Chapter 2

physical and mental human performance factors which affect an Aircraft Maintenance Technicians (AMTs) working environment Factors include:

vision,

hearing,

information processing,

attention and perception,

memory,

judgment and decision making

Physical capabilities and limitations must be considered.

People can also fail to function properly affected by cold, accidents, poor judgment, etc.

VISION

Light enters the eye through the cornea, then passes through the iris and the lens, and finally falls on the retina • Light stimulates the sensitive cells on the retina (rods and cones) which then pass small electrical impulses by way of the optic nerve to the visual cortex in the brain

- Parts of human eye, operation of human eye

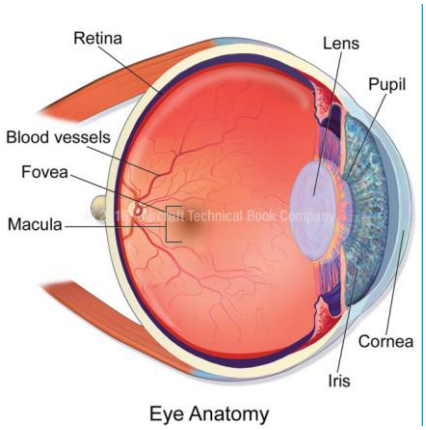
1) Cornea, clear window for focusing by the shape of the cornea bending

2) Iris, the colored part of the eye, controlling the amount of light entering the eye,

3) Pupil, the dark area in the center of the iris, that varies in size to change the light level

4) Lens, with a shape that changes by the muscles surrounding it. This change in shape is called accommodation. For focusing on a near object, lens thickens, for focusing on a distant object, lens is flattened.

5) Retina, located on the rear wall of the eyeball. It is made up of a complex layer of nerve cells connected to the optic nerve. Two types of light sensitive cells are found in the retina; rods and cones. It is here that the visual image is focused.



Eye Anatomy

- 20/20 visual acuity, Factors affecting visual acuity

Acuity of 20/20 vision should be able to see at 20 feet that which the so called “normal" person is capable of seeing at this range

• Factors affecting visual acuity:

1) Physical imperfections in one or both eyes (near sightedness, far sightedness) and age.

2) The influence of ingested foreign substances; drugs, medication, alcohol and cigarettes.

3) Environmental factors; the amount of light available, clarity of the air (e.g. dust, mist, rain, etc.).

4) Other factors associated with object being viewed such as:

• Size and contours of the object.

• Contrast of the object with its surroundings;

• Relative motion of the object.

• Distance of the object from the viewer.

• The angle of the object from the viewer.

BLIND SPOT

At the point at which the optic nerve joins the back of the eye, a 'blind spot' occurs.

Not evident when viewing with both eyes.

When viewing a stimulus that appears very fleetingly, that the blind spot may result in something not seen.

- Hyperopia/Hypermetropia what it is and what is causing

Hyperopia (farsightedness) also known as Hypermetropia:

1) a is caused by a shorter than normal eyeball which means that the image is formed behind the retina

2) Blurred vision will result when looking at close objects.

- Myopia nearsightedness: Myopia, what it is and what is causing

1) is where the eyeball is longer than normal, causing the image to be formed in front of the retina

2) Distant objects are blurred

3) A concave lens overcomes nearsightedness by bending light outwards before it reaches the cornea.

- Other visual problems: Cataract, astigmatism, glaucoma, migraine, what these eye imperfections are causing.

Cataracts: clouding of the lens usually associated with aging.

Astigmatism: a misshapen cornea causing objects to appear irregularly shaped.

Glaucoma: a buildup in pressure of the fluid within the eye which can cause damage to the optic nerve and even blindness

Migraine: severe headaches that can cause visual disturbances.

Foreign Substances: can get the Vision affected by drugs, medications, alcohol, smoking.

- Environmental factors affecting vision.

1) Lighting increases vision up to a point, more illumination causes glare.

2) Adapting in the light conditions very important

• Airborne particles such as dust, rain or mist can interfere with the transmission of light through the air, distorting what is seen

• Maximum wear time for contact lenses 8-12 hours

- Color vision and night vision

Color vision is required for AMT to see wires, tools etc.

Color defective vision referred to incorrectly as color blindness, **'Daltonism'**) :

1• Night Vision and Color Loss, poor central vision at night. Better to look at one side and not directly at the object

2• Night myopia little recognized but can be significant hazard

- VISION and AGING EYES Presbyopia, what it is, what it is causing it

Loss of vision for reading fine print Starting at the age of around 35 years **Presbyopia**, meaning old eyes, is the medical term for this loss of accommodation Near vision requires more refraction of light than far vision

Contraction of the ciliary muscles changes the shape of the lens providing the additional refractive power With this loss of elasticity, the ciliary muscles become less effective in changing the shape of the lens

Presbyopia can hinder the inspection process. Can influence safety of flight and its risk identification through the Safety Management System (SMS) is appropriate.

HEARING

Continuous exposure to noise can be fatiguing

- Noise prevention by closing hangar doors, and PPE use
- Colds, flu and ear infections can also affect our hearing capability
- Use communication equipment (such as headsets) in noisy environments

BASIC FUNCTION OF THE EAR

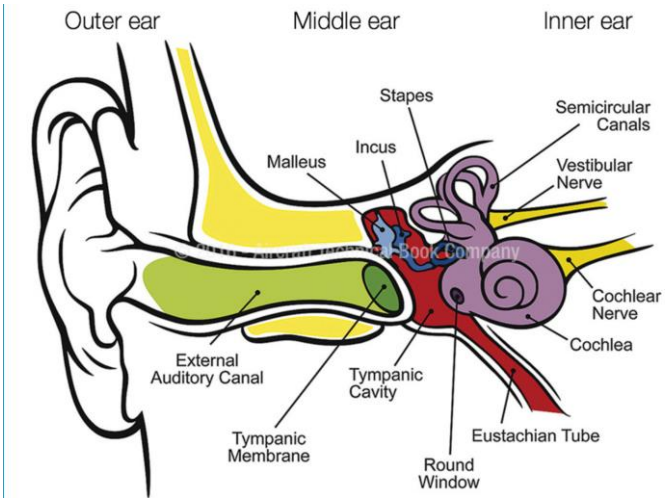
Ear performs two quite different functions: It is used to detect sounds by receiving vibrations in the air, and It is responsible for balance and sensing acceleration.

- • Ear has three divisions: Ear main parts

1) Outer Ear, directing sounds through the auditory canal to the eardrum

2) Middle Ear, transmitting vibrations from the eardrum to the inner ear by the three small bones, the Ossicles

3) Inner Ear, filled with fluid, transmitting vibrations to the brain via the auditory nerve



- BASIC FUNCTION OF THE EAR Audible frequency range

PERFORMANCE AND LIMITATIONS OF THE EAR. Audible frequency range that a young person can hear typically between 20 and 20 000 cycles per second (or Hertz), with greatest sensitivity at about 3 000 Hz

Noise has impact on performance, annoying, interfering with communication, cause accidents, fatiguing, damaging hearing

• Noise tends to increase errors and variability, rather than directly affect work rate

- Hearing protection at different frequencies

Hearing protection available, to a certain extent, using ear plugs or ear defenders, above 115 dB. • Noise levels can be reduced (attenuated) by up to 20 dB using ear plugs and 40 dB using ear muffs.

- Presbycusis, what it is

Presbycusis, the natural reduction in hearing is considered a signpost of aging.

- Hearing damage is cumulative, Noise induced hearing loss.

he louder the noise and the longer the exposure, the greater the risk of permanent damage.

usually caused by exposure to excessively loud sounds and cannot be medically or surgically corrected.

Information processing model (gathering info, perception/assessment, evaluation/decision making, action, feedback)

INFORMATION PROCESSING MODEL

1. Gathering information, using senses to collect Information and transform it to sensations
2. Perception or Assessment, brain provides previous info to decide if meaningful and create the internal model for assessing it.

3. Evaluation and Decision-Making, decide immediately or store it for later decision

4. Action/Response, occurs either consciously, with full awareness, or subconsciously

5. Feedback, to confirm that what we are getting is what we are expecting.

Attention and Perception

- Types of attention (selective, distraction, divided attention, focused attention, sustained attention)

Attention: Having detected information, our mental resources are concentrated on specific elements–this is attention

Selective Attention, when a person is monitoring several sources of input, with greater attention being given to one or more sources which appear more important.

Distraction, negative side of selective attention

• Divided Attention, common in most work situations, where people are required to do more than one thing at the same time. One task suffers at the expense of the other, TIME-SHARING ex: playing with your phone and watching tv

• Focused Attention, the skill of focusing one's attention upon a single source and avoiding distraction

• Sustained Attention, ability to maintain attention and remain alert over long periods of time, often on one task

- • **Illusions** of **Perception**, showing limits of human perception Illusions of perception

• One line looks longer than the other

• Same thing can be perceived differently (B or 13)

Perception, involves the organization and interpretation of sensory data in order to make it meaningful, discarding irrelevant data

• Perception can be defined as the process of assembling sensations into a usable mental representation of the world

• Maintenance Personnel use manuals and temp aides rather than to rely upon memory

• Writing something down temporarily can avoid the risk of forgetting or confusing information

- Situation Awareness, definition, for maintenance technician, summarized.

Situation Awareness

Situation awareness is the synthesis of an accurate and up to date 'mental model' of one's environment and state, and **the ability to use this to make predictions of possible future states.**

In the maintenance technician's context refers to:

1 • The perception of important elements, for example, seeing loose bolts, missing parts, leaking fluids, and hearing information passed verbally.

2 • The comprehension of their meaning, for example, why is it like this? Is this how it should be?

3 • The projection of their status into the future, for example, future effects on safety, schedule, and airworthiness

Situation awareness for an AMT can be summarized as:

• The status of the system that is being worked on.

• The relationship between the reported defect and the intended rectification.

• The possible effect of this work on other systems.

• The effect of this work on that being done by others and the effect of their work on this work

- Memory processes (registration, storage, retrieval), forms of Memory (ultra-short, short, long term), types of long term memory (semantic, episodic)

1 • **Registration**

2• Storage

3• Retrieval

Three forms of Memory:

1 • **Ultra Short Term**, 2 seconds duration Used as a buffer

2 • **Short Term,** receives a proportion of the information received into sensory stores, and allows us to store information long enough to use it (hence the idea of 'working memory'). Can store up to +/-7 items of information.

3 • **Long Term**, capacity of long-term memory appears to be unlimited. It is used to store information that is not currently being used.

The 2 types of long term memory:

Semantic Memory refers to our store of general, factual knowledge about the world, such as concepts, rules, one's own language, etc.

Episodic Memory refers to memory of specific events, such as our past experiences (including people, events and objects).

- Claustrophobia, what it is, how deal with it, fear of heights, what it is and how deal with it.

CLAUSTOPHOBIA and PHYSICAL ACCESS

Claustrophobia: can be defined as abnormal fear of being in an enclosed space.

Fear of Heights: Working at significant heights can also be a problem, especially when doing 'crown' inspections