Spatial Disorientation Training

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Spatial disorientation (SD) is a major cause of military aircraft accidents and incidents. Regardless of the age and in-flight experience, all aircrew members are vulnerable to disorientation in their flying career. The literature and aviation medicine forums abound with issues and concerns regarding SD in both civil and military flying with the ultimate aim of prevention of SD related incidents and accidents. There is now a world wide acceptance that SD prevention strategies need to focus on three major categories: education and training, research and equipment. The appreciation that SD is a manifestation of human physiological limitations in the in-flight environment has led to adoption of SD recognition and awareness training of aircrew as the main effort towards SD prevention [1,2,3,4,]. Devices offering demonstration of illusions on the ground and high-fidelity dedicated machines capable of simulating specific flight profiles to demonstrate SD to pilots are now being proactively used by various air forces.

Project Group (PG) 117 of Air Standardization Coordinating Committee's (ASCC) Working Party (WP) 61 is dedicated towards standardization of training and research in aspects of SD and exchange of information among the member countries in this regard. AIR STD 61/117/1 of ASCC relates to Aviation Medicine/Physiological training of aircrew in SD with the intent to define the minimum aviation medicine/physiology training in SD for aircrew. The AIR STD provides a standardized academic definition for SD, specifies details of the required (and agreed) classroom curriculum and makes general recommendations about ground-based and in-flight demonstration and training [5]. INFO PUB 61/117/8 Spatial Disorientation Training Curricula provides information of each member nation's SD training curricula in a standard format [6]. The ASCC nations are Australia, Canada, New Zealand, United Kingdom and the United States.

SD Training in the Indian Air Force

The aircrew in the Indian Air Force are exposed to dedicated instructions on SD during the basic, intermediate and advanced stages of flying training as part of the aviation medicine training package. This is followed by a regular reinforcement of these instructions by the squadron aviation medicine specialist in the field. Earlier, the experience of the SD phenomena was limited to the vestibular illusions (gyral and coriolis effects) demonstrated on the Barany's chair to the trainee pilots at basic stage of flying and consequent to head movements in a human centrifuge rotating at low G levels to operational pilots reporting for the Advance Fighter Aeromedical Indoctrination Course course at Institute of Aerospace Medicine (IAM), IAF, Bangalore.

The importance of instruments and their scan in maintaining orientation is generally demonstrated in the Unusual Attitude Recovery sortie under the hood in a fighter trainer, as part of the instrument flying (IF) training. The aim here is primarily to teach aircraft recovery and not the causes or preventive aspects of disorientation.

The IAF has recognized the importance of SD demonstration and training to combat SD and improve the SD coping skills of its aircrew. AMST, Austria manufactured Air Fox Disorientation Simulator was installed at IAM Bangalore in May 2004. The Institute is the centre of excellence in aerospace medicine in the country and spearheads all operational aeromedical research and training.

The SD simulator consists of a 6-DoF-motion system with an additional, continuously rotating yaw mechanism to generate linear and rotational motions. It utilizes advance electronic controls, computer-model driven responses and vivid graphic displays. The system provides safe and realistic real time disorientation training. The computer generated scenarios can also be manipulated from the control desk to generate full IFR capabilities including simulation of poor visibility, clouding and time of the day. The facility of a graded increase in the yaw rotation and additional heave motion gives an additional capability of being used for motion sickness desensitization [7].

The simulated training of IAF aircrew includes awareness of thirteen common illusions for fighter flying and three additional illusions for the helicopter aircrew. These are imparted by a trained specialist in Aviation Medicine. Five of these illusions involve passive operation of the simulator and serve to demonstrate the limitations of the orientational senses. The active illusions involve a closed loop control of the simulator by the pilot. These illusions are: coriolis, somatogyral, oculogyral, nystagmus, autokinesis, spin recovery, leans, dark night take-off, black hole approach, false horizon (clouds), and illusions of runway width and slope. For the rotary wing, the demonstration also includes height-depth perception over land, sea and snow and flicker vertigo.

The Institute was mandated from the beginning to initiate a structured SD training programme for the fighter and helicopter aircrew of IAF. Based on intensive discussions and interactions among experienced test pilots, operational pilots from both fixed wing and helicopter streams and aviation medicine instructors from the Institute, a curriculum was designed for the basic SD course. This course was started with the following aim and objectives:-

Aim

To augment ground based SD training imparted to the aviators of IAF to enable early recognition of SD and initiate appropriate corrective actions.

Objectives

(a) To increase awareness of the limitations of the physiological orientational mechanisms.

(b) To increase awareness of conditions predisposing to SD.

(c) Demonstration and experiencing of common in-flight illusions.

(d) To enhance the trust in instruments and ability to initiate corrective action.

The five-day course for ten fighter aircrew included 10 hours of theoretical lectures on SD, aviation psychology and human factors. Each aircrew then underwent about 2 hours of simulated exposure to SD demonstration and training. Similarly, ten helicopter aircrew underwent a two day basic course in SD indoctrination comprising 90 min of classroom instructions and about 60 min of simulated SD demonstration and training each.

In May 06, the requirement of basic SD training for all aircrew in the shortest possible time utilizing the full capabilities and service life of the SD simulator was reconsidered. The Institute was tasked to increase the frequency of the SD courses for fighter aircrew. Hence a 2 day modified basic SD indoctrination course has been initiated. The classroom lectures on SD have been reassigned as pre-course refresher by the aircrew from standardized material (lecture and power point presentation) circulated by IAM, under guidance of the local aviation medicine specialist

Subjective feed-back from the aircrew on the effectiveness of the SD simulator and training have been encouraging. Majority of them have reported an improvement in their awareness of SD phenomena to be very good to excellent after the course.

SD training in IAF vs other Air Forces. The IAF philosophy and curricula for initial SD training on simulator is akin to that being evolved and followed by other countries The instructors at IAM have gained sufficient experience in the operation of the SD simulator since its installation two years back in 2004. The current thrust is on delivering basic SD training to all the aircrew of IAF in the shortest possible time.

Future Directions. The installation of the simulator has given an impetus to SD related research at IAM. Projects on understanding the psycho-physiological basis of SD and reconstruction of SD related accidents on the simulator have been initiated. A survey of the prevalence of SD in the IAF utilizing standard questionnaire format is in progress. This intends to enhance the understanding of the occurrence of SD in IAF and aid in developing future preventive strategies. International cooperation and exchange of information on the training patterns to combat SD will go a long way in exploiting the full capabailities of these simulators. Such cooperation will also generate newer ideas for research on SD and related aspects.

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