

This glossary of terms is issued as a reference for some of the words and phrases associated with the subject of Human Performance. It is intended to act as a quick reference for those students who are not familiar with some of the technical terms used in the subject.

Accommodation : The changing of the shape of the lens of the eye, through the ciliary muscles, to achieve the final focussing onto the retina.

Action Slips: Action slips often occur at the initial stage of selection of a motor programme when an incorrect programme is selected and then carried through to conclusion without further thought.

Acuity : It is the ability to discriminate at varying distances. An individual with an 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

Adrenaline: A stress hormone which causes a massive release of sugar reserves from the liver and prompts the body into certain actions aimed primarily to assist survival.

Aerodontalgia: The pain experienced in teeth due to the expansion of gas pockets in and around the teeth as a result of poor fillings or from dental abscess formation at the apex of the tooth. The gas expansion can be caused by ascent to altitude.

Alveoli: The final division in the lungs; very fine sac-like structures where blood in the alveolar capillaries is brought into very close proximity with oxygen molecules. Under the effect of a pressure gradient, oxygen diffuses across the capillary membrane from the alveolar sac into the blood.

Anaemia: This occurs when cells of the various tissues are deprived of oxygen through insufficient haemoglobin or red blood cells.

Angina: The pain developing in the chest, or sometimes the neck, shoulder or arms, which is caused by a narrowing of the coronary arteries carrying blood to the heart muscle. The narrowing or gradual blockage of the coronary arteries results in insufficient blood reaching the muscle and the effect is to deprive part of the muscular pump of oxygen when demands are placed on it by exertion or emotion.

Anthropometry: The study of human measurement.

Anxiety: A state of apprehension, tension and worry. It can also be a vague feeling of danger and foreboding.

Aorta: The main artery leaving the heart's left ventricle before dividing into smaller arteries to carry the oxygenated blood around the body.

Apnoea: Cessation of breathing. Normal individuals may experience such apnoea lasting around ten seconds a few times a night when asleep. The cessation of breathing may cause frequent awakenings during the night.

Arousal: The measure of the Human Being's readiness to respond. It can be said to be the general activation of the physiological systems.

Attention : Attention is the deliberate devotion of the cognitive resources to a specific item.

Atrium: The left and right atria (auricles) are the upper chambers of the heart. The right atrium collects venous blood (de-oxygenated) and passes it to the right ventricle from where it is pumped into the lungs to receive oxygen. The left atrium collects the oxygenated blood from the lungs and passes it to the left ventricle from where it can be passed around the body to the various tissues.

Audiogram : This instrument measures hearing.

Auto-kinesis: This occurs in the dark when a static light may appear to move after being stared at for several seconds.

Autonomic nervous system (ANS): The nervous system controlling many of the functions essential to life, such as respiration, Arterial pressure gastrointestinal motility, urinary output, sweating, body temperature and the General Adaption Syndrome (sometimes known as the Fight or Flight Response) over which we normally have no conscious control.

Barotrauma: Pain caused by the expansion and contraction, due to outside pressure changes of air trapped in the cavities of the body, notably within the intestines, middle ear, sinuses or teeth. Barotrauma can cause discomfort or extreme pain sufficient to interfere with the operation of the aircraft.

Bends: Experienced during decompression sickness when nitrogen bubbles affect the joints causing pain.

Bit : In the field of communications one bit is the quantity of information which reduces the uncertainty of the receiver by 50%

Blind Spot: The site on the retina where the optic nerve enters the eyeball. Having no light sensitive cells in this area, any image on this section of the retina will not be detected.

Blood Pressure: Blood pressure as measured in mm Hg at a medical examination is given as two figures eg 120/80. The first (highest) figure is the systolic pressure which is the pressure at systole when the left ventricle is contracting to send the oxygenated blood around the body to the various tissues. The lower figure is the diastolic pressure which is the constant pressure in the system even when the heart is not contracting.

Body Mass Index (BMI): A measure of any excess fatty tissue in the body. The Body Mass Index relates height to weight by the formula:

$$\text{BMI} = \frac{\text{weight in kilogrammes}}{\text{Height in metres}^2}$$

Bronchus: A division in the respiratory system. Air drawn into the nose and mouth is passed first through the Trachea, which then divides into two large airways, the left and right bronchi. The bronchi carry the air into the left and right lungs before they divide into smaller airways eventually terminating in the alveoli.

Capillary: The smallest division of the blood circulation system. They are very thin walled blood vessels in which oxygen is in close proximity to the tissues and unlatches from haemoglobin. The oxygen molecules diffuse down a pressure dependant gradient across the cell walls into the respiring tissues. Carbon dioxide and water is picked up in exchange, and the capillary blood passes on into the veins.

Carbonic Acid: Carbon dioxide is produced in the tissues as the result of the oxidation of foodstuffs to provide energy. This carbon dioxide is carried in the blood in solution but largely in chemical combination as carbonic acid.

Cardiac Arrest : State in which the heart ceases to pump blood around the body.

Central Vision : Vision at the Fovea. Only at this part of the retina is vision 20/20 or 6/6.

Cerebellum : Second and smaller division of the brain. Responsible for receiving information from all nerve endings including the semi-circular canals in the inner ear.

Cerebrum : A part of the fore-brain which contains the cells that perform the functions of memory, learning and other higher mental powers.

Chokes: The difficulty in breathing experienced as a result of decompression sickness.

CH(F)IRP: Confidential Human Factors Incident Reporting Programme is a scheme which enables all Civilian Aircrew and Air Traffic Control personnel to report their errors in complete confidence to the RAF Institute of Aviation Medicine. The CHFIRP scheme was initiated and sponsored by the Civil Aviation Authority.

Chronobiology: The discipline of discovering and investigating biological rhythms.

Ciliary muscles : The ciliary muscles push and pull the lens of the eye to achieve the final focussing. - see also **accommodation** above.

Circadian Rhythms: Many physiological processes in the body exhibit regular rhythmic fluctuations, and they occur whether one is asleep or is kept awake. These rhythms are controlled not by reactions to the external environment but internally. The most common rhythms exhibited by man and other organisms have periodicities of, or about, 24 hours. These rhythms are termed "circadian rhythms", from the Latin "circa" - about and "dies" - day.

Circadian Disrhythmia : Disruption of the Circadian Rhythms (see above).

Co-action: Working in parallel to a common goal.

Cochlea: That part of the inner ear concerned with hearing. Vibrations in the air, sounds, are passed to the eardrum causing it to vibrate. This vibration is passed across the middle ear by a series of small bones to the fluid-filled cochlea of the inner ear. The cochlea contains a sensitive membrane which responds to vibrations and generates the nerve impulses which the brain interprets as sounds.

Conductive Deafness: See hearing loss.

Cones: Light sensitive cells situated on the retina at the back of the eye which are sensitive to colour.. These cells convert light into nerve impulses that travel up the optic nerve to the brain where the visual picture is built up.

Confirmation Bias: In decision making, once a decision is made, there is a natural tendency to stay with that decision. Here a subject will often take a small piece of information and use it to "confirm" the process that is already in place even to the extent of ignoring other more compelling evidence suggesting a flaw in the plan.

Coriolis Effect : An illusion of a change in the turn rate due to a sudden movement of the head.

Cornea : A transparent focussing layer at the front of the eyeball.

Coronary Thrombosis: See Heart Attack.

Cortex : That part of the brain which receives impulses from the auditory nerve and translates them into sound patterns.

Cortisol (Cortisone) : Substance released during 2nd. phase of General Adaption Syndrome to convert fats to sugar thus prolonging body mobilisation in face of perceived stress/threat.

Cyanosis : The development of a blue colour in those parts of the body in which the blood supply is close to the surface, the lips or under the fingernails, caused by a lack of oxygen in the blood and a consequent shortage of oxy-haemoglobin. Cyanosis is one of the signs of Hypoxia.

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Diaphragm: A muscular and tendinous sheet separating the thorax and abdomen. Movement of the diaphragm helps to reduce the pressure in the chest, drawing air into the lungs. In the process of breathing out the diaphragm is relaxed.

Diastole: See Blood Pressure.

Diffusion: The movement of particles from regions of high concentration to regions of lower concentrations.

ECG: Electrocardiogram, a device for measuring the synchronisation of the brain's electrical impulses with the beating of the heart (pulse rate).

EEG: Electroencephalogram, a device to measure the electrical activity of the brain.

EMG: Electromyogram, used to measure the electrical activity associated with the contraction and relaxation of muscles.

Endolymph: The fluid which fills the inner ear and in particular the three semi-circular canals which are used to detect angular movement and provide balance cues for the brain.

Electrolytes : Electrolyte is a chemical capable of carrying or conducting an electrical charge in solution. The body relies on the presence of electrolytes to carry nerve impulses and to maintain cell metabolism.

EOG: Electroculogram, a device to measure eye movement using electrodes attached to the outer corners of the eyes.

Episodic Memory: A part of Long-term memory storing episodes/events in our lives.

Ergonomics: The principle of design which ensures that the job required should be fitted to the man rather than the man to the job.

Expiratory Reserve Volume : The amount of air that can be still exhaled by forceful expiration after the end of the normal tidal expiration.

Faults : A category of Errors. The action satisfies the operator's intent, but the intent itself was incorrect.

FDM: Flight Deck Management.

Fight or Flight: See Automatic Nervous System.

Fick's Law of Diffusion: Diffusion rate is proportional to (concentration multiplied by surface area) divided by the thickness of the membrane.

Formication: A creeping sensation felt on the skin as a result / symptom of hypoxia.

Fovea: That part of the retina, composed only of cones, which is the most central part of the retina. Only at the fovea is there 6/6 or 20/20 vision. It is the area of highest visual acuity and away from the fovea the acuity declines rapidly.

General Adaption Syndrome (GAS) : the term used to describe the mechanism by which an individual reacts to an outside perceived threat.

Gestalt Theory: From the German word gestalt meaning "shape". This theory of learning proposes that any individual's understanding of the world results from sorting out and combining multiple cues perceived in the environment until a "coherent whole" appears that is acceptable according to the individual's standards as regards the world.

Glaucoma : A disease of the eye which causes a pressure rise of the liquid within the eye. Glaucoma can cause severe pain and even blindness. Glaucoma exists in two forms: Acute and Chronic.

Habituation: A term for Sensory Adaption. It is also sometimes used when referring to Environmental Capture (an error brought upon by habit).

Haemoglobin: Haemoglobin is made up of a combination of protein and a chemical called Heme which has an atom of iron contained in the middle of the molecule. It is found in the red blood cells and has the property of uniting with oxygen in a reversible manner to form oxy-haemoglobin. The combination will release the oxygen again to a gas mixture which contains little, or no, oxygen. Haemoglobin has a much greater affinity for CO (carbon monoxide) than for oxygen, therefore the presence of carbon monoxide in the air will cause a reduction in the amount of oxygen that may be carried in the blood.

Hearing Loss: Caused by a number of factors. A breakdown of the eardrum / ossicles system is Conductive Deafness. The loss of some hearing as the natural consequence of growing old is known as Presbycusis. Hearing loss caused by damage to the sensitive membrane in the cochlea by the intensity and duration of loud noises is called "Noise Induced Hearing Loss"(NIHL).

Heart Attack: Also known as myocardial infarction. The blockage of one of the coronary arteries, usually by a clot, will deprive some of the heart muscle of an oxygen supply. The effects are dramatic, often with severe chest pain, collapse, and sometimes complete cessation of the heart. (See also **Infarct**)

Homeostatis : The process of the body maintaining physiological equilibrium through organs and internal control mechanisms in spite of varying external conditions.

Hydrostatic Variation : The difference of the blood pressure in the legs and lower body and the blood pressure at the heart.

Hypermetropia: Long sightedness. A shorter than normal eye results in the image being formed behind the retina. Images of close objects will become blurred.

Hypertension: High blood pressure.

Hypertext : in the field of communications is the set of implicit information contained in a written text or spoken message.

Hyperventilation: Over-breathing, causing changes in the acid / base balance of the body. Can be caused not only by Hypoxia but also by anxiety, motion sickness, vibration, heat, high "G" or shock.

Hypoglycemia : Low sugar content of the blood normally caused by fasting not eating regularly.

Hypovigilance : Sleep patterns showing on an EEG during human activity.

Hypoxia: Inadequate oxygen supply. In mild cases the symptoms may hardly be noticed but as the hypoxia increases the symptoms become more severe, leading in some cases to unconsciousness and even death.

Iconic memory: The visual sensory store. Physical stimuli which are received by the sensory receptors (eg eyes, ears etc) can be stored for a brief period of time after the input has ceased. The iconic memory only lasts for about 0.5 to one second but it does enable us to retain information for a brief period of time until we have sufficient spare processing capacity to deal with the new input.

Incus (or Anvil) : The middle bone of the Ossicles.

Indifferent Zone Altitude : Sea level to 3,000m since ordinary daytime vision is unaffected. However there is a slight impairment of night vision.

Infarct: (Infarction). The death of a portion of a tissue or organ due to the failure of the blood supply. Hence the death of part of the heart muscle due to a failure of some of the coronary artery supply is also known as a "coronary infarction".

Insomnia : Inability to gain sufficient sleep. Divided into **Clinical Insomnia** and **Situational Insomnia**

Inspiratory Reserve Volume : The extra volume of air that can be inhaled over and beyond the normal tidal volume.

Leans: Experienced when the vestibular apparatus of the ear has given an incorrect assessment of attitude leading to the senses of the pilot giving, for example, a "banking sensation" when the visual picture will tell him that he is "straight and level".

Long Sightedness: See hypermetropia.

Malleus (or Hammer) : The outer bone of the Ossicles.

Mental Schemas: Mental representations of categories of objects, events and people.

Mesopic Vision: Vision through the functioning of both the Rods and Cones.

Metabolism: The chemical processes in a living organism producing energy and growth.

Metacommunications: The term that covers communication in its complete sense embracing everything from body language / facial expression to simple voice communication to enable a transfer of information to take place.

Microsleeps: Very short periods of sleep lasting from a fraction of second to two to three seconds.

Myopia: Short sightedness. A longer than normal eye results in image forming in front of the retina. If accommodation cannot overcome this then distant objects will be out of focus.

Narcolepsy: The tendency of an individual to fall asleep even when in sleep credit can even occur when driving or flying. Narcolepsy is a recognized disorder and is clearly undesirable in any aircrew.

Neuron : A nerve cell

NIHL: See Hearing loss.

Non-Declarative Knowledge : A skill or motor programme the possessor of which has difficulty to explain its components to others.

Oculogravic Illusion : Visually apparent movement of a forward object that is actually in a fixed position relative to the observer due to the displacement of the Otoliths.

Oculogyral Illusion : A false sensation of movement of an object viewed by a pilot. It is the visual sister to the Somatogyral Illusion.

Orthodox sleep : Another term for slow wave sleep.

Ossicles: The small bones in the middle ear which transmit the vibration of the eardrum to the cochlea of the inner ear.

Otoliths: Literally "stones in the ear". They are fleshy organs surmounted by calcite crystals located at the base of the semicircular canals and act as linear accelerometers.

Paradoxical Sleep: Another term for REM Sleep for although the person is certainly asleep the brain activity is very similar to that of someone who is fully awake.

Parasympathetic Nervous System: See Autonomic nervous system.

Percept: The immediate interpretation of the information in the sensory store. It is not necessarily a complete representation of the information.

Perception: The active process through which people use knowledge and understanding of the world to interpret sensations as meaningful experiences.

Peripheral Vision : Vision emanating away from the Fovea and from the rods cell-receptors of the eye.

Peristalsis: Automatic muscular movement of the intestine consisting of wave-like contractions that take place when the body is digesting food.

Photopic Vision: Vision through the functioning of the Cone light-sensitive cells of the eye.

Presbycusis: See Hearing loss.

Presbyopia: A form of long sightedness caused by the lens of the eye losing its elasticity with age. The loss of elasticity means that the lens can no longer accommodate fully and will result in close objects becoming blurred. A common condition in those more than 45 years of age, but easily corrected with a weak convex lens.

Pressoreceptors : are located in the wall of the Carotid Sinus in the neck and up-stream of the brain. They are part of the pressure-regulating system of the blood supply to the brain.

Proprioceptors : Information transmitters of the nervous system which feed spatial orientation impulses to the brain.

Psychosomatic: Refers to a psychological reaction to an outside stimulus causing physiological changes or changes. It refers to the interrelationships of the mind and body.

Pulmonary: Referring to the lungs. Hence the pulmonary artery takes blood from the heart to the lungs and the pulmonary vein carries oxygenated blood from the lungs back to the heart.

Rasmussen's Model : Danish exponent of the "SRK" theory of aircrew behaviour.

Regression : A symptom of stress in which correct actions are forgotten and substituted for procedures learnt in the past.

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REM: (Rapid Eye Movements) A term used in sleep studies to define a stage of sleep. In REM sleep the EEG becomes irregular and the EOG shows the eyes rapidly darting back and forth whilst the EMG shows the muscles to be relaxed. It is suggested that during REM sleep the memory is strengthened and organized. Sometimes referred to as Paradoxical Sleep.

Residual Volume : The volume of air remaining in the lungs even after the most forceful expiration

Retina: A light sensitive screen on the inside of the eye to which images are focussed. The retina has light sensitive cells, rods and cones, which convert the image into nerve impulses which are interpreted by the brain.

Risky Shift: The trait that a decision made by a group tending to be more risky than that made of an individual.

Rods: Light sensitive cells on the retina. They are sensitive to lower levels of light than the cones and are not sensitive to colour. To adapt completely to dark conditions will take the rods about 30 minutes and their adaption can be destroyed by even a transitory bright light.

Saccade: The eye cannot be moved continuously and smoothly when searching for a target, but moves in jerks, known as saccades, with rests between them. The external world is sampled only during the resting periods. An eye movement / rest cycle takes about 1/3 second, which means that the amount of the external world that can be examined in detail is strictly limited.

Saccules: A part of the otoliths.

Scotopic Vision: Vision through the functioning of the Rod light-sensitive cells of the eye.

Semantic Memory: A part of Long-term memory storing information as to general knowledge of the world.

Semicircular canals: The organs of the inner ear set in three planes at right angles to each other, which detect angular acceleration.

Skill : is an organised and co-ordinated pattern of activity. It may be physical, social, linguistic or intellectual.

Slips : A category of Errors. Slips do not satisfy the operator's intent although the intent was correct.

Somatogravic Illusion : The illusion of pitching up or down as a result of the movement of the Otoliths due to linear acceleration and by the resultant vector of the g forces acting on the pilot and aircraft. The Somatogravic Illusion can result from both these two quite different effects.

Somatogyral Illusion : is the sensation of turning in the opposite direction that occurs whenever the body undergoes angular deceleration from a condition of persisting angular velocity.

Somatosensory system : Pressure and position nerve receptors distributed throughout the body that provide information, for example, on the orientation of the seat on which we sit. The somatosensory system along with the vestibular apparatus and our vision enables us to maintain an image of our spatial orientation.

Somnambulism : Sleep Walking.

Somniloquism : Talking in ones' sleep.

SRK Theory : Skill, rule and knowledge based behaviour. See Rasmussen's Model above.

Staggers : Experienced when suffering from decompression sickness as nitrogen bubbles affect the blood supply to the brain causing the sufferer to lose some mental and body control functions.

Stapes (or Stirrup) : The inner bone of the Ossicles.

Stroboscopic Effect : A flickering effect of light and in Aviation is often caused by a propellor or, in the case of a helicopter, the rotor blade turning and cutting the sunlight.

Stereopsis : The ability to judge depth visually due to the principle that near objects produce images on each retina that are more different from one another than distant objects.

Stroke : A term used to describe the effects of a blockage of one of the arteries to the brain. The disruption of blood flow, and therefore oxygen supply to that part of the brain will cause a failure in the ability of the brain to control a particular part of the body. Depending on the site affected, the results could be paralysis, loss of speech, loss of control of facial expression.

Subcutaneous: An adjective meaning below or under the skin.

Suprarenal Glands : Glands which secrete Adrenaline causing massive release of sugar reserves from the liver in a situation of perceived threat/stress. They are also known as the Adrenal Glands.

Sympathetic Nervous System : See Autonomic Nervous System.

Synapse : The connection between two neurons.

Syncope: Fainting through a fall in blood pressure.

Systole: See blood pressure.

Tidal Volume: The volume of air inhaled and exhaled with each normal breath.

Time of Useful Consciousness (TUC): The amount of time an individual is able to perform useful flying duties in an environment of inadequate oxygen.

Thrombus: A clot of blood which can stop blood flow to any organ. If the blockage is in one of the Coronary Arteries then a heart attack can result or if in an artery to the brain then the result will be a stroke.

Trachea: The main airway leading from the nose / mouth into the chest cavity. It is a cartilage reinforced tube which divides into two Bronchi which deliver air to the left and right lungs.

Utricles: A part of the otoliths.

Ventricles: The two largest and most muscular divisions of the heart. The left ventricle, when it contracts, sends the blood around the body. The right ventricle passes blood from the heart to the lungs to be recharged with oxygen.

Vestibular Apparatus: The combination of the semicircular canals and the otoliths. The function of the vestibular apparatus is to provide data to the brain that enables it both to maintain a model of spatial orientation and to control other systems that need this information.

Visual Cortex : That part of the brain which receives the electrical charges from the Optic Nerve of the eye.

Visual Field : Visual Field comprises of both the Central and Peripheral vision.

Visual Perception Cascade : The reaction time from visual input, brain reaction, perception to recognition. In perfect conditions this takes approximately 1 second.

Vigilance (state of) : The degree of activation of the central nervous system. This can vary from deep sleep to extreme alertness.

Zeitgebers: From the German phrase "time givers", Zeitgebers are cues that serve to synchronise the internal body rhythms. Such body rhythms as temperature variations and sleep cycles may be adjusted by a change to external cues which over a period of time will allow the body clocks to adjust to, for example, a change to the time zone.