts of the process (clinical examination, and issuance decision based on the examination and any other clinical findings) should be considered in totality rather than in isolation.

Assumptions

1.2.17   A series of assumptions underpin the formulation of the competency framework. Text in italics is explanatory.

1.   The goal of the examination process is to optimize flight safety through managing aeromedical risk.

Whether or not the State requires the examiner to make certification decisions, the ultimate goal of the examination and evaluation process is to minimize the risk of safety being compromised as a result of aeromedical factors. These factors include, but are not limited to, incapacitation of pilots or other licence holders.

2.   Competency-based aviation medical examiner training should contribute to achieving the goal in (1) above.

In order to provide appropriately targeted evaluations, medical examiners should have a clear understanding of the considerations which underlie aeromedical decisions.

3.   The periodic medical examination and evaluation process should use a risk-based approach.

Characteristics of the applicant will help determine the areas on which the examination should focus. For example, in older applicants, cardiovascular risk becomes relatively more important as a potential cause of incapacitation. In younger applicants, depression is relatively more common. Aside from age, a number of demographic and other considerations may be important including gender, ethnic background, culture, and type of flying.

4.   Potential examiners are fully registered/licensed medical practitioners who already have acquired core clinical skills.

Being registered to practice medicine is taken to denote an acceptable level of competence in basic skills of history-taking, physical examination, diagnosis and medical treatment. It is therefore assumed that medical examiner training does not need to ensure that all basic clinical skills or core medical knowledge are in place. Rather, it is accepted that this has been verified within each State prior to training commencement. The aim of medical examiner training, as addressed in this chapter, is to build upon basic clinical skills and knowledge and provide additional, task-related knowledge and skills, and to foster those attitudes, that are required to achieve competency in the specialized tasks required of a medical examiner. The training and its assessment should therefore be focused on developing and verifying that such additional competencies have been achieved.

5.   Potential designated medical examiners have currency in medical knowledge and practice.

Ongoing education and clinical practice are essential to maintaining competency. States employ various means to ensure that examiners are receiving ongoing education and training and are maintaining currency in clinical practice. Verifying such currency is somewhat beyond the scope of the medical examiner training, although it may reveal deficiencies if present. Nonetheless, it may be necessary for States to verify that each applicant for medical examiner training remains fully conversant with the basic medical skills, especially if the applicant's usual work does not include practising such skills.

Background

1.   Guiding Principles

The following premises provide background to the rationale behind the formulation of the competency framework:

        a)   Physical incapacitation is a rare cause of accidents in two-pilot aircraft undertaking commercial flight operations.

      b)   Overall incidence of physical disease increases significantly with age.

      c)   In many States, the incidence of mental health problems, such as depression and problematic use of psychoactive substances is increasing, whilst cardiovascular disease is declining.

      d)   For some conditions, preventative strategies have been demonstrated to be effective in the general population, e.g. depression, alcohol misuse.

      e)   The current periodic medical examination does not formally address mental health or behavioural problems associated with ill health to the same extent as the detection of physical disease.

      f)   The periodic physical examination, like all medical examinations, benefits from a thorough history.

      g)   Current life events can adversely affect the performance of licence holders.

2.   Safety context

Since soon after the birth of aviation, medical standards have been applied to aviators with an overriding focus on maintaining the safety of flight. In the 100 years since the first fatal aircraft accident involving heavier-than-air aircraft in 1909 (DeJohn, 2004), the industry has evolved from aircraft carrying a few people to aircraft carrying several hundreds of passengers; consequently, a single aircraft accident today may have very severe consequences. Large aircraft are flown by professional pilots, a reason for this chapter being focused primarily on the professional pilot group, as mentioned above. When private pilots are involved in aircraft crashes, the number of individuals involved is much smaller since the aircraft typically flown carry only 1-3 passengers. Furthermore, the likelihood of causing harm to members of the public, either on the ground or in other aircraft, is minimal (although such accidents do very occasionally occur).

In reality, it is rare for medical factors to be the primary cause of aircraft crashes – probably 1 per cent or less, and for professional airline operations, well below this. It has been estimated that across the industry 3 per 1 000 aircraft accidents (15 per 1 000 fatal aircraft accidents) result from pilot incapacitation (Booze, 1989), although this does not include accidents in which medical factors may be a contributory, as opposed to primary, cause. Because of difficulties in identifying medical causes, there may also be situations in which a primary medical cause may have been present but which cannot be established through investigatory processes.

Importantly, in accidents caused by medical factors, certain causes predominate. In an analysis of fatal commercial (two-pilot) crashes over a 20 year period (1980-2000) in which medical factors were identified as the cause(s), ten incidents were found. Of the ten, eight were ascribed to a psychiatric disorder with the majority (six) being related to alcohol and/or other drugs (Evans, 2007). The discussion which follows will therefore place particular emphasis on these conditions.

3.   Aims and limitations of the examination process

The primary purpose of a medical examination is often considered to be the detection of conditions with a propensity to cause incapacitation (Evans, 2006). Examples include seizures, disturbances of heart rhythm, loss of consciousness. This, however, is only one aspect of the medical examination; one with important limitations.

Incapacitation can be sudden or insidious, and the degree of warning will affect the consequences. By far the commonest cause of in-flight incapacitation is acute gastro-intestinal upset, which is almost never predictable by routine medical examination. In considering incapacitation, there are also differences between obvious and subtle incapacitation with the latter having the potential for even more serious consequences due to delayed detection. A distinction may also be drawn between passive incapacitation, in which the individual becomes unresponsive, and active incapacitation, such as in a seizure, whereby the pilot has the potential to interfere directly with the control of the aircraft.

There is a further category of in-flight incapacitation which is related not to medical factors (although these are often attributed to medical causes in incident reporting systems) but to exposures relating to the operational environment, such as exposure to hypoxia, carbon monoxide or toxic fumes from combustion. These types of incapacitation are not strongly related to individual factors and are not predictable by medical examination.

Some degree of incapacitation risk is always present. For example, all individuals have a background risk of seizures, which is reported as between 0.1 per cent and 1 per cent annually depending on age (Heaney, 2002). Therefore, judgement will be required as to the acceptable level of risk. Much has been written on this subject, and many States apply a threshold of risk of no greater than 1 per cent per annum for an individual in the multi-pilot, professional operational environment, this being derived from a computation of acceptable risk of a catastrophic accident, relative to risks from other causes relating to aircraft operation (Tunstall-Pedoe, 1984). The detail will not be repeated here but the essential concept is that the 1 per cent threshold was calculated to produce a risk of catastrophic pilot incapacitation which was no greater than other catastrophic system failures such as those of major aircraft engineering systems. It has been argued more recently that the threshold of 1 per cent could be revised (Mitchell and Evans, 2004), but the important principle is that medical examiners should have a good understanding of the way in which aeromedical risk is assessed and of its limitations. (See Part I Chapter 3, Flight Crew Incapacitation, for further discussion of in-flight incapacitation and acceptable aeromedical risk.)

The frequency of actual in-flight incapacitations is not known (De John, 2004) and in order to gain better information, ICAO has adopted a recommendation that States establish mechanisms to collect data on in-flight incapacitation (ICAO Annex 1, paragraph 1.2.4.2, applicable November 2010). The chief protection against incapacitation in air transport aircraft is the presence of a second pilot, coupled with the training of pilots in dealing with an incapacitation emergency (De John, 2004). Similarly with air traffic controllers, protections exist when multiple controllers and supervisors can detect incapacitation and take over duties.

However, risk of incapacitation occurring from some unexpected event is only one of the areas evaluated in the aviation medical examination. Others include:

— assessment of functional ability to conduct aviation duties. Obvious examples include impairment of vision, hearing or mobility. Assessment of such functions requires application of standards and consideration of the aviation environment in which the individual may be working;

— assessment of conditions which may deteriorate because of the flight environment and thus impair flight safety. For example, an applicant with asthma could remain well on the ground, but experience an acute exacerbation when exposed to reduced oxygen pressures and cold temperatures associated with an explosive decompression at altitude. Alternatively, a pilot who has recently had a retinal detachment treated by injecting gas into the eyeball will be at risk of adverse effects on vision if exposed to low atmospheric pressure at high altitude;

— assessment of conditions which may be aggravated by the work environment. Examples include hearing loss which could be accelerated by exposure to noisy aviation environments. This is a slightly different consideration, related more to the occupational health of the individual than directly to the safety of flight – such aspects involve the effect of work on health, rather than the effect of health on work. It is arguable whether protection of the health of an individual is an appropriate objective of the regulatory authority, but in practice it is almost certain to be encompassed within the medical examination process.

In addition, two other processes may be considered. The first is the provision of health advice (for example, discussion of lifestyle factors such as smoking and exercise). Whilst it may be argued that this is not strictly the role of the aviation medical examiner, many medical practitioners, and applicants, would consider it appropriate, indeed best practice, to discuss such factors as they arise in the course of the medical examination process, and advice on these factors may be relevant to the applicant's future fitness for aviation duties.

The second process is that of building rapport between examiner and applicant, to facilitate declaration of medical conditions or events. At the time of the periodic medical examination, the applicant answers direct questions about such aspects, but since such examinations tend to occur annually or less frequently, most medical conditions arise in between medical examinations, and the processes for reporting them (including use of medications) are generally less regulated than those for the periodic medical assessments. Thus it is the pilot or air traffic controller who must decide whether to notify the Licensing Authority, and the degree of rapport with the medical examiner may be a factor in his decision.

ICAO has made progress in this area, and has introduced a recommendation in Annex 1 regarding reporting illness on occasions other than the routine medical examination:

> 1.2.6.1.1 **Recommendation.—** *States should ensure that licence holders are provided with clear guidelines on medical conditions that may be relevant to flight safety and when to seek clarification or guidance from a medical examiner or Licensing Authority.*

Handling such reporting should therefore be a competency of medical examiners so that they can make sound decisions on whether a pilot may continue to fly with a certain condition or treatment.

1.3   EXPLANATORY NOTES ON THE COMPETENCY FRAMEWORK

1.   Structure

The competency framework has four tier levels:

- 0.   Competency unit ("The main processes are…")
- 0.0   Competency element ("The steps within those processes that a competent designated medical examiner is expected to take are…..")
- 0.0.0   Performance criteria ("The DME will normally be expected to perform ……")
- 0.0.0.0 Evidence and assessment guide ("At the completion of training, the examiner will be able to demonstrate that he can….. ")

2.   Context

Some States have well-established training programmes which produce examiners who meet the competencies set out in this document. Other States may be seeking to establish courses which meet ICAO requirements, and this competency framework will provide the foundation for creating such programmes. In addition, programmes may be established to train medical examiners for a variety of different States. This framework provides direction as to the generic training applicable to all States, as well as those aspects which will need to be provided for, or on behalf of, each individual State to meet its specific requirements.

Amongst the various performance criteria and evidence and assessment guides are many items which will vary depending on the State in which the examiner is working. These context-specific items are shown in *italics*. If training is delivered for a future examiner who will work for a specific Licensing Authority, e.g. a Licensing Authority in a State other than that in which the training is being provided, it will be necessary for the information relevant to these items to be provided to the future DME by that Licensing Authority. For example, the medical form to be completed by an applicant may vary from one Licensing Authority to another, as may the administration process after its completion.

The relevant information could be provided in two ways — either the training organization will access the relevant up-to-date training requirements from the other State's Licensing Authority and provide these to the student(s) as part of the training course, or the examiner will receive extra training from the Licensing Authority separate from the training

course. In the absence of requirements to the contrary, the training provider may wish to train in accordance with normal practice for the State in which training takes place, in order to illustrate one acceptable method.

3.   Foundation knowledge

The draft competency framework is based on the need to train for skills required by the medical examiner in order to undertake a medical assessment of a licence applicant. In addition to the competency-based framework, foundation knowledge is essential for a medical examiner. It is up to the States/training providers to determine whether such foundation knowledge can be acquired as an integral part of a competency-based training programme for medical examiners or through a separate training programme acceptable to the Licensing Authority. This foundation knowledge includes aspects of aviation physiology, knowledge of clinical aviation medicine as it pertains to conditions of relevance for aviation, and aspects of regulatory medicine (such as ICAO terms, and relevant Standards and Recommended Practices). Included in this chapter is an item on the critical analysis of medical information, such as specialist reports — which is important since the writers of such reports may take the role of advocate for their patient, or they may express opinions as to fitness for flying which are not based on a sound understanding of the flying environment and their patient's role in it. Also included is an item on the concepts of risk management (including risk assessment through evaluating likelihood and consequence, and application of risk mitigation strategies) and how they can be applied to aeromedical decisions.

Appendix A outlines suggested minimum contents for this foundation knowledge.

Notes on specific aspects of the competency framework

The competency units and elements, performance criteria, and evidence/assessment guide items are listed here with explanation of key items (context-specific items are in italics). The complete Competency framework, without the addition of explanatory notes, is in Appendix B.

1.   FACILITATE COMMUNICATION

1.1   Initiate the interaction and agree the terms

This unit is largely procedural but is an important competency for the examiner to demonstrate. As each State will have its own procedures, these elements are mainly context-specific.

1.1.1   *Identify the applicant*
           1.1.1.1   Explain the importance of positive identification
           1.1.1.2   List the licensing authority's requirements for identification of applicants
           1.1.1.3   Describe the process by which an applicant is identified

1.1.2   *Have appropriate forms completed (including any declarations and consents)*
           1.1.2.1   Describe how to access the current versions of all available forms
           1.1.2.2   Explain how to select the appropriate forms for the given applicant
           1.1.2.3   List any aspects of the forms requiring particular explanation to applicants
           1.1.2.4   Describe process for checking the completion of the forms (including declarations and consents)
           1.1.2.5   Describe the actions in the event of improperly completed forms (including declarations and consents)
           1.1.2.6   Explain the consequences of false declaration

1.1.3   Clarify administrative details

    1.1.3.1 Explain the licensing authority's requirements for checking background details (e.g. licence, current/previous certificate, existing limitations) and the reasons for checking these

    1.1.3.2 Explain the licensing authority's other administrative requirements (e.g. collecting a fee)

1.1.4   Verify that the regulatory context of the process has been addressed

    1.1.4.1 Explain the medical examiner-applicant relationship

    1.1.4.2 Describe any potential/actual conflicts of interest (e.g. personal relationship, airline examiner) and how they would be managed

1.1.5   Provide applicant with information about privacy/confidentiality

    1.1.5.1 Explain who owns and who has access to the medical assessment report and associated documentation and information provided by the applicant

    1.1.5.2 Outline how this is explained to the applicant

In that medical examiners are designated by the State, the responsibility of those examiners is to assist States in fulfilling their responsibility to minimize flight safety risk. This role is different from many, or most, other clinical roles in which the doctor's primary responsibility is to the patient. In situations where these interests may be in conflict, the designated medical examiner's ultimate responsibility is to the State. In many States this can be complicated by the fact that the applicant may pay the regulatory examiner for the medical examination. However the lines of responsibility should be clear. An example of where a conflict may arise is when an applicant does not want a medical condition disclosed to the Licensing Authority, but the examiner believes the condition to have important safety implications. The examiner needs to be clear on how the safety obligation relates to the applicant's wishes, and what the examiner's legal obligations are regarding the release of this information. Any conflicts of interest must be understood by the examiner and managed carefully. The processes for dealing with confidentiality, consent, and disclosure need to form part of medical examiner training.

1.2   Establish rapport and encourage an open reporting environment

The use of the terms "medical examiner" and "medical examination" are relevant. The perception of many, including aviators, legislators and even DMEs themselves, is that the process of examination is an inspection aimed to identify medical conditions with potential adverse effect upon the safety of flight. This is true for only a few conditions; many relevant disorders are not detectable on physical examination, and the examiner often has to rely on information provided by the applicant. For example, a pilot or controller who suffers seizures or frequent fainting attacks is likely to appear normal on physical examination. In most cases, such conditions will only come to light when declared by the applicant, and the most effective mechanism for learning about such conditions is by encouraging open declaration by applicants.

Potential barriers to declaration by the applicant may include:

    i)   Not understanding the requirement to declare, or the significance of, a particular medical condition.

    ii)   Forgetting a medical condition or event.

    iii)   Fear of losing a valid Medical Assessment — of being unable to fly/work either temporarily or permanently.

    iv)   Mistrust of the examiner or of the aviation regulatory system. If the perception is that declaration of a problem will inevitably or unreasonably lead to cessation of flying or working, this will represent a barrier to reporting.

    v)   Guilt, shame or embarrassment — particularly for conditions in which a degree of denial is a recognized feature (such as substance dependence, psychiatric illness, eating disorder).

It is apparent that non-declaration is a common occurrence in some jurisdictions. Canfield et al (2006) compared medications found post-mortem in pilots involved in fatal crashes with the medical conditions and medications which they had declared to the U.S. Federal Aviation Administration, and found evidence of under-reporting by pilots in that

jurisdiction: of 387 pilots found to be taking medications, only 26 per cent had reported taking any medication, and only 8 per cent had reported correctly. Other studies have described similar evidence of under-reporting (Hudson, 2002; Sen, 2007).

It is believed by ICAO that medical conditions are more likely to be communicated when an environment of trust is achieved between the examiner and applicant. This is most easily achieved when a relationship is established over time. While some commentators have pointed to the risks of collusion between examiner and applicant (a factor addressed in 1.1.4.1 above), there is potentially a greater risk in the examiner not being provided with important safety-related information. Therefore, through the creation of an environment where open disclosure is encouraged, the medical examiner may potentially have a great impact on flight safety. Contact between examiner and applicant is typically infrequent and brief; it is therefore suggested that medical examiners should be encouraged to put effort into building rapport with the applicant as far as is possible within these constraints. Many factors in the environment and the interaction of the medical examination can contribute to such rapport.

1.2.1   Initiate interaction and discussion about general issues in such a way as to promote a non-threatening environment:

        a)   explain the importance of the initial moments of interaction;

        b)   list aspects of design/setup of the office or consulting room likely to help put applicants at ease;

        c)   list factors in the aviation medical process that may create a threatening environment;

        d)   list opening questions and comments appropriate for an aviation medical examination; and

        e)   list aspects of body language that facilitate rapport.

1.2.2   Enquire about work and home situations and challenges:

        a)   explain the importance of domestic and professional stressors on aviation performance and safety;

        b)   list areas of home and work life which may be appropriate to discuss;

        c)   identify suitable times in the encounter to enquire about work and home situations;

        d)   describe an open-ended question and explain the value of such questions and follow-up questions; and

        e)   list typical work and home challenges faced by aviation professionals.

If appropriately timed and executed, this discussion of work and home life has the dual benefit of promoting rapport and providing insight into the current circumstances of the applicant (item 2.2.7 below refers).

1.2.3   Demonstrate familiarity with typical aviation workplaces:

        a)   demonstrate familiarity with the workplaces of professional pilots and air traffic controllers; and

        b)   provide evidence of having visited a range of such workplaces (such as airliner flight decks, aircraft/ air traffic control simulators, flying schools, control towers, radar centres).

An examiner who has a familiarity with the work and workplace of an applicant is more likely to be trusted to understand the information provided by the applicant. An effective medical examiner will understand the flight environment, the stressors of flight and the roles of pilots and air traffic controllers, and will have gained familiarity with their workplaces;

knowledge and experience of those workplaces is a requirement of medical examiners under ICAO Annex 1 which states:

> 1.2.4.5.2 Medical examiners shall have practical knowledge and experience of the conditions in which the holders of licences and ratings carry out their duties.

When unfamiliar with the applicant's particular workplace, the examiner should at least display an interest in learning more.

1.2.4   Show interest in the applicant's general health and well-being:

   a)   explain the importance and relevance of discussing lifestyle/wellness characteristics and behaviours such as exercise, diet, alcohol and drug use, smoking and sleep;

   b)   describe typical health queries that may arise in discussion;

   c)   explain the importance of addressing these queries when they arise and providing advice; and

   d)   explain the process for dealing with health issues beyond the scope of the aviation medical examination.

Usually the medical examiner does not act as treating physician and, traditionally, the formal regulatory approach considers only the fitness for a Medical Assessment which may not appear to require evaluation of lifestyle or provision of preventive advice. However these issues have potential long-term implications for the applicant's health (Feig, 2005; About USPSTF, 2010) and the regulatory examination may provide an opportunity to engage in discussion about important health-related issues, as well as building trust. For some conditions, it may well be that efforts to encourage interventions which prevent future illness are of greater long-term safety benefit than efforts to detect such illness once they have developed. For example, the US preventive services task force found better evidence for benefit to health from advice on stopping smoking than from routine screening for coronary heart disease.

2.   GATHER AND PROCESS RELEVANT INFORMATION ON THE APPLICANT'S HEALTH STATUS

2.1   Elicit and evaluate medical history

As outlined above, a large number of the medical conditions relevant to safety will be identified only when declared by the applicant. An essential part of the aviation medical examination is thus a comprehensive medical history. This is usually facilitated by written questionnaire. The answers provided by the applicant may lead to further questioning by the examiner. It is easily argued that this medical history is a more critical component than the physical examination, and the examiner needs to be skilled at evaluating the information which has, or has not, been provided. Evaluating medical history is a core clinical skill of any medical practitioner, but in the aviation setting it is conducted and applied somewhat differently.

2.1.1   Question the applicant on the written history to elicit further detail on positive or omitted responses:

   a)   explain limitations of a written history questionnaire;

   b)   describe process used to check for omissions;

   c)   describe process for identifying key positive responses;

   d)   describe process for enquiring further into key positive responses;

     e)   list examples of key omitted responses; and

     f)   list examples of key positive responses.

2.1.2   Question applicant on negative responses in written history which may be relevant (as indicated by other responses):

     a)   describe process for identifying key negative responses;

     b)   describe process for enquiring further into key negative responses; and

     c)   list examples of key negative responses.

2.1.3   Question further in accordance with the risk profile of the applicant:

     a)   identify typical demographic and other factors which lead to risk of underlying conditions; and

     b)   list examples of specific questions that would be appropriate for specific risk profiles.

2.1.4   Continually update mental picture of potentially important issues:

     a)   list examples of areas from history that may require particular attention during subsequent examination;

     b)   describe how to identify and prioritize these issues for subsequent examination;

     c)   identify from a given medical history, the potentially important issues; and

     d)   demonstrate how to prioritize these issues with respect to flight safety risk.

2.2   Perform examination

The systematic physical examination is, on its own, not highly effective as a means of detecting important medical illness. However, as mentioned earlier, it may be the part of the medical assessment which is accorded the greatest weight by applicants. This is useful as it is important as a means of verifying matters raised in the history, and of conveying professionalism and trustworthiness.

2.2.1   Perform a systematic examination according to the requirements of the licensing authority:

     a)   *demonstrate how to find the licensing authority's requirements for examination;*

     b)   explain the objectives, purpose and limitations of physical examination;

     c)   describe a logical sequence of a full physical examination;

     d)   list processes used to avoid omissions; and

     e)   describe how the examination may be targeted to focus on specific systems or areas.

Much of the physical examination is routine and is part of the daily practice of all doctors. The examiner should be able to perform it in a systematic and comprehensive manner, but with extra attention to target areas which may have been highlighted in the foregoing medical history. Additionally, certain components stand out in terms of relevance to aviation

safety and the frequency of problems, and therefore merit particular focus during the examination, and these are outlined below.

2.2.2   Perform targeted examination as indicated:

     a)   describe how the examination may be targeted based on the history findings; and

     b)   describe how the examination may be targeted based on general examination findings or observation of the applicant.

The age and other demographic characteristics of the applicant should be considered; the more likely issues for the current age group or profile should be given particular attention. ICAO has recommended (2009) that States allow medical examiners to omit certain elements of the routine physical examination of applicants aged under 40, in favour of concentrating on those items considered most relevant to the risk profile of the applicant (Annex 1, 6.3.1.2.1).

2.2.3   Focus examination on higher risk areas pertaining to incapacitation:

     a)   identify aspects of the physical examination which may require particular attention with regard to incapacitation risk; and

     b)   describe the process for carrying out these aspects of the examination.

As discussed earlier, most causes of an incapacitation that is potentially possible to identify during a periodic medical examination are more likely to be identified from medical history than from medical examination; however, the examination of the cardiovascular system in particular may provide valuable information, especially in the older applicant.

2.2.4   Focus examination on high risk areas pertaining to functional capacity, specifically visual acuity:

     a)   *list the licensing authority's requirements for testing distance and near vision*;

     b)   demonstrate or describe the process for testing and recording distance and near visual acuity, corrected and uncorrected;

     c)   identify potential errors in the process and how to avoid them; and

     d)   *describe the actions to be taken following an abnormal result*.

Of the special senses, vision (including colour vision) and hearing should be highlighted, both as part of the examination and in the training of examiners.

2.2.5   Focus examination on high risk areas pertaining to functional capacity, specifically colour vision:

     a)   *list the licensing authority's requirements for testing color vision;*

     b)   demonstrate or describe the process for color vision screening using pseudoisochromatic plates;

     c)   identify potential errors in the process and how to avoid them; and

     d)   *describe the actions to be taken following an abnormal result.*

Pseudoisochromatic plates are mentioned specifically because of their prominence in colour vision assessment and because they are mentioned in Annex 1, Standard 6.2.4.3:

6.2.4.3   The applicant shall be tested for the ability to correctly identify a series of pseudoisochromatic plates in day-light or in artificial light of the same colour temperature such as that provided by CIE standard illuminants C or D_{65} as specified by the International Commission on Illumination (CIE).

However if new technologies are developed and introduced, medical examiners will need to be competent with their use.

2.2.6   Focus examination on high risk areas pertaining to functional capacity, specifically hearing:

    a)   demonstrate the whispered voice test; and

    b)   describe techniques using a tuning fork or other suitable methods to distinguish conductive from sensorineural hearing loss.

While many States use audiometry routinely it is not required at every examination and there is still a need to employ clinical techniques in the assessment of hearing.

2.2.7   Focus examination on high risk areas relating to behaviour, specifically evaluating psychiatric and psychosocial factors:

    a)   describe methods for assessing psychiatric function in an aviation medical setting;

    b)   identify important indicators as to abnormal psychiatric function;

    c)   describe methods for further evaluating these indicators;

    d)   explain the importance of current psychosocial factors;

    e)   describe methods for gaining insight into psychosocial factors; and

    f)   describe methods for further evaluating the severity and impact of these factors.

Perhaps the most important areas of the examination relate to behaviour. An important competency in this regard is the evaluation of psychiatric and psychosocial factors. This phrase may appear to confuse different elements, but is chosen deliberately. A full psychiatric examination would not normally be conducted by an aviation medical examiner: it should, however, be normal in the course of an assessment to undertake some empirical evaluation of the features of psychiatric illness including behaviour, appearance, orientation, memory, form and content of thought, mood and affect/emotion.

Similarly, although time precludes a full psychological evaluation, it would be valuable for medical examiners to gain some degree of insight into the psychological milieu and social circumstances of the applicant, in a discussion of such areas as domestic/family situation and work stresses, which is referred to in 1.2.2 above. It could be argued that this is at least as important as many other parts of the traditional physical examination. Many of the conditions which could be contributory to an accident are not major medical problems but situational i.e. dependent on the current circumstances in which an individual finds himself. Current life events or concerns such as relationship worries, domestic strife, family stress, financial difficulty, work challenges (including fatigue), or workplace conflict (or even positive events such as marriage, new baby or promotion) have potential to cause preoccupation and distraction in pilots or air traffic controllers and may thus have a significant impact on flight safety, even if they do not constitute a medical condition or diagnosis. The DME is well placed to identify such situations and discuss them with the applicant to ensure that adequate professional support is provided, whether non-medical or medical, and also that good judgement is exercised by the applicant as to temporarily avoiding flying where appropriate. Further guidance concerning mental health and behavioural issues can be found in Part I, Chapter 2 and Part III, Chapter 9.

2.2.8   Focus examination on high-risk areas relating to behaviour, specifically identifying abnormal cognitive functions:

      a)   list typical important causes of abnormal cognition in aviation applicants;

      b)   list indicators of abnormal cognitive function; and

      c)   identify available tools for further evaluating cognitive function.

A distinction is drawn between psychiatric and psychosocial factors, and cognitive function. While decline in cognitive function is often discussed in connection with the ageing pilot, it is relevant to many other situations such as head injury, depression, cerebrovascular disease, and problematic use of substances. Cognitive decline occurs normally with age, but the rate and onset are not predictable, and it may present in aviation professionals well before their typical retirement age. Whilst such decline might be better detected in an operational environment (such as by simulator assessments or in-flight performance checks ('line checks')) it may also be the medical examiner who is first able to detect such changes. Competency in evaluating cognitive function would in such cases support the required evaluation of psychiatric/ psychological factors. The use of short-term memory tests, mini-mental status questionnaires, and other simple office-based assessments can form an initial evaluation of cognitive function when a suspicion of deterioration exists.

2.2.9   Focus examination on risk areas relating to behaviour, specifically assessing for potential problematic use of substances (such as alcohol, prescription and non-prescription medications, and non-prescription drugs used for recreational purposes):

      a)   explain the importance of problematic use of substances in the aviation workplace;

      b)   list features of problematic use of substances including the differences between abuse and dependence;

      c)   describe how prescription medication may result in problematic use;

      d)   describe how non-prescription (over the counter) medication may result in problematic use;

      e)   list indicators of problematic use of substances;

      f)   identify available tools for further evaluating problematic use of substances;

      g)   outline processes for determining the likelihood of substance dependence; and

      h)   identify available management options for applicants with problematic use of substances.

Detection of problematic use of substances, including potential substance use disorders and particularly substance dependence and substance abuse, is emphasized here. Substance dependence is accepted as a medical condition under both the American Psychiatric Association's DSM-IV and the World Health Organization's ICD-10 ("dependence syndrome") and its detection is made difficult by the characteristic feature of denial. It is therefore suggested that medical examiners should be required to have a level of competency in the detection and evaluation of substance use disorders. This should include familiarity with the ICAO *Manual on Prevention of Problematic Use of Substances in the Aviation Workplace* (Doc 9654).

The management of substance dependence in aviation is one demonstration of the value of open reporting systems, in the form of programmes such as that known in the United States as the Human Intervention Motivation Study (HIMS). Prior to the 1970s a diagnosis of substance dependence, including dependence on alcohol, led to permanent disqualification, with the consequence that detection rates were very low (as most pilots were unwilling to admit to their

problem). The HIMS programme introduced a pathway by which substance-dependent pilots could, with successful treatment and follow-up measures in place, be allowed to return to flying in a supervised ongoing recovery programme. Well over 4 000 pilots have been returned to flying through HIMS in the past few decades (Hudson, 2009). Many other States have analogous programmes in place. Medical examiners should have a sound understanding of such programmes and their place in the management of substance use disorders in aviation.

Whilst it might be argued that problematic use of substances is merely a component of psychiatric and psychological evaluation, it is emphasized separately here because of the disproportionate contribution of alcohol and other drug-related issues in medical cause accidents (see also Part III, Chapter 9, *Mental Health*). It is suggested that these or similar tools should be incorporated into the training and competencies of examiners.

2.2.10   Focus examination on high risk areas pertaining to functional capacity, specifically sleep disorders and fatigue:

>   a)   explain the importance of sleep disorders in commercial aviation;

>   b)   list features of circadian rhythms, normal sleep patterns, and common sleep disorders;

>   c)   list appropriate questions to ask about sleep and fatigue;

>   d)   list physical signs associated with sleep disorders;

>   e)   describe processes for further evaluating and treating a possible sleep disorder;

>   f)   describe how risk of fatigue can be minimized by sleep hygiene measures; and

>   g)   describe how medication may be used to minimize fatigue risk, and list precautions to be taken.

The final area which deserves highlighting is that of common sleep disorders, principally obstructive sleep apnoea. The potential flight safety consequences of somnolence are evidenced by a 2009 case of two pilots overflying their destination while asleep (National Transportation Safety Board, 2008), which has been linked in part to a diagnosis of sleep apnoea in one of the pilots. Sleep apnoea is probably significantly under-diagnosed in commercial aviation as it is in drivers (Krieger, 2007) and is likely to be missed unless specific questioning is undertaken on symptoms such as snoring, observations on breathing by the bed partner, daytime sleepiness and nocturnal sweating, and the examiner should be extra vigilant in applicants with Type 2 diabetes mellitus or a large neck circumference. This latter measurement is therefore one area which should be noted on physical examination.

The use of hypnotics by applicants is also an issue that needs to be addressed during training. Many Licensing Authorities accept that such medication has a place in regulatory aviation medicine, but clearly some hypnotics are unsuitable. Topics that should be addressed are:

- Acceptable medications
- Relevant pharmacology, e.g., duration of effect
- Minimum time required between ingestion and reporting for duty
- Need for licence holders to avoid "over the counter" medication or unsupervised treatment
- Requirement for those providing advice to licence holders to fully understand the operational context of licence holders.

Part III, Chapter 17, Fatigue and flight operations, provides further information concerning sleep disorders and fatigue.

2.3   Conduct and interpret results of routine investigations required by the licensing authority

Additional reports are received in association with the medical examination and need to be interpreted by the examiner. In some States these may be numerous, but as a minimum, examiners will be receiving electrocardiograms, audiometry (in most States) and in some cases, vision reports. These relate to key organ systems and a degree of expertise in their interpretation should be expected of medical examiners.

2.3.1   Conduct and interpret electrocardiograms:

   a)   *identify the licensing authority's requirements for conducting electrocardiograms*;

   b)   describe how to prepare applicant and set up equipment;

   c)   describe how to optimize electrode contact and avoid interference;

   d)   demonstrate the correct positioning of leads and how to identify lead reversal;

   e)   identify common normal electrocardiographic variants;

   f)   identify important disturbances of rate, rhythm and axis such as heart blocks, atrial fibrillation, supraventricular tachycardia, and bundle branch blocks;

   g)   identify left ventricular hypertrophy; and

   h)   identify old or recent myocardial infarction, and current ischaemia.

2.3.2   Interpret pure-tone audiometry (or alternative methods of assessing hearing):

   a)   *identify the licensing authority's requirements for conduct of audiometry*;

   b)   describe how pure-tone audiometry is undertaken;

   c)   explain temporary threshold shift and its importance;

   d)   identify significant hearing loss;

   e)   identify asymmetric hearing loss and describe its importance;

   f)   describe how to distinguish conductive from sensorineural hearing loss;

   g)   list potential causes of conductive hearing loss;

   h)   list potential causes of sensorineural hearing loss;

   i)   identify follow-up actions for various causes of hearing loss; and

   j)   describe alternative methods of assessing hearing and their merits.

2.3.3   Interpret vision testing:

   a)   *identify the licensing authority's requirements for vision testing*;

b)   identify the applicable standards for distance and near vision;

c)   explain myopia, hyperopia (hypermetropia), presbyopia and astigmatism;

d)   correctly interpret refractive errors from ophthalmology or optometry reports;

e)   explain the importance of phorias to flight safety;

f)   describe the features of spectacles and contact lenses;

g)   list flight safety concerns with common spectacle and contact lens types; and

h)   list flight safety concerns with common types of refractive surgery.

2.4   Request and interpret additional investigations and reports, as indicated

On the basis of findings from history, examination and any required routine investigations, the medical examiner may request and organize further investigations. This process requires the application of skills which are fundamental to medical practice, using an understanding of the patterns of findings from history, examination, and routine investigations, and formulating new questions to be answered by further investigation.

2.4.1   Recognize common patterns from clinical findings which suggest the need for further examination:

a)   identify examples of common symptom patterns from history which suggest the need for investigation;

b)   identify examples of common patterns of examination signs which suggest the need for investigation; and

c)   identify examples of common abnormalities of routine investigations which suggest the need for further investigation.

2.4.2   Arrange appropriate investigations:

a)   from common examples of medical conditions, describe the approach to selecting investigations;

b)   describe how to arrange the appropriate investigations; and

c)   review the investigation findings and report findings.

3.   USE THE AVAILABLE MEDICAL INFORMATION
          TO FACILITATE A COMPLETE MEDICAL ASSESSMENT

3.1   If required by the licensing authority, provide a risk-based aeromedical opinion

In assessing an applicant who does not fully meet the relevant medical Standards, often a degree of judgement is involved and this is recognized by ICAO in the concept of "flexibility" wherein, even though there is a medical Standard, and the applicant does not meet that Standard, "accredited medical conclusion indicates that ….exercise of the privileges of the licence applied for is not likely to jeopardize flight safety" and this conclusion takes into consideration the relevant ability, skill, and experience of the applicant as well as any limitations placed on the licence holder (Annex 1, 1.2.4.9).

In many States medical examiners not only conduct examinations, they also have the authority to issue or decline a Medical Assessment. In some States this is a temporary decision pending confirmation by the Licensing Authority; in others it is the substantive decision. In some States, the medical examiner may even have the authority to form an accredited medical conclusion. Even in States where the regulatory authority makes the "issue/decline" decision centrally, the medical examiners may be asked to advise pilots or controllers on temporary unfitness. Almost inevitably, examiners will be making aeromedical dispositions, which is the core function of civil aviation medicine practitioners.

3.1.1   Compile and review findings

a) describe process for reviewing the findings from history, examination and investigations, and compiling a list of relevant medical conditions and considerations; and

b) describe process for checking completeness of the compiled information and preparing for communication to relevant parties.

3.1.2   Consider work context and assess risk:

a) identify aspects of the applicant's work and work environment which affect the level of flight safety risk associated with the medical condition;

b) identify possible restrictions or other risk mitigating factors which could be applied; and

c) taking those factors into account, describe the process for assessing the flight safety risk imposed by the applicant's medical conditions, to estimate the severity and likelihood of aeromedical consequences from those conditions.

3.1.3   Formulate recommendation:

a) list the steps for preparing a recommendation or opinion to the licensing authority; and

b) demonstrate how to make a recommendation from an example of clinical material.

3.1.4   *Communicate opinion to applicant and authority as required:*

a) state the licensing authority's requirements for provision of recommendations and opinions;

b) describe the required process for communicating the recommendation/opinion;

c) list any potential legal considerations associated with communicating this information.

The procedures for communication will be context-specific, and each State will need to ensure that its examiners are familiar with the relevant procedures.

3.2   Conduct administrative processes

Although the processes and detail may vary greatly amongst States, it is inevitable that one of the key areas of competency for examiners will be the administrative process associated with medical examinations. These will include elements such as record keeping, reporting and communicating with the Licensing Authority, and maintaining medical confidentiality. It will also encompass participating in and supporting whatever review or audit process is undertaken by the Licensing Authority. There may be elements of follow-up required of the applicant such as periodic review during the period of validity of the Medical Assessment. Good medical practice requires that one examiner alone is not responsible for assessing fitness without some form of routine audit by another appropriately trained individual. All of the

administrative processes will be context-specific so that each State will need to ensure the competency of its examiners in this area.

3.2.1 *Collate documents and correspond with the licensing authority:*

    a) *describe the process for collating the documents and assembling those required to be sent to the Licensing Authority;*

    b) *State requirements for communication with the Licensing Authority;*

    c) *State requirements imposed by the Licensing Authority for review or audit of medical examinations; and*

    d) *describe the process for participating in review or audit.*

3.2.2 *Communicate and store information as required:*

    a) *describe the requirements for communicating with the Licensing Authority, the applicant, and any other applicable party;*

    b) *describe how to reference the data protection/privacy requirements which apply to medical examination records;*

    c) *describe the processes for protecting and securing records; and*

    d) *describe to whom records may be released, and under what circumstances.*

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Appendix A

SUGGESTED MINIMUM FOUNDATION KNOWLEDGE REQUIRED FOR A MEDICAL EXAMINER

As explained earlier, all examiners will be involved to some extent in making fitness decisions concerning medical conditions. To do this the medical examiner must build on a sound understanding of the regulatory framework, responsibilities and accountabilities, including the process of flexibility as per Standard 1.2.4.9 of Annex 1. This will be achieved by employing knowledge of clinical aviation medicine, taking into account aspects of risk management.

As background for evaluating aeromedical issues, examiners need to learn about the psychological and physiological challenges of flight. The following summary is suggested as a reasonable basis of knowledge to support the specific competencies within the framework given above. These subjects could be taught in a knowledge-based manner or as part of a competency-based programme.

Aviation physiology

- Cognition and aviation
- Decision making and communication in aviation
- Sleep and fatigue as related to commercial aviation
- Physics of the atmosphere; effects of altitude on trapped gas
- Effects of hypoxia
- Functional aspects of vision relevant to aviation
- Spatial disorientation
- Effects of acceleration

Clinical aviation medicine

- Aspects of incapacitation in flight
- Effects of ageing as related to flight safety
- Cardiological conditions relevant to flight
- Neurological conditions relevant to flight
- Ophthalmological conditions relevant to flight
- Ear/nose/throat conditions relevant to flight
- Respiratory conditions relevant to flight
- Psychiatric conditions relevant to flight
- Metabolic/endocrine conditions relevant to flight
- Other conditions relevant to flight (especially gastro-enterological, haematological, urological, renal, gynaecological/obstetric, orthopaedic and oncological disease)
- Medication relevant to flight

Public Health

- Introduction to the World Health Organization International Health Regulations (2005)
- Knowledge of SARPs related to public health
    - Annex 6 — *Operation of Aircraft*: On board medical supplies
    - Annex 9 — *Facilitation:* Public Health Emergency preparedness planning, Aircraft General Declaration
    - Annex 11 — *Air Traffic Services*: Aspects relevant to public health emergencies in contingency planning
    - Annex 14 — *Aerodromes*: Aspects relevant to public health emergencies in aerodrome emergency planning
    - *Procedures for Air Navigation Services — Air Traffic Management*: See Part III, Chapter 18, Appendix

Annex 18 — *The Safe Transport of Dangerous Goods by Air:* Carriage of medical items by air e.g. radioactive materials and biological specimens

Regulatory medicine

- Convention on International Civil Aviation and its Annexes
- ICAO Standards and Recommended Practices, with focus on medically related SARPs
- Licence types and differences in medical requirements between them
- ICAO Annex 1: difference between "Licence" and "Medical Assessment". Validity periods of Medical Assessments
- Application of "Flexibility Standard" 1.2.4.9 in Annex 1 and accredited medical conclusion
- Evaluation of evidence — critical appraisal of specialist reports and data
- Decrease in medical fitness — administrative process for an "unfit" decision
- Other medical regulations in the ICAO Annexes (psychoactive substances, fatigue, oxygen)
- Principles of risk management
- Principles of safety management, as applied to aviation medicine

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Appendix B

COMPETENCY FRAMEWORK

The competency framework has four tier levels:

0.   Competency unit ("The main processes are…")

0.0   Competency element ("The steps within those processes that a competent designated medical examiner is expected to take are…..")

0.0.0   Performance criteria ("The DME will normally be expected to perform ……")

0.0.0.0 Evidence and assessment guide ("At the completion of training, the examiner will be able to demonstrate that he can…..")

1.   FACILITATE COMMUNICATION

1.1   Initiate the interaction and agree the terms

This unit is largely procedural but is an important competency for the examiner to demonstrate. As each State will have its own procedures, these elements are context-specific.

1.1.1   Identify the applicant
           1.1.1.1 Explain the importance of positive identification
           1.1.1.2 List the licensing authority's requirements for identification of applicants
           1.1.1.3 Describe the process by which an applicant is identified

1.1.2   Have appropriate forms completed (including any declarations and consents)
           1.1.2.1 Describe how to access the current versions of all available forms
           1.1.2.2 Explain how to select the appropriate forms for the given applicant
           1.1.2.3 List any aspects of the forms requiring particular explanation to applicants
           1.1.2.4 Describe process for checking the completion of the forms (including declarations and consents)
           1.1.2.5 Describe the actions in the event of improperly completed forms (including declarations and consents)
           1.1.2.6 Explain the consequences of false declaration

1.1.3   Clarify administrative details
           1.1.3.1 Explain the licensing authority's requirements for checking background details (e.g. licence, current/previous certificate, existing limitations) and the reasons for checking these
           1.1.3.2 Explain the licensing authority's other administrative requirements (e.g. collecting a fee)

1.1.4   Verify that the regulatory context of the process has been addressed
           1.1.4.1 Explain the medical examiner-applicant relationship
           1.1.4.2 Describe any potential/actual conflicts of interest (e.g. personal relationship, airline examiner) and how they would be managed

1.1.5   Provide applicant with information about privacy/confidentiality
           1.1.5.1 Explain who owns and who has access to the medical assessment report and associated documentation and information provided by the applicant

1.1.5.2   Outline how this is explained to the applicant

1.2   Establish rapport and encourage an open reporting environment

1.2.1   Initiate interaction and discussion about general issues in such a way as to promote a non-threatening environment:

   a)   explain the importance of the initial moments of interaction;

   b)   list aspects of design/setup of the office or consulting room likely to help put applicants at ease;

   c)   list factors in the aviation medical process that may create a threatening environment;

   d)   list opening questions and comments appropriate for an aviation medical examination; and

   e)   list aspects of body language that facilitate rapport.

1.2.2   Enquire about work and home situations and challenges:

   a)   explain the importance of domestic and professional stressors on aviation performance and safety;

   b)   list areas of home and work life which may be appropriate to discuss;

   c)   identify suitable times in the encounter to enquire about work and home situations;

   d)   describe an open-ended question and explain the value of such questions and follow-up questions; and

   e)   list typical work and home challenges faced by aviation professionals.

1.2.3   Demonstrate familiarity with typical aviation workplaces:

   a)   demonstrate familiarity with the workplaces of professional pilots and air traffic controllers; and

   b)   provide evidence of having visited a range of such workplaces (such as airliner flight decks, aircraft/air traffic control simulators, flying schools, control towers, radar centres).

1.2.4   Show interest in the applicant's general health and well-being:

   a)   explain the importance and relevance of discussing lifestyle/wellness characteristics and behaviours such as exercise, diet, alcohol and drug use, smoking and sleep;

   b)   describe typical health queries that may arise in discussion;

   c)   explain the importance of addressing these queries when they arise and providing advice; and

   d)   explain the process for dealing with health issues beyond the scope of the aviation medical examination.

2.   GATHER AND PROCESS RELEVANT INFORMATION ON THE APPLICANT'S HEALTH STATUS

2.1   Elicit and evaluate medical history

2.1.1   Question the applicant on the written history to elicit further detail on positive or omitted responses:

   a)   explain limitations of a written history questionnaire;

   b)   describe process used to check for omissions;

   c)   describe process for identifying key positive responses;

   d)   describe process for enquiring further into key positive responses;

   e)   list examples of key omitted responses; and

   f)   list examples of key positive responses.

2.1.2   Question applicant on negative responses in written history which may be relevant (as indicated by other responses):

   a)   describe process for identifying key negative responses;

   b)   describe process for enquiring further into key negative responses; and

   c)   list examples of key negative responses.

2.1.3   Question further in accordance with the risk profile of the applicant:

   a)   identify typical demographic and other factors which lead to risk of underlying conditions; and

   b)   list examples of specific questions that would be appropriate for specific risk profiles.

2.1.4   Continually update mental picture of potentially important issues:

   a)   list examples of areas from history that may require particular attention during subsequent examination;

   b)   describe how to identify and prioritize these issues for subsequent examination;

   c)   identify from a given medical history, the potentially important issues; and

   d)   demonstrate how to prioritize these issues with respect to flight safety risk.

2.2   Perform examination

2.2.1   Perform a systematic examination according to the requirements of the licensing authority:

   a)   *demonstrate how to find the licensing authority's requirements for examination;*

   b)   explain the objectives, purpose and limitations of physical examination;

      c)   describe a logical sequence of a full physical examination;

      d)   list processes used to avoid omissions; and

      e)   describe how the examination may be targeted to focus on specific systems or areas.

2.2.2   Perform targeted examination as indicated:

      a)   describe how the examination may be targeted based on the history findings; and

      b)   describe how the examination may be targeted based on general examination findings or observation of the applicant.

2.2.3   Focus examination on higher risk areas pertaining to incapacitation:

      a)   identify aspects of the physical examination which may require particular attention with regard to incapacitation risk; and

      b)   describe the process for carrying out these aspects of the examination.

2.2.4   Focus examination on high risk areas pertaining to functional capacity, specifically visual acuity:

      a)   *list the licensing authority's requirements for testing distance and near vision*;

      b)   demonstrate or describe the process for testing and recording distance and near visual acuity, corrected and uncorrected;

      c)   identify potential errors in the process and how to avoid them; and

      d)   *describe the actions to be taken following an abnormal result*.

2.2.5   Focus examination on high risk areas pertaining to functional capacity, specifically colour vision:

      a)   *list the licensing authority's requirements for testing color vision;*

      b)   demonstrate or describe the process for color vision screening using pseudoisochromatic plates;

      c)   identify potential errors in the process and how to avoid them; and

      d)   *describe the actions to be taken following an abnormal result.*

2.2.6   Focus examination on high risk areas pertaining to functional capacity, specifically hearing:

      a)   demonstrate the whispered voice test; and

      b)   describe techniques using a tuning fork or other suitable methods to distinguish conductive from sensorineural hearing loss.

2.2.7   Focus examination on high risk areas relating to behaviour, specifically evaluating psychiatric and psychosocial factors:

      a)   describe methods for assessing psychiatric function in an aviation medical setting;

      b)   identify important indicators as to abnormal psychiatric function;

      c)   describe methods for further evaluating these indicators;

      d)   explain the importance of current psychosocial factors;

      e)   describe methods for gaining insight into psychosocial factors; and

      f)   describe methods for further evaluating the severity and impact of these factors.

2.2.8   Focus examination on high risk areas relating to behaviour, specifically identifying abnormal cognitive functions:

      a)   list typical important causes of abnormal cognition in aviation applicants;

      b)   list indicators of abnormal cognitive function; and

      c)   identify available tools for further evaluating cognitive function.

2.2.9   Focus examination on risk areas relating to behaviour, specifically assessing for potential problematic use of substances (such as alcohol, prescription and non-prescription medications, and non-prescription drugs used for recreational purposes):

      a)   explain the importance of problematic use of substances in the aviation workplace;

      b)   list features of problematic use of substances including the differences between abuse and dependence;

      c)   describe how prescription medication may result in problematic use;

      d)   describe how non-prescription (over the counter) medication may result in problematic use;

      e)   list indicators of problematic use of substances;

      f)   identify available tools for further evaluating problematic use of substances;

      g)   outline processes for determining the likelihood of substance dependence; and

      h)   identify available management options for applicants with problematic use of substances.

2.2.10   Focus examination on high risk areas pertaining to functional capacity, specifically sleep disorders and fatigue:

      a)   explain the importance of sleep disorders in commercial aviation;

b)   list features of circadian rhythms, normal sleep patterns, and common sleep disorders;

c)   list appropriate questions to ask about sleep and fatigue;

d)   list physical signs associated with sleep disorders;

e)   describe processes for further evaluating and treating a possible sleep disorder;

f)   describe how risk of fatigue can be minimized by sleep hygiene measures; and

g)   describe how medication may be used to minimize fatigue risk, and list precautions to be taken.

2.3   Conduct and interpret results of routine investigations required by the licensing authority

2.3.1   Conduct and interpret electrocardiograms:

a)   *identify the licensing authority's requirements for conducting electrocardiograms*;

b)   describe how to prepare applicant and set up equipment;

c)   describe how to optimize electrode contact and avoid interference;

d)   demonstrate the correct positioning of leads and how to identify lead reversal;

e)   identify common normal electrocardiographic variants;

f)   identify important disturbances of rate, rhythm and axis such as heart blocks, atrial fibrillation, supraventricular tachycardia, and bundle branch blocks;

g)   identify left ventricular hypertrophy; and

h)   identify old or recent myocardial infarction, and current ischaemia.

2.3.2   Interpret pure-tone audiometry (or alternative methods of assessing hearing):

a)   *identify the licensing authority's requirements for conduct of audiometry*;

b)   describe how pure-tone audiometry is undertaken;

c)   explain temporary threshold shift and its importance;

d)   identify significant hearing loss;

e)   identify asymmetric hearing loss and describe its importance;

f)   describe how to distinguish conductive from sensorineural hearing loss;

g)   list potential causes of conductive hearing loss;

    h)   list potential causes of sensorineural hearing loss;

    i)   identify follow-up actions for various causes of hearing loss; and

    j)   describe alternative methods of assessing hearing and their merits.

2.3.3   Interpret vision testing:

    a)   *identify the licensing authority's requirements for vision testing*;

    b)   identify the applicable standards for distance and near vision;

    c)   explain myopia, hyperopia (hypermetropia), presbyopia and astigmatism;

    d)   correctly interpret refractive errors from ophthalmology or optometry reports;

    e)   explain the importance of phorias to flight safety;

    f)   describe the features of spectacles and contact lenses;

    g)   list flight safety concerns with common spectacle and contact lens types; and

    h)   list flight safety concerns with common types of refractive surgery.

2.4   Request and interpret additional investigations and reports, as indicated

2.4.1   Recognize common patterns from clinical findings which suggest the need for further examination:

    a)   identify examples of common symptom patterns from history which suggest the need for investigation;

    b)   identify examples of common patterns of examination signs which suggest the need for investigation; and

    c)   identify examples of common abnormalities of routine investigations which suggest the need for further investigation.

2.4.2   Arrange appropriate investigations:

    a)   from common examples of medical conditions, describe the approach to selecting investigations;

    b)   describe how to arrange the appropriate investigations; and

    c)   review the investigation findings and report findings.

3.   USE THE AVAILABLE MEDICAL INFORMATION
          TO FACILITATE A COMPLETE MEDICAL ASSESSMENT

3.1   If required by the licensing authority, provide a risk-based aeromedical opinion.

3.1.1   Compile and review findings:

          a)   describe process for reviewing the findings from history, examination and investigations, and compiling
               a list of relevant medical conditions and considerations;

          b)   describe process for checking completeness of the compiled information and preparing for
               communication to relevant parties.

3.1.2   Consider work context and assess risk:

          a)   identify aspects of the applicant's work and work environment which affect the level of flight safety risk
               associated with the medical condition;

          b)   identify possible restrictions or other risk mitigating factors which could be applied; and

          c)   taking those factors into account, describe the process for assessing the flight safety risk imposed by the
               applicant's medical conditions, to estimate the severity and likelihood of aeromedical consequences
               from those conditions.

3.1.3   Formulate recommendation:

          a)   list the steps for preparing a recommendation or opinion to the licensing authority;

          b)   demonstrate how to make a recommendation from an example of clinical material.

3.1.4   Communicate opinion to applicant and authority as required:

          a)   state the licensing authority's requirements for provision of recommendations and opinions;

          b)   describe the required process for communicating the recommendation/opinion; and

          c)   list any potential legal considerations associated with communicating this information.

The processes for communication will be context-specific, and each State will need to ensure that its examiners are
familiar with the relevant procedures.

3.2   Conduct administrative processes

3.2.1   *Collate documents and correspond with the licensing authority:*

          a)   *described the process for collating the documents and assembling those required to be sent to the
               Licensing Authority;*

    b)   *State requirements for communication with the Licensing Authority;*

    c)   *State requirements imposed by the Licensing Authority for review or audit of medical examinations; and*

    d)   *describe the process for participating in review or audit.*

3.2.2   *Communicate and store information as required:*

    a)   *describe the requirements for communicating with the Licensing Authority, the applicant, and any other applicable party;*

    b)   *describe how to reference the data protection/privacy requirements which apply to medical examination records;*

    c)   *describe the processes for protecting and securing records; and*

    d)   *describe to whom records may be released, and under what circumstances*.

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