Short Review Article

Extended night operations

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ABSTRACT

Latest night enabling technologies have made it possible for the aircraft to fly exacting missions during night. But, the human being is faced with a variety of problems due to changes in bio-rhythms. This paper discusses some problem areas related to extended night flying and highlights the importance of close co-operation between flying unit personnel and the aero medical community. The paper also recommends measures to enhance night capability along with improved flight safety.

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KEY WORDS: **Aircrew fatigue, Night flying, Extended night flying**

In the past, night missions have been flown only during contingency situations.

Today, battle space is considered four dimensional. Along with night, depth and breadth of battle field; time has become an important component of warfare and it continues to change the importance of Center's of Gravity (COG). A key target of the moment could soon become unassailable if not attacked in time.

In our subcontinent key movement of surface forces take place at night. Furthermore, night attacks keep a continual pressure on the enemy's AD capability and deny him vital time for rest, cooling, servicing and repairs. Thereby degrading his offensive potential, interfering with repairs of his airfields, imposing psychological pressure and creating confusion and harassment. Therefore the side, which is able to carry out night strikes, is likely to have a decisive edge in future operations. Hence, it is imperative that IAF should have a 24 hour and dedicated night capability which integrates technology, doctrine and force structure. This paper highlights the problem areas during extended night operations and suggests remedial measures [2].

Dedicated Night Strike Capability

Few squadrons of IAF have been assigned with the task of performing dedicated night strikes. These squadrons are engaged in carrying out extended night operations on regular basis.

Key Issues

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Circadian Rhythm

Human being experience a regular cycle of sleep and wakefulness, which has a constant relationship with the day-night cycle. Day-light and darkness are the most important environmental influence on this circadian rhythm. Disturbance in the environment and unusual patterns of work are likely to change the sleep-activity cycle of circadian rhythm. Figure 1 shows the average range for human core body temperature. Sleep normally corresponds with the section of the curve where core body temperature and alertness level is low. A schedule that routinely conflicts this cycle can be expected to predictable difficulties in obtaining adequate sleep and lead to associated decrements in performance both short term and cumulative [1].

Sleep physiology

The sleep physiology of human beings could best be understood with the help of a graph Figure-2. The X axis displays the time of the day and latency to drowsy sleep is reflected in the Y axis (time in minutes). The graph could similarly be plotted for night also [1].

An analysis of the sleep latency test clearly indicates that a person feels drowsy between 1400-1600h and again after 2200h. During this time period, the alertness level of most individuals is lower and his ability to concentrate lesser. Hence, chances of committing a mistake in a skilled task would be higher.

Night operations

The night operations have inherent differences with day flying. These include re... external visual references, loss of dep... perception, chances of disorientation and in... to fly at extreme low altitudes. Hence, night ... is inherently more stressful and demanding. ... routine flying activities need more concentr... at night than that required during day time.

Technology Limitations

The fighter ac available with IAF today assigned for extended night roles has techn... limitations. There are no night vision devices ... there is a lack of accurate night navigation aid... as well as precise targeting equipment. Hi... increased performance is required from the ... even to carry out routine flying activities. ... increased performance requirement puts the ... under additional stress and adds to the cumula... stress burden at night especially during extend... night operations.

WORKING HOURS OF A SQUADRON

It is well known that the working hours ... an Sqn is longer than any base working ho... These working hours, without adequate rest p... in between, is liable to cause cumulative st... over a period of time.

CASO Restrictions : Aircrew Fatigue

Considering the stress involved with ... flying, the CASO'S stipulate a few restrictio...

(a) Night flying beyond 2400h for not ... than three consecutive nights.

(b) Minimum ten hours gap between cess... of night flying to commencement of ... flying.

(c) Normal duty period should be eight hours and maximum should not exceed ten hours. The station working hours should not govern the working hours of a unit.

(d) If aircrew is required to be on duty for periods in excess of ten hours on three consecutive occasions, a 24-hour period should elapse before resuming flying duties.

It is difficult to follow the CASO in letter and spirit. The primary reason is that the station working hours commence from 0700h. Therefore mass briefings; parades, Boards of Officers, Duty Officer and other station duties need to be attended to during thise time period.

DIFFERENT TYPES OF STRESS

Stress should be as defined as physiological response to the pressures of daily routine and is vital for affective living [2]. Stress could be due to conflict with co-workers/family members, unrealistic expectations, work pressure, lack of sleep, money worries, inadequate self confidence and demand of quality. Some amount of stress is beneficial as it raises the alertness level and makes a human being perform better. Also stress is necessary for achievement of goals. However, cumulative stress beyond a threshold level (which varies from individual to individual) is harmful and the performance graph of the individual drops considerably thereon.

Stress could be classified as follows: -

(a) **Environmental (physical).** This is due to cold, noise and vibrations. Also in aviation, it relates to higher stress level during night flying.

(b)**Environmental (working environment/ Human relationships).** Martial problems or problems with children put additional burden on the aviator. Also, the entire environment surrounding the aircrew is geared to work during day and sleep by night. The aviator involved in dedicated night strike squadrons is unable to devote adequate prime time towards children's education, social engagements and wife. This results in fraction and demand on the aviator to devote time from his rest time towards family/social activities. This type of stress is equally important to all personnel on ground including technical, ATC, Met and flight safety who are actively involved in flying operations.

(c) **Psychological** the psychological stress relates to G effect, disorientation and health problems. This stress considerably reduces the pilot's situational awareness and his ability to react correctly to changed circumstances.

(d) **Reactive** this stress essentially relates to response towards emergent and unforeseen or unfamiliar situations.

EFFECTS OF EXTENDED NIGHT FLLYING AND EXTENDED WORKING HOURS

Extended night flying implies flying at extended durations in a 24/48-hour period. With less number of qualified pilots for extentended night operation in a squadron, some aircrew needed to fly even 05 hours per day. In some aircraft without autopilot, night operations did add additional stress to the pilot. Some of the experiences of extended night flying are highlighted in the succeeding paragraphs.

Sleep loss. Though sleep requirements vary considerably, it is generally perceived that six to eight hours of sound sleep per day is a requirement. Sleep loss affects the quality of

thinking, concentration ability and decision making capability. Sleep loss also results in fatigue and increased stress level. As this is cumulative, there is a deterioration in the performance of the aircrew, technical personnel and traffic controllers. Thereby making them liable to commit mistakes during stressful situations.

Sleep loss and fatigue could lead to the following: -

(a) Complacency. Easier acceptance of substandard performance.

(b) Computational and Navigational errors. Mathematical and abstractional abilities are reduced.

(c) Degradation in Human performance. There is a marked reduction in human performance to carry out routine tasks.

(d) Communication Errors. Ability to communicate effectively gets degraded.

(e) Sense of Disjointment. Feeling of being alone especially while flying during late night hours with limited external lights and less number of ac flying.

(f) Reduced situational Awareness. Ability to respond to changed circumstances or stressful situations reduces.

(g) Disorientation. Fatigue increases chances of disorientation (especially at night). It is possible that the accidents at night due to disorientation could be resulting from cumulative fatigue as one probable cause. Disorientation could be of the following types.

(i) Empty Field myopia Relative short sightedness in flight.

(ii) False Reference. Stars near the horizon are mistaken for lights on ground. Also, whilst engaging clouds at night, changes of false reference is very high.

(iii) Autokinetic illusion. Staring at stars lights leads to movement of stars light areas.

(iv) Occulogravic illusion. Gives a feeling nose up attitude of ac while the aircraft accelerating on ground.

(h) Psychological Effects. Sleep loss and fatigue slowly result in psychological problems irritation and quarrelsome nature. Thereby leading to demoralization over a period of time.

(i) Reduced Ability to combat stress. Sleep loss and fatigue reduces the ability of the aircrew and personnel to combat stress and there is a tendency to give up in stressful situations.

REMEDIAL MEASURES.

There is no doubt regarding the need for 24 hrs operations. At the same time, there are problems related to extended night operations. Both these needs could be meshed and balanced provided certain issues are tackled in the right spirit and there-by meeting both operational requirements and flight safety considerations. Some of the measures required are enumerated below.

Co-Location of Night strikes squadrons. Though op location could be different from peacetime location of both dedicated night strike squadrons should be at one base. This would optimize the working hours of all the agencies involved with night operations. Besides ensuring better and efficient maintenance of night ready (as and when the Mig-27 ac are fitted with improved avionics and night vision devices) squadron's incumbent responsibility of station duties would also get optimized. The station working hours could start in the afternoon and end at night. This would ensure that a squadron need not work from 0700 hrs in the morning till 2400 hrs at nigh, thereby re-

cumulative fatigue and excess working hours producing reduced output. Additionally, the environment around the night squadron itself would now be in consonance with night operations, thereby reducing overloaded on all agencies involved in flying operations. In case jaguar squadrons are given dedicated night capability, similar placement of two jaguar (night) squadrons at one base could be considered an option.

Continuity of Night operations : Night flying should be planned on consecutive days; not more than five days and not more than two weeks in a month (preferably alternate weeks). This block method of training would ensure that biorhythms of the personnel adjust to night operations periodically.

Mig-27 ac up gradation : To enhance combat potential and reduce pilot stress, equipping them with modern avionics and night vision devices would enhance the Mig-27 ac's performance capability and reliability. In the night equipment acquisition process, the dedicated night strike squadron personnel should also be integrated.

Changes in force structure : The night strike squadron could be split into two-flight structure with enhanced manpower. The two flights should work on day/night shifts for that week on alternate eight week basis. This would ensure that 24 h capability is retained within the squadron and yet flight safety is not compromised. The personnel chosen for the dedicated squadron should have displayed better night performance in their previous squadrons. No ops U/T aircrew should be posted to the Night strike squadron (One single aircrew could take away as much as 25-30% of available day task). This would reduce operational day training hours available with the squadron for other aircrew. Only ops day/Fully ops on type should be posted to dedicated night strike squadron.

Physical Fitness : It is a known fact that physically fit individuals are less prone to disorientation and are more capable of handling combat stress as well as cumulative fatigue. Fully equipped gyms should be provided at squadrons and time should be made available to utilize these facilities. Even Gym utilization (three days a week) in morning/evening could be made compulsory depending on the officers work shift.

Role of Aeromedical officer : An Aeromedical officer would need to be a part and parcel of the dedicated night strike Squadron. He/She would have to closely integrate with the squadron personnel (officers and airmen) including their families. Also, he/she would have to play the role of a psychotherapist. The need would be to assess individual stress levels and to identify cumulative fatigue signals. Thereafter advice the commanding officer on corrective measures. Also, the medical officer would need to regularly counsel the squadron personnel as a whole.

Education of families : Education of families in recruiting their understanding and support will play vital role in conserving flight safety. It is here that AOC/Stn Cdr and doctors have a major role to play.

Leave periods and exercise durations : The best method to counter cumulative fatigue is regular and periodical leave. It should be ensured that in every six months all personnel of the squadron take at least two weeks of continuous leave. Squadron detachments and courses should be streamlined at the Air HQ level in a focused manner so that an aircrew is not out of his peacetime location for more than eight to ten weeks at a time (except lone term professional courses)