



Occupational Hygiene Relevance in Aviation Medicine

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Aviation Medicine (Aerospace Medicine)

- Concerns the determination and maintenance of the health, safety and performance of persons involved in air (military and civilian) and space travel.
- Multi-disciplinary: doctors, nurses, physiologists, bioenvironmental engineers, occupational hygienists, environmental health practitioners, human factors specialists, psychologist, and other professionals



Aviation Medicine in Hong Kong

- Civilian
- Medical assessments on applicants (Pilots / Air Traffic Controllers)
 - physically / mentally fit to perform necessary tasks
 - any risk of physical / mental incapacitation
 - whether environment adversely affect any existing conditions
- Approved Medical Examiner – conduct medical examinations, Cert AvMed
- Approved Medical Assessor – sign medical certificates, DAvMed / Master AvMed

Aviation Medicine in Hong Kong

Licence	Holder's Age	Class of Medical Certificate		Validity period in months	
		Class	Description	Class	Description
CPL/ MPL(A)/ ATPL	Under 40	1		12	
	40-59	1	(i) Single-crew commercial air transport operations carrying passengers	6	
		1	(ii) Commercial air transport operations other than (i) above	12	
	60 or over	1		6 for commercial air transport operations	
PPL/ Student Pilot	Under 40	2		60	
	40-49	2		24	
	50 or over	2		12	
Air Traffic Controller's Licence	Under 40	3		48	
	40-49	3		24	
	50 or over	3		12	



Training in Diploma in Aviation Medicine

- 6-month course
 - 3 months in King's College, London
 - 3 months in Royal Air Force (Henlow base)



Training in Diploma in Aviation Medicine

■ Lectures

- Physiology – cardiovascular system, respiratory system, altitude physiology, hypoxia, pressure, acceleration, vibration, thermal, vision, etc
- Psychology – human performance, sleep & fatigue, decision making, crew resource management, etc



Training in Diploma in Aviation Medicine

- Clinical – cardiovascular system, respiratory system, ophthalmology, noise and ENT, neurology, renal, GI, haematology, psychiatry, dermatology, infectious diseases, etc
- Operational – motion sickness, spatial disorientation, environmental control and life-support systems, radiation, selection, training, emergency and disaster planning, accident investigation, etc
- Pilots, aircrew and passengers – fitness to fly
- Air traffic controllers



Training in Diploma in Aviation Medicine

- Visits
 - Centrifuge (acceleration)
 - Land and sea survival
 - Air traffic control
 - British Airway
 - Martin Baker Aircraft Co.— ejection, escape system
 - Aircraft Accident Investigation Branch
 - Civil Aviation Authority
 - Military base (RAF, Navy, Army)

Examination

- King's College
 - Post-graduate Certificate in Aeromedical Science from 2012 (6-hour written in 1 day)
- Faculty of Occupational Medicine, Royal College of Physicians, London – Diploma in Aviation Medicine
 - 2 parts: physiology / psychology; and clinical
 - Written – 3 hours in am and 3 hours in pm
 - Oral



Aircraft Cabin Air Contamination

- For > 20 years, reports on
- Possible relationship between
 - Exposure to fumes from heated engine and hydraulic oils contaminating air drawn into air conditioning systems (“bleed air”).
 - Post-exposure acute and chronic symptoms experienced by cabin occupants, mostly aircrew
- No air quality monitoring system on board



Aircraft Cabin Air Contamination

- In 2007, Civil Aviation Safety Authority (CASA), Australia established an Expert Panel on Aircraft Air Quality
- Panel members with expertise in aircraft engineering, occupational and environmental health, aviation medicine, toxicology and epidemiology



Aircraft Cabin Air Contamination

- Literature search completed in September 2009
- Review of governmental inquiries, expert opinions, incident reports, media reports, in vitro and animal studies and human epidemiology studies, as well as individual testimonies
- Report in October 2010



Aircraft Cabin Air Contamination

- Sources of contaminants
 - jet engines
 - auxiliary power units
 - air conditioning machines
 - de-icing fluid
 - condensation, smog, fog
 - from engine exhausts of aircraft
 - during takeoff, landing, significant change of altitude – oil seals vary in effectiveness



Aircraft Cabin Air Contamination

- Known contaminant of heated engine oils – tri-ortho-cresyl phosphate (TOCP), an organophosphate, neurotoxic
- Volatile organic compounds (VOCs)
- Carbon dioxide, carbon monoxide
- Fumes from oil leaks, hydraulic leaks, water leaks, inhibitor fumes



Aircraft Cabin Air Contamination

- Insufficient evidence to reach any conclusion on the normal range of air contaminants and their concentration in commercial aircraft during normal operation
- Likely contaminants: CO, organophosphate derivatives



Aircraft Cabin Air Contamination

- Symptoms
 - Irritant effects: eyes, throat, respiratory symptoms, skin
 - Central nervous system effects: loss of recent memory, poor concentration, lethargy, incoordination, confusion, headache
- Could not link to any identifiable cause in cabin air or extent of exposure



Aircraft Cabin Air Contamination

- Biomarkers not sensitive:
Butyrylcholinesterase inhibition, TCP metabolites in blood / urine
- Rare reports of aircrew incapacitation
- Chronic illness
 - Delayed effects, non-specific symptoms, neurobehavioural, neuropsychological



Aircraft Cabin Air Contamination

■ Prevention

- Maintenance of engines to minimize seal failure
- In contamination events, immediate use of 100% oxygen, smoke goggles
- Report events and investigate



Aviation Ergonomics

- Mainly military
- Anthropometry
 - Measurement of human body and its segments to survey aircrew population
 - Check against aircraft cockpit size limits
- Aircrew equipment integration



Aviation Ergonomics

- Aircrew equipment integration
 - Life support – oxygen equipment, anti-G protection, CBRN , warfare protection, personal conditioning
 - Operation – communication facilities, vision enhancement, flying overalls
 - Escape & survival – restraints & parachute harnesses, head protection, flotation, immersion protection



Aviation Ergonomics

■ Applications

- Cockpit workspace design – minimize cockpit size to reduce aerodynamic drag, limited range of seat, wide range of clothing, display and control
- Aircrew selection – critical dimension: sitting height, arm length (functional reach), leg length (buttock heel), thigh length (buttock-knee)
- Weight restriction – small size → injury potential



Noise

- Source of internal noise in aircraft
 - Power source, transmission system, propellers (rotary wing), jet efflux
 - Cabin-conditioning, pressurizing system, hydraulic system, communication equipment
 - Armament discharge



Noise

- Reduction of cabin noise level
 - Increase canopy thickness
 - Smoothing boundary layer
 - Redesign conditioning system, reduce airflow throw system
 - Damping walls of cockpit – but weight penalty

Noise

- Protection of aircrew
 - Helmet, headset – with earmuff, ear plug
 - ANR – Active noise reduction (production active noise reduction system fitted to the earshell of an RAF aircrew helmet)
 - Active ear plug – allows communication signal to be fed to the ear through noise cancelling transducer, as with conventional earshell ANR
 - Wireless connection between headset and earplug communication transducer



Thermal Stress

- Heat / cold
- High altitude, sea, land (normal operation, emergency landing, escape)
- Cockpit (Green house effect)
- Protective clothing
- Plan for operation
- Use of WBGT



Radiation

- Occupational exposure limit
 - 20 mSv/year effective dose, average over 5 years
 - 50 mSv in any one year
- ≥ 6 mSv/year = radiation worker
- Airlines - ensure aircrew's exposure
< 6mSv/year



Thank You