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38 Functional characteristics of helicopter pilot suits during cold water immersion and hot air exposure

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There is an increasing demand for the development of constant wear thermai protective garments for aircraft personnel. Such suits are required to offer adequate thermal protection in case of accidental cold water immersion and should not precipitate heat stress during normal flight operations. Such a suit must therefore incorporate an optimal balance between fabric permeability and insulation and should allow adequate ventilation of the suit microenvironment. Two suit design solutions have been suggested for aircraft personnel servicing offshore installations- a) wet suit concept and, b) dry suit concept.

Four types of helicopter pilot suits were investigated, representing both the dry and wet suit concepts: A) Goretex. 6) Cotton ventile, C), Nomex/lnsulite, and D) Nomex/Neoprene. Suits A and **B** were of the dry suit type, whereas suits C and D were of the wet suit type. The insulative characteristics of the suits during cold water immersion were investigated in the first part of the study. Five subjects were immersed in 10°C water on five separate occasions. During the first immersion, subjects wore only shorts, while in the remaining four immersion trials they wore the four suits under evaluation. In addition to the helicopter suit, subjects wore long cotton underwear, a longsleeved cotton undershirt, woolen socks, boots and gloves. Suit D was a thin Nomex coverall, to be worn above a short long-sleeved neoprene wet suit.
The second part of the study evaluated the suit in simulated summer cockpit conditions. Subjects were seated in an Environmental Chamber at an ambient temperature of 2OOC. The temperature of the chamber was elevated linearly to 4OoC over a one hour period and the subjects remained seated in the chamber for a total exposure of three hours

Results indicate that suits C and D (wet suit concept) offered better thermal insulation during cold water immersion. Subjects wearing suits A and B during head out immersion in 10°C water had a much greater cooling rate. During the hot air exposure, greatest elevations in core temperature during the three hour exposure were observed in subjects wearing suit C (Nomex/lnsulite). Suit assembly D (Nomex coverall with a long-sleeved short wet suit) appeared to have the best overall performance results. It offered adequate protection during cold water immersion and did not induce excessive heat stress during the hot air exposure.

It is concluded that performance tests of constant wear thermal protective clothing should include tests of ventilation and permeability characteristics. Clothing fit is extremely important for adequate insulation, especially in suits based on the wet suit principle.

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