Aeromedical problems of operations at high altitudes

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Operating helicopters from and over snow-bound airfields and helipads imposes significant stress on aviators. Most of these problems are perceptual in nature and many are not well understood. A questionnaire survey was carried out on the problems specific to high-altitude operations. Sixty-eight pilots operating in the area responded to the questionnaire. The results of the questionnaire survey are presented with specific reference to the operating environment. The operational and flight safety implications are brought out and the possible solutions discussed.

Keywords: Helicopter operations, Snowbound terrain

Operational flying undertaken over the western Himalayan ranges is often intense. There are times when some of the important tasks are to be carried out under adverse conditions. Proximity of an international border with poorly marked line of actual control complicates the problems further. The look of the terrain changes overnight from lush green and well-delineated to snowbound and without contrast. Snow piles up on the runway and the helipads, giving different perceptions to pilots. The temperature at some of the helipads drops to as low as –55°C. The blizzard and the wind chill effects make the chances of survival remote. The weather is highly unpredictable, with a tendency to change for the worse. Often there are pressing requirements to fly under adverse conditions, at times taking calculated risks in order to accomplish the mission or to return back to the base.

Problems of high-altitude operations are unique and start right from the stage of induction without proper acclimatization. Fighter operations acquire a new dimension in view of the readjusted engine parameters, and airframe wear and tear due to higher true air speed (TAS). The cockpit work-load increases, thus reducing the time for effective navigation and system handling. Tactical manoeuvres become critical due to low air density, higher TAS and lower thrust. The radius of turn increases, and hence the bank has to be readjusted. This becomes critical, especially on the base leg of approach and landing, if one has to avoid overshoot. Adapting to all these changes takes time before the pilot gets mentally tuned to the readjustments and develops the ability to cope. There is also a feeling of 'coming to halt' while entering the snowbound areas even at high speed, due to no contrast [1]. In helicopter operations, a compatible oxygen system for continuous use is mandatory. Weather is unpredictable and flying in 'dead man's valley' gives the feeling of isolation.

Following the first sortie after a snowfall, the pilots were interviewed to find out whether there was any problem of aeromedical concern. The problems so described were discussed with pilots flying subsequent sorties and on the basis of these discussions an elaborate questionnaire was prepared. In addition, there were options to put forth any problem which was otherwise not mentioned in the questionnaire.

Only fully operational first pilots operating at high-altitude airfields and helipads were included in the study. Before answering the questionnaire, the pilots were briefed about the aim and the scope of the study. A total of 68 pilots (64 helicopter pilots and 4 Indian Airlines pilots) participated in the study.

Some of the problems reported in this study, common to all the phases of flying, include the

glare from the surroundings and faulty depth perception over the snow. Glare has always been a problem in snowbound areas [2]. At times the glare is strong enough to cause snow blindness. Glare has been stated to be of maximum concern in the taxi/hover and landing phase because some of the pilots avoid putting on their (cortino) visors, which perhaps are not suitable for flying as they cut off the much needed visual cues due to their low transparency. Three of the pilots rated the glare to be of the order of 7, which is just short of causing an aircraft accident. Glare in the cruise phase, though persistent, does not cause much concern. Poor depth perception, on the other hand, is evident in all phases of flying. In the taxi/hover phase one is not sure of one's height above the surface. During the cruise the altimeter assists well in supporting the visual cues, but during approach/landing there are all sorts of problems like an odd pilot flaring too high or too low. In addition, the weather also plays its role in faulty estimation of the horizontal distance, with the slightest of haze leading to gross overestimation and a clear weather to underestimation of the distance [1].

Pilots show concern for poor clearance from the edge of 8–10 ft piled-up snow at the time of taxi and hover. There is a fear of even collision with the adjacent structures. There is considerable strain on the pilots at the time of hover as the fresh and loose snow is blown up, reducing the outside visibility. Under such conditions, it is difficult to judge the height above the ground, the rate of spot turn is always a guess and a slow drift is imperceptible. In the narrow valleys there is an occasional illusion of nose-down/going-down during take-off due to high mountains making the horizon appear high up. This feeling reduces with experience of the terrain.

Problems during the cruise have been minimum. An illusion of bank is perceived in a level flight mostly over a sloping surface. The illusion is compounded by the lack of the pilot's faith in the air-driven Gyro instruments [1]. Arctic white-out was reported very often in this study as well as in other studies [2]. It may be that pilot enters clouds as he fails to differentiate an approaching small patch of cloud from that on the distant horizon. Such conditions are mostly reported by the MI-17 crew while going for a drop sortie.

Problems during approach/landing and flare were reported by a large number of pilots. Three of the four Indian Airlines pilots reported of an illusion of snow-blocked runway just beyond the middle marker while approaching overhead at a particular angle. It was an overcast weather condition just before noon at a surface temperature of 0.2°C. A thin layer of water which had formed a patch on the runway was the cause of this illusion. The illusion was so real that it did not show any difference between the snow on the runway and that on the rest of the surface – possibly the effect of reflection from the thin layer of water on the surface of the runway. The illusion disappeared while flying out of the bracket.

The pilots in the glacier report defective perception of ground speed under shadow/overcast condition while landing. At times, they also failed to perceive the slope in and around the helipads even though the helipad markers were laid out. Over the slopes, pilots tended to attain transition much above or below the helipad and at the last moment had to undertake corrective actions. At some of the places the men and material are too close to the table top helipads and any error can lead to disaster.

As relates to flying clothing, 47 of the 64 helicopter pilots commented that the protection afforded by the flying boots, gloves and visors was inadequate for operations in such areas. Low temperatures resulted in leg pain, and the sensory inputs from the rudders, cyclic and collective, were often faulty. There was numbness over the feet and the hands, and the feel on fingers was altered. Escape from fighter aircraft should take into account faulty depth perception over snow for timely initiation of ejection, and the higher parachute-opening shock due to the

higher setting of the barostatic time unit. Tumbling, spinning and oscillations are even more at these altitudes. Landing after ejection may be at a narrow peak or a crest, over soft or hard snow, each having its own problem. Over such terrains even survival is difficult.

Direct questions pertaining to any illness received poor answers. Only a few pilots indicated of forgetfulness, lethargy, sleepiness and light headache at high altitudes. Flying fatigue was possible among MI-17 aircrew when they flew 8–10 sorties of 40–50 min each on a clear-weather day. A look at the sickness trend among ground crew showed indigestion, flatulence, loss of appetite, bleeding per anum and constipation, which could be attributed to the loss of appetite and low roughage in the diet. In general, there were certain psychological problems as well, which included mood changes, irritability, argumentative behaviour and mild depression. Such effects have been noticed in some of the other studies also [3]. No pilot reported sick with such problems, possibly fearing suspension from flying.

Conclusions

Problems of aeromedical concern in flying over snowbound areas have been studied in each phase of flying. Glare and poor depth perception have been found to be ever present. Estimation of distance is likely to be faulty under different weather conditions.

Blowing up of fresh snow during hover gives errors in the height above the surface and the rate of spot turn, and the slow drifts become imperceptible.

During cruise, an illusion of bank has been reported. A small patch of cloud becomes indistinguishable from that on the distant horizon.

During approach, an illusion of blocked runway has been reported. Altered ground speed was perceived in shadow and overcast conditions. A sloping surface caused an error in the approach. The present flying boots, gloves and visors have been opined to be inadequate for operations under extreme cold climate. Lethargy, sleepiness, light headache, constipation and epistaxis are common. Minor psychological problems have also been seen amongst the ground crew, which could involve the pilots as well.

References

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