

Heat Stress — A Pilot's Point of View

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THE operating environment in our country is unique in that we have all types of terrain, viz., deserts, plains, hill tracts and the mighty Himalayas. The environmental conditions vary from region to region. The temperature gradients and seasonal variations particularly in North India are of great significance to Military Aviation. The summer lasts almost six months a year and very high surface temperatures are recorded with peaks in April, May and June. The months of July, August and September are hot and humid.

The operational dictates are such that our Air Force has a large force operating in the plains and desert regions of North India. Therefore, we have to adapt ourselves to operate under trying conditions of heat and we are doing so successfully. Our aeromedical experts have conducted useful research and made significant contribution towards our understanding on problems of heat and associated stress.

Heat and Aviation

The governing factors in Military Aviation for successful task accomplishment are man, machine, mission, medium, and management.

It is clear, therefore, that the man-machine combination must be managed in the medium to accomplish the mission. A fighter aircraft is basically a weapon platform capable of performing various operational tasks. We have come a long way since World War I and the modern day supersonic aircraft are capable of tremendous performance. It calls for

a very high degree of skill on the part of the man or the pilot to make an effective combination with the machine. The performance level of this combination suffers when subjected to heat stress. The aircraft on its own is capable of operating at high temperature levels without loss of performance, due to strides made in technology. It is therefore clear that man is the weak link in the combination.

I shall confine myself to heat stress encountered by pilots flying fighter aircraft. It is small in size and the cockpit has a transparent bubble canopy. It is not feasible to have a large air-conditioning system like in a passenger jet. The aircraft is manned by a single pilot who is expected to perform the following tasks:

- (a) Fly in formation for the operational task while simultaneously performing duties as a formation team member.
- (b) Manoeuvre aircraft skillfully in three dimensions.
- (c) Navigate and look around.
- (d) Acquire the target and accurately deliver the weapon load in a hostile environment.
- (e) Keep a constant listening watch on R/T.
- (f) Handle in-flight emergencies in a cool manner.

The cockpit has a maze of instruments and switches which the pilot is required to monitor and operate. He is required to wear protective flying

clothing like pressure suit and anti 'g' suit. The work load for a pilot in the cockpit is very high and he is always at a certain stress level. Heat therefore would be additional stress.

The missions usually flown are either Ground Attack or Air Defence. The Ground Attack role consists of either Counter Air missions or Offensive Air Support for the ground forces. The pre-flight briefing for a ground attack mission takes 40 to 45 minutes. The leader would cover the task and duties of each member of the formation. He would explain the tactics for the sortie at great length. The briefing rooms are not always air-conditioned and in summer they get quite hot, even with fans. Each pilot in the formation must thoroughly understand the briefing. The pilot's ability to pay attention and concentrate on the briefing would be reduced when it is hot and uncomfortable.

After briefing, the pilots proceed to the aircraft at least 15 minutes before start-up. The aircraft are parked in the open, and in summer, even during the early hours it is difficult to touch any metallic part of the aircraft, as it would be extremely hot. During later hours the aircraft parts are so hot that even gloves offer very little protection. On entry to the cockpit, the pilots feel as if inside an oven. They sweat profusely and a high degree of physical discomfort sets in. These discomforts are ignored to a large extent because they get busy with the pre-start checks and procedures. After start-up the formation would taxi out to the take off point. In most aircraft, taxiing is done with the canopy closed with no ventilation. In summer months especially when it is humid, fatigue sets in right away. The time spent on the ground prior to take-off is usually 10 minutes. This period is considerably increased at times, even upto 20 minutes, due to other traffic. It is most irritating for a pilot to wait on the ground in anticipation of take-off, sweating away and listening to blaring R/T. An experienced pilot would have the patience to wait whereas an inexperienced pilot would feel totally helpless. The sweating is so profuse that it pours down to the eyes and causes irritation, and is difficult to be wiped off.

The formation would execute a take off and settle down to pre-arranged positions. For Ground

Attack mission the aircraft are flown at low level and high speed. At this altitude the cockpit conditioning is inadequate and the temperature keeps rising due to aerodynamic heating. The thermal discomforts are ignored to a certain extent because of high work load. Poor visibility due to dust haze, bird menace and turbulence make the task difficult for an average pilot. The formation while navigating to the target is expected to tackle enemy defences, acquire the target and accurately deliver the weapon load. It has also to defend itself against enemy aerial opposition and return safely back to base. All these call for a high degree of skill and efficiency and a pilot under heat stress is certainly not at his best.

The formation after landing would spend about 10 minutes on the ground, taxiing back to the dispersal area before switching off. This is one of the most uncomfortable times spent in the cockpit. Pilots are very tired, sweating away, and all they want to do is switch off, open the canopy and take off their clothes. The pilots would then return to the briefing room to carry out a de-brief of the mission, which usually lasts for about 30 minutes. Drenched in sweat with dripping clothing they crave for cool drinks to recuperate.

An Air Defence mission consists of quick alert interception and air combat, combat air patrol over an area or providing escorts to Ground Attack aircraft. The sortie duration is usually short. A pilot is subjected to large accelerative forces during air combat. In air defence sorties though the aircraft may climb to medium levels, the duration being short, the cockpit does not have a chance to cool down to comfortable temperatures. The recovery phase, landing and return to the dispersal are very similar to that of Ground Attack mission.

Peace time operational training is very exhaustive. On each flying day a pilot averages 2 or 3 sorties, involving both Ground Attack and Air Defence. The supervisory staff average 3 to 4 sorties a day. The flying stamina varies from person to person and over a period of time an experienced pilot easily copes up with the flying task and does not feel the strain. An inexperienced pilot becomes very tired after two sorties a day and therefore the build up in his case has to be gradual.

In my own experience I have regularly encountered cockpit temperatures of 50 to 55° C and on one or two occasions I have even recorded temperatures upto 70° C. I have all along flown in the Punjab plains and over the years adapted myself to a degree where heat has not really bothered me. I have found an instructional sortie, involving circuits and landings, most taxing. In tandem seat trainers the rear cockpit has no ventilation at all. The pilot in the front cockpit is trying to do his best but the instructor in the rear cockpit is at the end of his patience. Circuit flying is very demanding where adjustments have to be made for other traffic. There is a constant harassment due to bird menace and turbulence and the instructor has to keep talking to the trainee. All this in a hot, uncomfortable cockpit makes one tend to lose temper, particularly when the trainee in the front is not getting things right. A very similar situation is encountered during dual checks for air to ground firing. The firing exercises involve high 'g' conditions for prolonged period. I have also found that, when the mission demands are high physical discomforts are automatically ignored. However, they manifest themselves during routine operations like recovery, landing and taxiing. I have personally found that the degree

of discomfort is colossal during the months when humidity is high, even though the surface temperature is quite low.

The correlation between heat stress and flight safety is obvious. The aero medical experts would deal at length about various aspects of heat stress and its management. I have a few suggestions to offer. The briefing rooms need to be air-conditioned/aircooled. The flying clothing must be made more comfortable. The pilot's environment should be conducive to proper rest by day and peaceful sleep at night. The nutritional status of the pilots should be maintained at optimum level for safe and efficient performance. All these would help in enhancing heat tolerance.

Conclusion

In a tropical country like ours, heat stress is a problem that our aircrew are required to cope with. The difficulties that a pilot encounters due to heat have a bearing on his performance and ability to concentrate. A few suggestions have been offered to improve the existing facilities so that our pilots perform better and better.