

ABSTRACT OF SUBROTO MUKHERJEE ORATION

On Indian Explosions of May 11-13, 1998

Dr SK Sikka

At the Pokhran test site in Rajasthan, five explosions were detonated by India in May 1998. The three done on 11 May 1998 comprised of a thermonuclear (hydrogen) bomb, a pure fission device and a sub kiloton device. The two explosions on 13 May 98 were also sub kiloton ones. The devices were based on robust designs and the tests have provided us with the necessary data for a credible nuclear deterrent. The thermonuclear device can be scaled up to higher yields and the sub kiloton devices have given us a capability to carry out sub critical tests and calibrate over computer codes for the design of nuclear weapons. There has been some recent controversy about the yields of these tests. In this talk, we will show that this is based on misinterpretation of seismic data by some foreign experts. I will also dwell upon some effects of nuclear explosions both for peaceful uses and in a war.

ABSTRACTS FROM PAPERS

Overview Of NBC Warfare And Threat Perception

Gp Capt Y Talwar

The world scenario in the field of NBC warfare has undergone tremendous change in the last 2-3 decades. NBC warfare agents pose immense potential health hazards in causing massive casualties. The use of poisons derived from plants and animals to render weapons more lethal dates to pre-historic times. During the First World War, casualties due to chemical weapons was estimated at 13 Lakhs, of whom some 90,000 died.

Due the signing and ratification of the CWC, threat from chemical weapons has receded. However, our adversaries can use these weapons under adverse conditions. Both China and Pakistan are declared as Nuclear Weapon States.

CWC and BTWC are Comprehensive in nature non discriminatory and therefore India has no hesitation in signing and ratifying these treaties. However, anti proliferation treaty like NPT, CTBT & FMCT are considered by India to be discriminatory and unequal in nature and therefore India is rightfully now talking of universal disarmament. India's concern regarding NPT, CTBT & FMCT are discussed during the presentation. In view of the changing global threat probability, there is a need to constantly review NBC protection measures and make mid term corrections.

Nuclear and Biological Warfare : Effects and Protection

Wg Cdr RS Bhakay, Wg Cdr PD Navathe, Wg Cdr JK Srivastava

In the prevailing geopolitical situation, the possibility of a nuclear strike cannot be ruled out, particularly in view of the possibility of upgradation of the conflict from the proxy war presently being waged on our borders. While a nuclear or biological strike will cripple an army formation, replacement/augmentation of manpower is feasible for the army from neighbouring formations. The Indian Air Force does not have this luxury since highly trained aircrew and support personnel cannot be easily replaced. Therefore, it is vital for the Indian Air Force to be aware of the effects of Nuclear and Biological warfare. The effects of Nuclear and Biological warfare are outlined, and protective measures discussed. The protective gear is demonstrated and the implications on operational effectiveness discussed.

Decontamination Of NBC Casualties

Sqn Ldr Rajesh Vaidya

Decontamination is the process of making any person, object or area safe by absorbing, destroying, neutralizing, making harmless, or removing chemical or biological agents, or by removing radioactive material clinging to or around it. In an NBC scenario, both personal as well as collective decontamination may have to be carried out. Systematic and thorough decontamination of casualties is a crucial component of medical support in NBC operations.

A prerequisite for the process of decontamination is distinguishing between contaminated and clean casualties. Contamination detection equipment should, therefore be available at the point where the casualties are first received so that segregation of clean and contaminated cases can be done at the earliest. Contaminated casualties not requiring emergency medical or surgical management can carry out personal decontamination under supervision. Serious contaminated cases will however, have to undergo emergency life saving procedures prior to decontamination.

The main danger from radioactive contamination is from beta radiation. General methods of decontamination of personnel exposed to nuclear fallout includes removal of all outer clothing and shoes and washing of exposed skin such as the face and hands. The need for contamination procedures following exposure to biological warfare agents continues to be debatable. The principles of decontamination in such cases remains similar to the ones for general hygiene. Casualties contaminated with chemical agents pose major hazards to the attending personnel who should be adequately protect themselves. All contaminated clothing and equipment must be removed. Adsorbent material such as Fuller's earth may be used for decontamination.

Any future conflict may involve the use of NBC weapons. Apart from handling human death and injury on an unprecedented scale, medical services will have to be capable of receiving and handling contaminated casualties, which may constitute a hazard to those attending to them as well as to other patients. Decontamination procedures should, therefore, be clearly laid down and drills practiced to minimise this hazard, thereby assuring that medical support can be provided in the NBC scenario.

Training Of Manpower and Proposed Op Plan to Combat NBC Disaster/Terrorist Scenario

Wg Cdr HM Sridhara

Management of casualties in a NBC environment is another challenge in modern warfare due to various reasons. As in any other disaster situation, proper planning and effective execution in a changing tactical scenario is the hallmark of operational preparedness. Multiplicity of Chemical and Biological agents in addition to widespread devastation caused by Nuclear Weapons are factors which have been considered in organising NBC defence.

Prevention of Spinal Ejection Injuries with Special Reference to Harness System and Weight Limitations

Wg Cdr MM Dogra

Ejection spinal injuries in the IAF have been noted to have an incidence during a study covering period 1993-98 caused concern. Two major modes of spinal injury related to factors leading to poor body positioning including harness system and factors modifying ejection forces including weight limitations have

been given another look. Technical literature available with us as well as obtained from ejection seat manufacturer lays down strict weight limitation, which the IAF has to strictly implement. Similarly, the manufacturer lays down strict weight limitation, which the IAF has to strictly implement. Similarly, there is little choice regarding the harness system provided by the manufacturers. We must ensure that our crew fit into the harness system anthropometrically to prevent spinal injuries.

Analysis Of Post Ejection Spinal Injuries : An Indian Experience

Sqn Ldr Amit Sinha, Wg Cdr VK Gupta

Spinal fractures are a common occurrence during ejection. Statistics show that 25-30 % of successful ejections result in spinal fractures. Common segments involved are T10-L2 and C5-C6. These are usually flexion compression injuries and cord involvement is not common. Other injuries are flexion-rotation causing dislocation and cord involvement. Diagnosis is made on X-rays and MRI. Treatment is according to stability or instability of fracture as, also, on neurological involvement. Stable fractures are managed conservatively where as unstable fracture, though, can be managed conservatively, but at present, operative fixation is preferred for early ambulation and rehabilitation. Neurological recovery is independent of the mode of treatment, but cord decompression is urgently required if there is evidence of progressive neurological loss or compression of the cord by bone fragment and disc.

Radiological Review Of Spinal Injuries sustained during Combat Flying, Hard Landing and following Ejections, evaluated at IAM during 1996-98

Wg Cdr AK Shukla

An aeromedical review of 26 cases of radiologically detected spinal injuries sustained in fighter aircrew during ejection and combat flying carried out at IAM during the years 1996-98 were studied. Spinal injuries sustained following ejection, by nineteen aircrew from Mig aircraft, three from Kiran and one from Jaguar aircraft were evaluated. Spinal injury sustained by one aircrew during hard landing in Mig aircraft and by one aircrew each following high +Gz combat manoeuvre in Mig-21 and Mig-29 aircraft are also discussed.

Evaluation Protocol And Disposal Of Aircrew With Ejection Injury

Gp Capt GS Nayar

The introduction of the emergency escape system for combat aircraft has been one of the most important milestones in operational military flying. In spite of the advances in the design of ejection seats, the inherent limitations of human spine in tolerating high +Gz forces especially in relation to the posture at the time of ejection continue to result in unacceptable incidence of spinal injuries during ejection. Among the various potential injuries associated with the different phases of ejection, spinal injuries occur in 20-30% of ejections from different aircraft. Most of these injuries are highly amenable to conservative treatment and the aircrew are returned to flying duties. This paper presents the protocol followed by the Institute of Aerospace Medicine in evaluating the functional status of the spine after full clinical recovery. The recent advances in imaging techniques of the spine need to be fully exploited to achieve better objectively in determining whether a fracture is stable. Confidence of the aircrew in early return to flying after ejection will go a long way in preventing avoidable delay in initiating ejection, an important factor in spinal injuries.

Noise In Aviation : Historical Background & Extent Of Problem

Gp Capt KS Soodan

Noise has been invisibly polluting our environment due to rapid technological developments and industrial flare-up including the aviation industry. Noise surveys have revealed noise levels to be much beyond the acceptable limits of 90 dB affecting the hearing of people working in noise polluted areas without their knowledge. Hearing loss amongst aircrew and technical staff has also been established by different audiometric surveys by various authors which has been highlighted in the paper. The existence of noise pollution as a health hazard is beyond any doubt and therefore there is a need to introduce some kind of legislative measures to control noise pollution and its ill effects.

Noise Environment In And Around Some Of The Fighter Aircraft In The IAF

Mr MK Vyawahare, Wg Cdr GBS Kang, Wg Cdr S Sodhi, Wg Cdr K Kartik, Mr B Aravindakshan

To estimate the noise load in the Light Combat Aircraft, noise data in respect of operational fighter aircraft of the IAF was required to be generated. Accordingly, a noise survey was carried out for Kiran Mk II, Mig-21 (Trainer), Mig-29, Jaguar (Trainer) and Mirage 2000 aircraft using sound level meters (Type 2230 and Type 2231) of M/s Bruel & Kjaer, Denmark. Noise levels in the proximity of aircraft on the ground with engine(s) on as well as inside the cockpit during flight were found to be in excess of 90 dB(A).

It is therefore prudent for personnel working in and around fighter aircraft to use suitable noise defenders. These defenders must be chosen after ascertaining their attenuation characteristics.

Effects Of Noise On The Audio Vestibular System

Gp Capt SK Nanda

Chronic exposure to noise leads to sensorineural hearing loss. The vestibular apparatus and cochlea are developed from the optic capsule, and have a common blood supply and an interconnecting fluid system. Hence disease process affecting the cochlea also invariably affects the vestibular system. Objective assessment with caloric test and ENG revealed significant vestibular dysfunction in severe sensorineural hearing loss in patients.

Non Auditory Effects Of Noise : Psychological Task Performance

Dr Catherine Joseph, B Aravindakshan, MK Vyawahare

The information processing interpretation of various aviation tasks emphasises the importance of attentional and cognitive processes. This review discusses the empirical evidence of one of the non auditory effects of noise : namely the effects on psychological task performance. Three main aviation relevant abilities are outlined : vigilance, serial responding, and memory & cognition. It is proposed that the seemingly equivocal evidence in this field can be best explained in dynamic environments within the conceptual framework of Wickens (1984) multiple resources model. In this model *task* variables (modality of inputs, type of coding operations, stages of processing and nature of responses) and *subjective* variables such as selective strategies are seen to be the prime determinants of quantitative and qualitative effects.

Conservation of Hearing Programme in the IAF

Wg Cdr (Mrs) K Jauhar

In Military and Aviation, the machines of war have become more devastating and deafening. Aviation activity is plagued with the problem of high noise levels that the nuisance value of unwanted sound has now been recognised as a "Public Health Problem" and an occupational hazard in the Indian Air Force. The harmful effects of noise cause both auditory and non-auditory effects which creep in slowly and painlessly and go unnoticed for a long duration of time.

On the basis of extensive studies, carried out in the IAF, it is proposed to recommend a Conservation Of Hearing Programme for the IAF on the basis of the ones prevalent in the US and Vietnam Air Force.

Ventilatory Responses In Simulated Heat Stress

Wg Cdr PK Jan

Heat stress is common in military flying and it may be a cause of alterations in ventilatory function. Any deterioration in the ventilatory function of an aircrew is likely to affect his performance. Ventilatory responses to 40 minutes exposure to heat stress in a hot cockpit were studied in 19 young healthy male subjects. Out of these 13 subjects were exposed to hot and humid (HH) environment and the remaining 6 were exposed to hot dry (HD) environment. Their respiratory minute volume (V_E) and dynamic pulmonary function tests were determined prior and after the exposure. Exposure to HH and HD environments resulted in an increase in V_E by 65% and 45% respectively. An increase in the flow rates indicating a small airway resistance was observed only in HH environment. FVC, FEV1, FEV1 % and PFR did not show any significant change by both types of heat. It is concluded that exposure to HH and HD environments do not compromise ventilatory functions in a detrimental way.

Evaluation Of Heat Stress in Mig-27 Aircraft

Sqn Ldr P Pant

Heat stress is an important problem in aviation, specially in a tropical country like ours. The problem assumes large magnitude because of the cumbersome flying clothing worn and operating temperatures. This factor, coupled with absence of proper ventilation in the cockpit, raises temperature by several degrees above the ambient, specially from the time the pilot occupies the cockpit to the time he gets airborne. Though modern aircraft provide for air-conditioning of cockpit, this is ineffective during low level high speed flying, when the pilot's efficiency has to be at its peak in the interest of operational performance and flight safety. A questionnaire survey was conducted to evaluate the heat stress in strike aircraft. The study included squadrons operating both the Jaguar and the Mig-27 aircraft (since both operate in low level, high speed environment). A total of 150 questionnaires were given out of which 111 were received. The data collected is presented and implications on flying performance discussed. Practical solutions are offered for consideration by the operational commander, to ensure optimum utilisation of aircraft capability.

Evaluation Of The Microclimate Cooling System

(Liquid Cooled Vest) In Amelioration Of Heat Stress In Aviation

Sqn Ldr MS Natraj, Mr AS Arvind, Gp Capt (Mrs) P Bandhopadhyay,
Sqn Ldr DK Dubey

Moderate to severe heat stress environment are commonly encountered in military aircraft in the tropics. Heat stress imposed on aircrew in low level high speed flying during summer months could exceed their

tolerance limits and may result in performance deterioration and compromise operational efficiency and flight safety.

Cockpit airconditioning and precooling of aircrew currently practiced in military aviation to reduce heat stress have proved to be inadequate. Personal cooling systems in the form of Liquid Cooled Suit (LCS) seems to be a better mode of keeping aircrew in a state of physiological and subjective comfort. The major difficulties encountered in the operational use of the LCS were the practical problems of installation in fighter aircraft, interference with flying clothing, reduction in G-Tolerance of pilots and likelihood of interference during ejection. A new technique involving cooling of the upper part of the body by an ice bag vest or a liquid cooled vest (STEELE) has led to significant reduction in heat stress. This study aims to develop a liquid cooled vest using frozen polyurethane foam gel (PUF) and to evaluate its efficiency in reducing heat stress and also integration of the vest with the anti-G suit. The results and trends shall be discussed later.

Endocrine / Metabolic Cost Of Transport and Helicopter Pilots

Dr EM Iyer, Sqd Ldr J Singh, Wg Cdr PK Jain, Gp Capt NS Bahoo

Sympathoadrenal, adrenocortical, metabolic and urinary electrolyte change in transport (n=12) and helicopter (n=12) pilots was assessed after sorties of average duration of 11 minutes. The results were analysed in relation to flying experience, day and night flying and the duration of flight. The findings of this study indicated greater stress in inexperienced pilots. Even though the day time fliers, helicopter pilots and pilots of shorter duration flights exhibited greater stress response, it was found to be related to their lesser flying experience. The resting value of sympathoadrenal activity was higher in night fliers than the day fliers. Details of the findings are presented and discussed.

Epidemiology Of Ischaemic Heart Disease

Gp Capt MK Mishra, Sqd Ldr Rajesh Vaidya

Ischaemic heart disease is the largest cause of death worldwide. It accounted for over seven million deaths in 1996, much greater than other major killers such as tuberculosis, malaria and AIDS. The silver lining is that there has been a marked reduction in mortality due to IHD in several industrialised nations. This decline is ascribed more to lifestyle changes than to any advances in medical science, giving us the hope that IHD prevention is feasible.

IHD has been amongst the top five causes of mortality amongst IAF personnel for the last several years. Analysis of data over the last fifteen years (1983 - 1997) reveals a declining trend in absolute mortality due to IHD as well as mortality due to IHD as a percentage of mortality due to all causes.

Incidence of IHD amongst the three services over the last three decades (1965 - 1994) was compared. Army officers were found to have statistically significantly higher incidence of IHD as compared to Air Force officers during the period of study. The other ranks of the Air Force were, however, found to have significantly higher incidence of IHD as compared to their Army and Navy counterparts for almost the entire period. These differences in IHD incidence have no ready explanation.

A number of prolonged cohort studies have been used to identify risk factors associated with IHD. These factors have traditionally been classified into two groups - modifiable and nonmodifiable. The nonmodifiable risk factors are age, male sex, heredity and personality type. Modifiable risk factors known to be associated

with IHD include diet, smoking, hypertension, diabetes, high cholesterol levels, obesity, sedentary habits and alcohol.

Protocol of Evaluation of Asymptomatic Abnormal ECG Cases

Gp Capt MM Singh

Diagnosis, evaluation and proper disposal of Armed Forces personnel with asymptomatic ECG abnormality always poses a challenge to the evaluating physician. Proper disposal of such cases assumes greater importance when the personnel employed on important duties like flying, driving, sea divers & Air Traffic Controller etc, where sudden incapacitation due to cardiovascular problem may be affected and end up with disastrous consequences. Physicians should keep in mind the proper evaluation and disposal of such cases without compromising with his health and flight safety in cases of Aircrew. A stepwise evaluation protocol is followed to find out the cause for the ECG abnormality. We have acquired sufficient experience over a period of time in the evaluation of such cases, using both non-invasive as well as invasive techniques. Now we are in a position to say that if specific non invasive procedure like stress thallium is done as a routine test in most of these cases and invasive the total period of observation may be significantly reduced and individual can be given a proper disposal in a short period. Another advantage would be the follow up of these cases will be streamlined, stress thallium studies are cost effective as well.

Protocol of Evaluation After Myocardial Infarction

Wg Cdr N Bhalla

Coronary Artery Disease is progressive in character. Myocardial revascularisation for obstructive CAD has grown spectacularly in the last decade. Newer and innovative methods of PTCA, use of devices such as stents, atherectomy and rotablation catheters are ever increasing. Newer antiplatelet drugs, safer anticoagulants and improved understanding of pathophysiology have made revascularisation safer than ever before and encouraged cardiologists to be more aggressive in managing CAD. In addition, exciting growth in CABG surgery such as use of arterial conduits upto total arterial evascularisation, warm cardioplegia and other innovative methods for fast tract recovery and mobilisation of the patient, and growing experience in minimally invasive coronary artery surgery (MICAS) without the need of cardiopulmonary bypass, have all contributed to patient well being, faster recovery and good long term prognosis.

Nevertheless these modalities of treatment are palliative and do not retard, or halt the progress of the disease. This mandates periodic monitoring of continued successful revascularisation mostly by use of non invasive methods and occasionally by repeat CART when indicated. This is specially true for evaluation of aircrew and in serving the twin objectives of conserving trained manpower and passing on the benefits of modern technology to the patient and, equally important, looking after safety of man, machine and passengers.

A suggested protocol for evaluation shall be presented and deviations from the existing protocols and reasons thereof shall be discussed.

Ischaemic Heart Disease : Present Policy & Disposal Of Service and Civil Aircrew

Wg Cdr Rajeev Kapur

Advances in the diagnosis and treatment of Ischaemic Heart Disease (IHD) and the need to conserve trained aircrew have been kept in mind while laying down the new policy on disposal of service aircrew

issued vide Amendment No 25 to IAP 4303 and of civil aircrew vide Medical Information Circular No 1/97. The new policy has reduced the minimum period of observation after undergoing Angioplasty (PTCA) or Coronary Artery Bypass Graft Surgery (CABG) to enable early return to flying by aircrew if they have been adequately treated and meet the specified medical evaluation criteria.

SU 30 Aircraft : A Challenge To The Squadron MO

Wg Cdr JK Srivastava, Wg Cdr PD Navathe

The induction of the SU 30 Mk 1 into the Indian Air Force has changed the face of military aviation in India. The aircraft is a twin seater, multirole fighter aircraft with tremendous agility and massive firepower. Due to its large endurance of 10 hours or a range of 8000 Kms with multiple inflight refueling, the aircraft presents a challenge to the aviation medicine specialist. The ability to fly the aircraft for such long durations is restricted to human failing, viz; fatigue and inflight nutritional requirements. The aircraft has been provided with a couple of unique features i.e., Positive Pressure Breathing for enhancing G-tolerance and an Integrated Flying Overall with an air ventilated suit. Use of these facilities requires indoctrination and training of the crew members. These are issues related to cockpit crew co-ordination and crew resource management in this twin seater fighter aircraft, as also the philosophy of flying training. The G-tolerance of the combined crew is going to be momentous in exploiting the aircraft potential to its maximum. Use of drugs for local application and in-flight exercise regime to prevent fatigue and reduce dependent edema in aircrew will have to be addressed to ensure aircraft comfort. It is imperative to find a practical solution to these problems, to suit the Indian conditions. This paper highlights the challenges of modifying equipment, policies on training patterns by the aviation medicine specialist.

Aeromedical Challenges In Long Duration Fighter Flying

Wg Cdr NN Aggarwal

With the latest acquisition of twin seater endurance multi-role fighter 'SU-30' during mid 1997, the IAF has ventured in to a novel situation of sustained non-stop flying for ten hours or more in fighter aircraft. IAF has no previous experience of maintaining man in air efficiently for such long duration in cramped up space of fighter cockpit. With limited experience of the country of its origin itself on this twin-seater fighter as late as 1991 and nil expertise from relatively well experienced western countries, the Indian aeromedical community needs to meet several interactive man-machine challenges related to endurance fighter flying. Its relevance has become more urgent with the recent demonstration of SU-30 MK 1 prototypes during July this year. While several aeromedical challenges may emerge with newer version, hitherto well identified challenges include optimization of twin crew by prudent sharing of workloads between the two pilots, inflight hydration and nutrition, sanitary disposal of bio-fluids and bio-wastes, maintenance of inflight alertness and situation awareness, in-flight rest and exercises, use of drugs to combat the pressure and gravitational effects of prolonged sitting, fatigue of physical, visual and mental origin, shift to day or night operations, flight and duty time limitations, alteration in life style patterns of involved crew besides addressing all other aviation stresses encountered in any other high performance conventional single seater fighter. Exposure to lateral accelerations and some exposure to radiation in high electronic warfare environment may be inevitable in later upgrades. The role of proper aero-medical monitoring, ergonomic and more efficient design of protective and life support systems to suit Indian environment is specifically important. The paper discusses the above factors and attempts to address various issues of importance in the wake of available literature and work carried out at IAM so far.

Two Pilot Fighter Cockpit

Wg Cdr PD Navathe, Wg Cdr JK Shrivastava

With increasing complexity of aircraft systems and the progress in the field of avionics, the amount of information available to the pilot increased 100-fold. Gradually, the realization dawned on the designers that the amount of information was far too much for a single pilot to handle alone and the concept of a two pilot fighter cockpit was born. With the advent of twin crew fighter aircraft came the crucial question of manning, two to satisfaction; different philosophies of deployment and operations in the same country have different crew composition. With the induction of SU-30 aircraft in the IAF, this question assumes importance for us. The IAF has little experience of twin crew fighter operations. By opting for twin pilots, apart from the advantages of redundancy, it will have to find a way to cope with other problems, viz. training costs in relation to time and expense, and maintain expertise with the available limited resources. This paper takes a look at the manning philosophy from the aviation medicine specialist point of view, i.e. division of workload, cockpit resource management, indoctrination and training needs.

Mental Workload in ASF Aircraft

Sqn Ldr KS Raju, Wg Cdr PD Navathe, Wg Cdr N Rattan

With the advent of newer generation aircraft with advanced technology, there has been a shift in the pilot's role from manual operation to that of a systems manager. The emphasis is now more towards mental workload rather than physical workload of the pilot. The latest technologies incorporated in ASF aircraft requires the pilot to deal with a large number of inputs from the aircraft systems. Effective utilisation of the system provided depends on intelligent interpretation and the capability of the aviator to obtain a holistic picture for precise and effective accomplishment of the task. For the assessment of mental workload in ASF, a study was conducted in the Mirage 2000 and SU 30K squadrons and the findings obtained were assessed so as to find out the effect of mental workload in a two pilot aircraft vis-a-vis in a single seater aircraft. The study was conducted using a questionnaire filled by structured interviews. The study was able to elicit subjective ratio of mental workload in different roles of the aircraft. The differences in the workloads are brought out, and implications of testing in two pilot aircraft discussed.

Helmets For Fighter Aircraft In The IAF : A Sizing Perspective

Sqn Ldr VV Joshi

A large variety of helmets are in use in the IAF consequent to the large variety of aircraft, both of western and eastern origin on the inventory of the IAF. Correct sizing of helmet is important to achieve maximum in-flight comfort and head protection. The paper reports the findings of a study in which a survey of 109 aircrew, flying different types of fighter aircraft was done. Alarmingly low helmet fitness satisfaction levels were found amongst the Russian stream helmets. The reasons for poor fitment were discussed. The methods used by the aircrew in selection of their flying clothing are also discussed. The paper also correlates the sizing schedules prescribed for various helmets with the aircrew anthropometric database to identify the incongruencies in these schedules. Remedial field level measures which can be carried out to improve the fitment satisfaction are recommended.

*Suggested Indian Schedule To Consolidate The Process Of
Certification Of Oxygen Mask*

Wg Cdr Pankaj Tyagi, Dr (Mrs) Parvati Gopal, Gp Capt GS Nayar,
Air Cmde AK Sengupta, Gp Capt Ranjit Kumar

The MIL SPEC requirements to test an oxygen mask, for fighter aircrew were studied. Elaborate and expensive infrastructure arrangements required to conduct such tests have been brought out in this paper. Suggestions and justifications have been made to have an Indian Test Schedule with specific tests that could be conducted at the existing facilities, with slight modifications, thus creating an inhouse capability to type certify an oxygen mask for fighters, which is a vital component of integrated life support system (ILSS). A different approach, from the conventional mindset to test equipment against foreign test schedules, would be able to save foreign exchange and dependence on foreign labs, while maintaining high levels of confidence required for such an equipment. If acceptable, such an approach could be extended to the other components of ILSS.

Qualify Control Indigenous Flying Clothing : Field Experience

Wg Cdr VS Shrivastava, Gp Capt RR Kapur

Quality control for flying clothing is of paramount importance, more so for fighter flying. Flying clothing has to be of high standard so that there are minimum chances of its failure in air. Recently, there has been a thrust towards indigenisation of flying clothing which is a desirable step. However doubts are being raised at various levels regarding quality control of indigenous flying clothing. To alleviate this fear and to get feed back from the users leading to improvement of the quality of the flying clothing, Air HQs had issued a policy letter to examine all flying clothing received at Station Logistics Section. As per that policy, a team consisting of an Av. Med. Specialist, a pilot and a technical officer are examining all flying clothing before its being issued to the users. Defect or observation report if required, is raised based on the observations by this team.

It has been observed that besides the indigenous flying clothing, some used flying clothing items are being retrieved, repaired and are sent back for issue. The details of the repairs carried out is not being mentioned. Similarly it is not known if these repaired items are being tested and certified by any competent authority/agency. This trend is not desirable. This paper highlights the experience on the subject for last two years at no. 11 Wing AF. Suitable recommendations are also made.

Indigenisation of Aircrew Equipment

Wg Cdr VN Jha

Indigenisation of aircrew equipment is mandatory for the Indian Armed Forces which possess a variety of aircraft having a large inventory of flying clothing. A large sum in foreign exchange is paid every year for equipment which has relatively a low technology and many of which has already been developed indigenously. We have the expertise to be self reliant but the developmental work has to be planned with a vision on future requirements. Reverse engineering is no longer an advisable method and only a new development with own design and data base should be undertaken. The aircrew equipment having considerable flight safety concerns, understandably has a complex indigenisation process involving many government evaluating, inspecting and certifying agencies. As a result the developmental process is largely a coordinated effort where project completion is as such bound to take longer time. However, there are some problem areas in the process of indigenisation which further delays the project and hence is required to be

solved on priority. After the completion of the development work, the responsibility for subsequent quality control of the bulk productions lay with altogether a different agency, the Directorate of Quality Assurance.

Retrospective Analysis Of HBOT Operations At IAM
Sqn Ldr CS Thakur, Wg Cdr V Gopal, Dr Parvati Gopal

The Rapid Recompression Chamber which is also utilised for administering hyperbaric oxygen therapy (HBOT) was installed at this Institute in 1967. The chamber has been put to good use for treating cases from Service and Civil Institutions. A retrospective analysis of all cases treated till date is presented highlighting the experience of IAM and difficulties/problems encountered. The aim of presentation is to highlight the role of HBOT as a valuable tool in the armamentarium of therapy in the treatment of indicated/experimental clinical conditions. The current concepts of HBOT and newer frontiers have also been discussed.

Hyperbaric Oxygen Therapy : Our Experience at No. 1 AMTC AF
Sqn Ldr D Malik, Wg Cdr G Gomez

The role of HBOT in saving life or limb in certain medical and surgical conditions has been well established as the primary mode of treatment, or as an adjunct to other measures. This is based on the physiological and physical attributes of HBOT by achieving better oxygenation of tissues. However, its role in several conditions remains less convincing and is still on a trial basis. HBOT was started at No. 1 AMTC AF in 1991 with the installation of multiple HBO chamber. During the last 7 years a total of 77 cases have been treated with HBOT with mixed response.

Maximum cases were of CNS origin where hemiplegia/paraplegia/quadruplegia were the clinical manifestations due to various aetiologies. CVA with hemiplegia being maximum number of cases (27). Traumatic paraplegia, Arachnoiditis, Cerebral Oedema were the other causes (9). Three causes of cerebral embolism phenomena (post RHD) were also treated by HBOT. The treatment schedule was adjusted as per the clinical response and on an average 2.5 ATA for 90 minutes (with oxygen breaks) for 6-7 days for four weeks was the usual regime. Response of these neurological cases was varied and defied any set pattern. However, it was seen that traumatic and thromboembolic lesions responded better than hemorrhagic lesions. Two salient aspects were, the duration of the pathology wherein fresher cases responded better than in the old ones and concurrent physiotherapy was found to have synergistic effect on recovery from the illness. Six cases of residual Bells Palsy with residual facial muscle weakness were treated with dramatic results. Most of the case recovered fully with the recent cases recovering completely within two weeks of HBOT. Trial on other neurological cases such as Multiple Sclerosis, Motor Neurone Disease, Muscular Dystrophy, Maculopathy, Poliomyelitis, etc did not show any convincing response.

On the other hand various surgical cases such as Crush Injury of limbs, Lacerated Wounds, Impending Gangrene were treated with HBOT (9). All of them showed favourable response and good salvaging of borderline viable tissue was achieved. Cases of Non Healing Ulcers, Burn Injuries, Skin Grafting Discharging Sinuses also showed predictable response and benefited the patients by achieving healthy granulation and net-fibrogenesis.

Importance Of Dose Titration In HBOT

Wg Cdr V Gopal, Dr (Ms) Parvati Gopal, Sqn Ldr CS Thakur

HBOT has evolved into a highly specialised field and the newer books lay great emphasis on monitoring of patients during HBOT. At this Institute, we are operating the chamber with no monitoring of patient's parameters. Facilities for administering HBOT are available at select Air Force and Naval Units. It has recently been introduced in the civil also. Current concepts in the administration of HBOT emphasise on the importance of Dose Titration so as to minimise oxygen toxicity and achieve the best desired results in therapy. This is so because the conventional monitoring equipment have to be modified keeping in mind the limitations imposed by safety criteria of HBOT chambers. High oxygen concentrations within the chamber impose a serious threat of fire / explosion. Hence most monitoring equipment used in hyperbaric chambers have to be modified with respect to their power source and mode of data transmission. This paper discusses the necessity and requirements for Dose Titration in patients receiving HBOT.

Oxygen Toxicity : Newer Concepts

Dr (Ms)Parvati Gopal, Wg Cdr V Gopal, Sqn Ldr CS Thakur

Oxygen toxicity has been recognised since long. Inhalation of oxygen at high partial pressure can be harmful if the duration of exposure is more than the latent period for development of a form of oxygen toxicity. The safe latent period becomes shorter as oxygen pressure is raised. Two main organ systems involved are Toxicity on lungs (Lorraine - Smith Effect) and Toxicity on CNS (Paul Bert Effect): Two types of crises have been described.

The exact mechanism of oxygen poisoning and the nature of cellular resistance to the oxygen are not well understood. Molecular oxygen can be considered to be a potent enzyme inhibitor. Oxygen can also oxidise some of the important non protein constituents of the cells into inactive forms.

The pathophysiology of development of oxygen toxicity with emphasis on current concepts of the importance and mechanism of Free Oxygen Radical Generation (FOR) and their metabolism in normal tissue is elucidated in the paper. Newer concepts in the understanding of CNS toxicity, i.e., role of Nitrous Oxide, will also be discussed.

Air Sickness : Morbidity Pattern And Strategies

Sqn Ldr S Sood

Airsickness (AS) is a common aeromedical problem of ab-initio flying training. It is an important cause of aircrew rejection at Flying Training Establishments. This paper reviews the incidence and etiology of AS amongst flight cadets during 1996-98 at BFTS. A total of 52 aircrew suffered from AS during Phase I of Flying Training imparted on HPT-32 an incidence of 18.5 +/- 2 %. Various contributory factors having a bearing on the problem of AS and management strategies are discussed. The beneficial effects of these measures when used in combination and before the onset of AS have been highlighted.

A Comparison Of Two Non-Pharmacopeal Methods Of Management Of Air Sickness

V Chandramohan, Dr MS Thimmappa, Air Cmde AK Sengupta

The present investigation concerns the use of two non-pharmacopeal methods of airsickness management in enhancing adaptation and tolerance to vestibular induced motion sickness. The sample consisted of 60

airsickness referral cases from No 2 AMTC who were not benefitted with other conventional methods of airsickness management. Twenty subjects were assigned randomly to each one of the three groups : Biofeedback Therapy Group, Combined Yogic Exercises Group and the Cognitive-behaviour Therapy Group and Control (no treatment) Group. Each group had undergone one mode of management training and 10 sessions were given for each group. The desensatisation training consisted of ground phase of desensatisation training and airbourne phase of desensatisation training. The result indicated that of the two experimental groups, only the Combined Yogic Exercises and the Cognitive-behaviour Therapy Group exhibited significant increase in tolerance. The airbourne phase of desensatisation revealed that 5 (25%) from the Biofeedback Group, 20 (100%) of the Combined Yogic Exercises and Cognitive-behaviour Therapy Group and None from the Control Group could be managed successfully. The review after six months showed that there was no relapse successfully managed for airsickness. Combined yogic exercises and cognitive-behaviour therapy deserves to be an effective prophylaxis. Also, this method seems to be a more cost effective and less time consuming method of treatment for airsickness.

Fear Of Flying : A Case Report

Sqn Ldr Sanjeev Sharma, Wg Cdr PD Navathe, Sqn Ldr Vipin Sharma

During armament phase training, a young Iskara pilot had an unnerving experience. He presented with symptoms of anxiety which were aggravated on the days of solo sorties. He vomited in the cockpit on two occasions. Physiopathological abnormality was ruled out at the local Sick Quarters and the local Military Hospital. There was a reluctant admission by the individual about his fear to continue fighter flying. A diagnosis of Fear of Flying (FOF) was made. He was referred to IAM IAF for management by the aviation psychiatrist. A prolonged evaluation and detailed psychiatric evaluation lead to a diagnosis of neurotic depression. The case is discussed to analyse the intricacies of the illness. The role of the Squadron Medical Officer for early diagnosis of FOF is also highlighted.

Neurocysticercosis In An Aircrew : A Case Report

Wg Cdr S Damodaran

Neurocysticercosis is known to present with varied clinical manifestations. Epilepsy with variable neurological deficits is one of the common mode of presentation. Psychiatric symptoms with behavioral abnormalities is an unusual clinical presentation. A case of neurocysticercosis in an aircrew who initially presented with unspecified psychosis and later developed epilepsy is discussed.

Ergonomic Factors During Spin Recovery in IJT-16 Trainer Aircraft

Wg Cdr NN Aggarwal, Sqn Ldr VV Joshi

Spin manoeuvre familiarisation is an essential part of training syllabus and requires simultaneous two handed operation in recovery of aircraft (ac). Amongst trainer ac in the IAF, spin recovery problems were perceived more in IJT-16 (Kiran). An ergonomic laboratory study involving 10 experienced male fighter pilots in applicable flying clothing revealed that the overall forces on control column were within tolerance limits of single handed operations, the second hand guidance was required for better precision. The reach envelop studies in harness tight conditions for maximum forward operation of control column with permissible shoulder movements and without shoulder movements showed mean angular motion difference at the control column $4.320^{\circ} \pm 1.26^{\circ}$. The mean difference between forward movement of hands in two study protocols involving one hand and simultaneous two hand operation was $1.81^{\circ} \pm 0.86^{\circ}$. The observed differences are statistically significant ($p < 0.001$) influencing peak compromises under static and

dynamic flying conditions of spin under simultaneous accelerative stresses. The situation could get further compounded by anthropometric and geometrical variation in elbow-wrist and shoulder-arm complex of individual crew and in women pilots who generally have shorter limb parameters compared to their male counterparts. The paper discusses various spin related ergonomic problems considering anthropometric and cockpit design factors.

A New Taxonomy For Aircrew Decision Making

Wg Cdr PD Navathe, Gp Capt GS Nayar, Wg Cdr Bhupinder Singh

The process by which aviators make decisions is hidden in the neuristics involved in all decision making. It is more difficult to identify the process because of the lack of time to identify various processes and pathways. Moreover, the information is rarely forthcoming from the aviator because he may not be able to describe events, and his decision is also likely to be suspect since it could be the result of conscious modifications or unconscious defence mechanisms. However, based on contemporary knowledge and interviews with several dozen experienced aviators a taxonomy has been derived. The taxonomy and pathways were tested against existing accident data obtained at the DFS. The pathway did not require modification within the accidents reviewed. The taxonomy is presented and the data analysis presented as a sample data to exemplify the role of such taxonomies in human factor elucidation.

Low Positive Gz Tolerance During Centrifuge Training

Wg Cdr Harish Malik

High +Gz centrifuge training in the Indian Air Force was started in March 1991. 308 fighter pilots have undergone the training so far. Only five pilots could not complete the minimum criteria of +Gz level and +Gz duration tolerance laid down for the successful completion of the course. One of these pilots repeated the training after three years and could complete the training successfully. However, one pilot who came back again after only 6 months, was not able to tolerate the required +Gz runs. The present paper discusses the minimum criteria of +Gz tolerance and the cases of low Gz tolerance during the centrifuge training and its implications.

Post High Sustained +Gz Albuminuria

Sqn Ldr CS Thakur, Wg Cdr H Malik, Gp Capt GS Nayar, Wg Cdr Gokulnath

Exposing a healthy subject to high gravitational (HSG) forces in +Gz axis causes considerable strain on several systems of body including renal system. Fighter pilots who are exposed to HSG and simulated aerial combat manoeuvres (SACM) using anti G suit during the centrifuge training are required to do anti G straining manoeuvres (AGSM) involving large group of muscles. In this situation, appearance of albuminuria can be taken as one of measure of strain of kidneys. For this purpose, urine was tested albumin on twenty four occasions in fourteen pilots under going centrifuge training at IAM after various levels of HSG viz 7G, 8G and 9G and SACM of varying duration. None of these pilots were found to have albuminuria in the post-G exposure urine samples. Possible mechanism of albuminuria during HSG and role of Anti G suit in prevention of such albuminuria is discussed in this paper.

Neuroprotective Measures in Neurodegeneration

PN Bindu

Injuries to central nervous system (CNS) are devastating events for which there are currently few therapeutic options. Recent studies have shown that the CNS is capable for repair if the right neurochemical envi-

ronment exists. The proper environment requires a decrease in factors that are inhibitory to neuronal repair and an increase in factors that are stimulatory which enhance the survival.

(-) Deprenyl, a MAO-B antagonist, has been shown to be an effective neurotrophic, neurorescue and neuroprotective agent in various models of neurodegeneration induced by MPTP, axotomy and mechanical injury. Similarly, Phenyl-Butyl-Nitron (PBN), an effective spin trapping agent which reacts readily with many free radicals and thereby hinders the cascade of free radical generation in situations where highly oxidative radicals shown to cause oxidative injury such as traumatic brain injury, age related oxidative changes of brain and exposure to endotoxin. Neuroprotective efficacy of (-) Deprenyl and PBN has been evaluated in different situations of neurodegeneration, spinalcord ischaemia and aluminium neurotoxicity. Treatments with (-) Deprenyl and PBN in spinalcord ischaemia have shown to improve the locomotor deficits. Similarly, exposure to aluminum caused neurodegeneration of rat primary cortical cultures and addition of either (-) Deprenyl or PBN can significantly attenuate the aluminium neurotoxicity and protected neurons from degeneration.

In conclusion, the studies conducted in our laboratory shown that (-) Deprenyl and PBN can neurons subjected to different forms of insult.

Estimation of Foetal Weight in Normal Pregnancy by Ultra Sonography
Dr KJ Vedavathi, Dr. HB Veeranna

This scientific work was done in the Physiology Department under the guidance of Prof HB Veeranna with modern sonographic technology foetal weight is estimated with reasonable accuracy. This estimation is based on the premise that volume can be derived from measurements of the foetus and the foetal volume is related to foetal weight. This relationship is justified as volume is equal to the product of mass and density and the overall foetal density is close to unity throughout gestation. All pregnant women are screened as early as possible to prevent neonatal and maternal complications. 30 pregnant women in the age group of 18-34 years and at 28-40 weeks were scanned at regular intervals between I, II, III trimesters. They excluded diabetes, hypertension, abortions, congenital anomaly and without any complications. Parameters of AIRCRAFT & HC were taken and foetal weight was estimated by using Dr. Woo's formula. In all the cases $P < 0.0001$. In all trimesters the rate of growth was estimated. Statistically these parameters are found to be significant. (PPBS - Mean 95.16 ± 14.37 , AIRCRAFT 34.116 ± 2.356 , HC 33.3 ± 0.9 , GW 2753.8 ± 177.89 , BW 2.89 ± 0.2647). This study concludes that the rate of growth is increased from I to III trimester of pregnancy and ultrasonograms must be done as early as possible in I and II & III trimesters to prevent neonatal and maternal complications.

Comparative Study of Mean Platelet Volume in 30 Healthy Males with Respect to 30 Healthy Females
Dr SV Umadevi, Dr HB Veeranna

This scientific work was done in the Physiology Department under the guidance of Prof HB Veeranna platelet size is a determinant of platelet function. Estimation of MPV is a simple out patient technique to determine the platelet function. The larger platelets are more reactive per unit volume than smaller platelets. They produce more prothrombotic factors such as thromboxane A₂. Mean platelet volume is also a predictor of recurrent myocardial infarction. There are very few studies carried on MPV in male and females. There is controversy as to whether there is a variation in MPV in healthy males and females. In our study we have screened 100 healthy subjects and have chosen 30 males and 30 females. The criteria for

selection being the age group 0-60 years, subjects were not on any medications. Hemoglobin level in females < 12 gms/dl and <14 gms/dl in males, no history of blood transfusion. Female subjects were not pregnant or consuming oral contraceptives. Smokers and alcoholics were excluded from the study. The age of the males were matched with the age of the female subjects.

1ml of EDTA venous samples were drawn between 9-10 am & MPV was estimated using celldyne 1700, a automatic cell analyser. Mean & SD in 30 healthy male subjects were 7.4200 ± 0.67 and in 30 healthy female subjects were 7.3433 ± 0.5563 . 't' value was 0.5746 & 'p' values were not significant. Mean & S.D of MPV was raised in males as compared to female subjects even though t & p values were not significantly raised. This may be the reason for increased incidence of cardiovascular disease in males as compared to females.

Neurobiology Of Unconsciousness

Metu B. L.

Consciousness is defined as an awareness of self and environment. According to modern medicine consciousness states are classified into waking, dream and deep sleep. For the worldly transactions, we relate the consciousness as a property of waking state. This waking consciousness involves an individual's ability to perceive and process the on-going events in the light of past experiences, current circumstances and future options. According to the ancient Indian system of philosophy consciousness does not differentiate into waking. It is all pervading un-differentiable, ever existing pure conscious state usually referred as TURIYA.

So far it is not possible to point out and understand this TURIYA state scientifically, as it seems to be experienced subjectively. However efforts are being made to understand in terms of electrophysiological alterations induced through yogic practices which are affecting the functioning of the mind like meditation and pranayama. Though we have not observed any clear cut changes in EEG or autonomic parameters due to meditation, practice of pranayama showed increased EEG power, decreased Sympathetic activity and shortening of middle latency potentials. Shortening of middle latency potential indicates suppression of interneuronal activity with enhanced ongoing synaptic activity. However the meditators sleep architecture found to be altered, showing prolonged REM sleep with minimal or absence of deep sleep. The results indicating the alteration in their consciousness states due to meditation, provide many clues for the understanding of consciousness.

Emerging Trends In Neurosciences

TR Raju

Rapid progress is taking place in the field of Neuroscience at behavioural, systems, cellular and molecular levels. Scientists are able to define the molecular basis of higher mental functions such as learning and memory. The Non-invasive imaging techniques such as MRI and PET allow us to visualize the structural and functional aspects of the brain. Computational Neuroscience is enabling us to model and predict how the brain can perform complex tasks such as information processing. The discovery of the property of neuronal plasticity suggests that even an adult nervous system is capable of forming new connections or withdraw some already existing connections. New light has been thrown on the possibility of central nervous system regeneration. Molecular neurogenetics is progressing in a rapid manner and gene mutation for several mental health and neurological disorders have already been identified. The identification and purification of a novel group of molecules namely neurotrophic factors hold new promises for treating degenerative disease of the nervous system. Even drosophila genetics is contributing immensely to under-

stand the various aspects related to neural development and synaptic activity. To recognise this tremendous progress in Neuroscience, the entire decade of 90's has been declared as the 'Decade of the Brain'.

Hospital Waste Management In The Armed Forces

AVMLK Verma, Wg Cdr JN Srivastava

Hospitals are an important feature of social structure. Hospitals are places of healing as well as a potential source of infection. In the recent past danger of improper hospital waste disposal has been realised. In a society where civic amenities are already under stress great care will have to be taken to see and ensure that other avoidable stress is not allowed to play up on it. There is always a limit as to what and how much stress can be sustained. But when the break out point is crossed the deterioration and degradation will be very rapid. Therefore, we have to take care before break out point is reached.

Hospital waste acquires special significance since a part of it (15-20%) is infected. It is also more heterogeneous than the municipal waste. Therefore a system approach to managing hospital waste has to be adopted. Lack of awareness amongst health care managers & handlers only compounds the problem.

Review of Medical Documentation : Court Cases

Wg Cdr MG Ajmani

A progressive increase is seen in number of personnel seeking remedy through judiciary on account of invalidments, grant of extension and promotions due to being declared medically unfit and for grant Disability Pensions. There is scope for reduction of such court cases and appropriate representation in courts by AFRO (legal Cell), when extra care is given in medical documentation at all levels.

Certain amendments and endorsements on AFMSF-16 and 17 have been decided by office of DGAI/MS, in view of rising court cases on account of Disability Pension and question of deciding on attributability and aggravation factors. There is also need for giving additional details on AFSI-15.

The policies on Promotions and Extensions of service of Arimen have been recently revised. Personnel in low medical category GEE with disabilities neither attributable nor aggravated to service are affected by these and have started to go to courts for remedy certain changes have been made in regards to issue of fitness certificates by medical officers which are required to be strictly followed.

In this presentation, effort is made to cover above aspects. Certain examples are given and a few cases cited where correction act in medical documentation is possible which would lead to enhanced efficiency at medical wing of AFRO.