

Heat Stress in Maritime Reconnaissance Sorties

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Abstract

MARITIME reconnaissance (MR) sorties involve flying at low altitudes (500 - 2000 feet) over the sea for long duration (8 - 11 hours). Air over the sea in summer is hot and humid and air conditioning in Super Constellation aircraft is ineffective at these altitudes. A study has been carried out to evaluate the heat stress in seven MR sorties.

Introduction

Maritime Reconnaissance sorties using Super Constellation involve low flying between 500 ft to 2000 ft over the sea for prolonged duration of 8 to 11 hours (typical sortie is 10 hours). Super Constellation, is a very comfortable passenger aircraft when cruising at 12000 ft. and above. Air conditioning system works on the inflow of cold ambient air from outside which is circulated inside the aircraft. During low altitude flying over the sea, ambient air is hot and humid and air conditioning becomes ineffective. Particularly at mid-day in summer, the cockpit is most uncomfortable and it has been observed that crew often discard their flying overall and fly in their shorts.

In addition to the heat stress mentioned above there are other factors which affect aircrew performance:—

- (a) Prolonged duration of 8-11 hours continuously searching for contacts at sea produce fatigue.
- (b) There is an acute problem of glare over the sea during bright sun. When the aircraft is facing the sun, there is direct exposure to sun rays. It not only increases the heat load, glare often becomes irritating to the point of distress. This may cause headache and mental irritability.
- (c) The judgement of distance and depth perception is poor over water.

In view of the above, it was realised that heat stress coupled with other stresses could adversely affect the efficiency of the aircrew and could pose a flight safety hazard. Hence a pilot project was initiated to study the quantum of heat load.

Material and Methods

Following environmental parameters were recorded in flight in seven MR sorties:

- (a) Dry bulb temperature in the cockpit and also in the Navigator's compartment, using a mercury thermometer.
- (b) Radiation was measured by Globe thermometer, 6 inches diameter black globe was used and was kept on the Signaller's seat in the cockpit.
- (c) Air movement was recorded using Katalthermometer.
- (d) Humidity - wet bulb readings were taken from Whirling Psychrometer in the Navigator's compartment.
- (e) Ambient temperature was noted by the temperature gauge provided at the Navigator's table.

Corrected Effective Temperature (GET) was calculated from nomograms available². In-flight data were recorded at half hourly time intervals at various altitudes during actual reconnaissance sorties.

Results

The study was conducted during two sorties in October 73, three in August 74, one in December 74 and one in June 75. Progressive changes in the values of GET for the last five sorties are presented graphically in fig. 1. The ambient temperature during these sorties ranged between 59-95°F.

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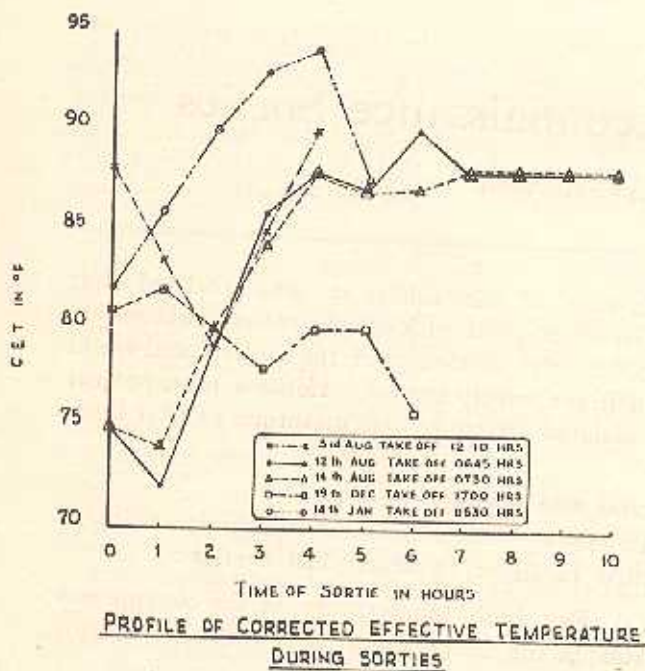


Fig. 1

Cockpit dry bulb temperature was found to be about 10-15°F higher than ambient temperature. Maximum cockpit temperature recorded was 101°F. It was also observed that dry bulb temperature in the Navigator's compartment was 2-7°F lower than cockpit temperature.

Air velocity recorded was between 0-30 ft per minute inside the cockpit.

Maximum value of globe temperature recorded was 106°F. Though the pilots were sometimes exposed to direct rays of the sun, globe kept at the corner of Signaller's seat was not exposed to direct sun rays. Flying in the bright sun, globe temperature was often 7-15°F higher than dry bulb temperature.

Discussion

The comfort zone for heat acclimatised Indian subjects has been laid down as 76-80°F.³ It can be seen from fig. 1 that a greater duration of the sortie was in an environment above the comfort level.

Air movement is an important factor for thermal comfort. It helps sweat evaporation particularly in humid atmosphere. Inside the aircraft

there is hardly any air movement. One small fan is provided over the signaller's seat which is inadequate.

This degree and duration of the heat stress can affect mental capacity and aircrew efficiency, since the hottest period along the Indian coastline is April-May, higher degree of thermal stress can be expected during these months.

Recommendations

- Any MR sortie of more than six hours duration in summer should carry an extra set of aircrew so that one crew is resting in passenger compartment by turns.
- Light weight porous cotton cellular overall to be used for MR sorties.
- Cockpit should have large dark green movable visors to prevent heating by direct sun-rays.
- More fans to be provided in the cockpit for better air movement.
- Any previous ill health, particularly fever, upsets heat regulating mechanism and predisposes to effects of heat. Pre-flight medical check must be thorough and more purposeful.
- Facilities should be provided for adequate supply of cold water, fresh lime (with salt & sugar) and beverages during flight.
- The air conditioning system in this aircraft should be improved.

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