AVIATION SPECIFIC PROBLEMS

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I. OVERVIEW

Seabee medical and dental personnel generally have limited involvement with flight crew. The airborne cockpit environment places peculiar challenges and obligations on practitioners, which necessitates specialty training. This training, which includes primary flying training, lasts approximately 6 months and qualifies the participant as a Naval Flight Surgeon. Aircrew who present for medical care should be seen by a qualified flight surgeon if available.

There will be occasions when a flight surgeon is unavailable. In these situations, the medical department may be required to deal with problems in the absence of a flight surgeon. Problems may be medical, or emergencies such as an aircraft mishap. In order to act in an informed and appropriate manner, the medical department needs to be familiar with aviation specific problems.

II. AVIATION ENVIRONMENT

Aviators work in stressful surroundings. In the demanding physical environment of flight, mission workload can be overwhelming. Personal and operational stressors can create a psychological environment that compounds the problem of decision making. Resulting errors can be critical and unforgiving.

The aviation physical environment encompasses the extremes of air pressure, temperature, noise, vibration, motion, speed and acceleration. Many of these variables change quickly and can be compounded by clothing and equipment. Movement to effect control of the aircraft must be done against resisting harness straps, safety equipment and aircraft motion. A protective winter flying suit required for outside environmental survival may become insufferably hot in a busy cockpit.

Against this environmental backdrop, mission workload involves the physical tasks of controlling the aircraft, the intellectual tasks of problem identification and analysis, and the executive tasks of decision making and effecting action. Complete professional expertise not only is required, but must be immediately accessible during conditions of severe psychological stress. Mission duration can vary from a few minutes to many hours, perhaps days. Geographical displacements can result in extreme circadian rhythm disruptions. Operational necessities can severely reduce periods of rest.

Aviator performance of in-flight tasks must be organized and efficient despite the degrading influence of the environment. Efficient human performance is dependent on good health and

fitness. Maintenance, restoration and surveillance of health are medical issues. An omission or a failure in judgement by a medical officer can potentiate disaster.

III. AVIATION SPECIFIC PROBLEMS

A. Pre-mission.

Pre-mission planning includes maintaining a state of health sufficient to accomplish the task of the flight. As well as the usual spectrum of medical problems, health breakdown sufficient to threaten successful flight can include the less obvious, such as situational anxiety due, for example, to marriage breakdown or financial difficulty. Problems can also include fatigue caused by operational pressure, circadian rhythm changes, or poor lifestyle judgement, or stress caused by a multitude of personal, imposed or operational factors. While stress or fatigue symptoms may be consistent with ground duties, they take on special meaning in the air. Cockpit workload in a stressed, physiologically fatigued aviator can become overwhelming. As a result, breakdown of attention in trained behaviors can occur, leading to dysfunction.

B. Mission.

The mission begins on the ground. Aviators frequently experience the extremes of hot and cold during pre-flight walk around checks or in the cockpit prior to activation of atmospheric control systems. Delays in ground taxi or takeoff in a canopied jet without ground air conditioning can lead to dehydration and hyperthermia that may not present clinically until airborne. Helicopter operations in hot climates present a particular problem.

Once airborne, motion sickness can be a problem for the uninitiated, but is unusual in trained aviators unless underlying pathology exists. Noise exposure can be extreme in airborne situations, and high frequency hearing loss is common in middle aged pilots. Although temperatures in the cockpit and flight cabin are regulated, equipment failure can result in sudden and profound extremes.

Aircraft acceleration and the profound changes in air pressure that characterize some types of military flying have special significance due to their physiological effects. Forward aircraft acceleration, such as that experienced on take-off, can be exhilarating and is rarely a problem. Of more significance is the centripetal acceleration, which occurs during high-speed turns. This acceleration results in a force that pushes the aviator down into the seat. Internally, blood redistributes to the lower extremities under this downward force, reducing blood volume and flow in the upper body and head. With enough downward force, cranial blood flow will be reduced to the point of ischemia in critical areas, and central nervous symptoms will appear. These symptoms can consist of peripheral vision loss and/or visual clouding ("grey-out"), complete loss of vision ("black-out"), and complete loss of consciousness (LOC), with or without seizure activity. These symptoms affect flying safety and the result has been the loss of many aircraft and lives over the years. Acceleration remains an important aeromedical concern that has attracted much research interest.

Changes in air pressure occur with changes in altitude during flight. Pressurization systems in modern aircraft ameliorate, but do not eliminate, the effects of these changes. Problems occur when air cavities in the body fail to equilibrate with changing external air pressure, and a pressure differential results. Intervening nerves and soft tissue become mechanically stressed and symptoms develop. For example, when the middle ear cavity fails to equilibrate with external air pressure during aircraft descent due to a blocked eustachian tube, the resulting stress on the tympanic membrane may lead to injury, perforation or vestibular problems. Often, frontal or maxillary sinuses become blocked on descent with resulting pain and hematoma formation. Any air cavity can be affected.

Another pressure related problem that can occur results from supersaturation of nitrogen in blood with increased altitude. When supersaturation occurs, nitrogen can come out of solution and form in tissue or blood. The resulting micro-emboli can become symptomatic and lead to "bends". Aviators who engage in sport diving are especially prone to this problem, and for that reason regulations restrict diving prior to flying.

C. Emergency escape.

An ejection seat is the chief means of emergency escape from jet aircraft. Ejections can occur in ideal conditions that consist of controlled, relatively low speed level flight. Out of control escapes, or escapes at high speed will result in increased number of ejection related injuries. Ejections outside the design limits of the escape system frequently result in fatalities.

Seabee medical personnel may be involved in rescue of a downed aviator. The priority is preservation of life, clinical stabilization and early medical evacuation for definitive care. Resuscitation or treatment efforts may be hampered by retained flight equipment. Parachute harness and safety equipment should be cut away if needed to gain exposure, remembering the danger of sidearms or unused signal devices that may be carried by the aviator. The oxygen mask must be promptly removed if it has been retained, as it will restrict breathing. The helmet can be left on to aid in neck stabilization. The ejection seat, if lying nearby, should not be approached due to residual hazard from the rocket and initiators. Note that a downed pilot may possess a radio transmitter or other signalling device that can be used to coordinate rescue.

D. Mishap.

Aircraft mishaps remain an unfortunate reality of military aviation. Crashes involving loss of life are an emotional and physical trial for rescuers, medical personnel and families. The medical department may be involved in the immediate medical response to a mishap.

The first priority is preservation of life and that includes the lives of rescuers. Casualties should not be approached until it is safe to do so. A crash site is a dangerous place. Fuel and aircraft materials may be burning, unburned fuel tanks or pressurized oxygen tanks may explode, and unexpended ordinance may ignite. Loss of a medical response team due to poorly judged heroics at a crash site will increase the magnitude of tragedy and remove hope of survival for the critically

injured.

In the case of multiple casualties efficient triage, sorting of treatment priorities at a central collecting point, and rapid medical evacuation will be essential. Initial treatment should be aimed at stabilization and rapid evacuation. The key to success in mass casualty management lies in previous training and planning. Seabee Medical Officers should know and implement applicable unit mass casualty procedures.

The next priority is preservation of crash-site evidence for later investigation. This evidence includes human remains. An accident investigation board will convene soon after the mishap. This board will include a flight surgeon member who has been trained in accident investigation. Until the arrival of this member, the Seabee Medical Officer may be required to take charge of human remains. Improper handling of this evidence can compromise an investigation.

There are several guidelines. Do not remove human remains from initial locations in the crash site unless directly ordered by proper authority. Human remains most commonly belong to the jurisdiction of the local coroner who will need to authorize any release or movement. In addition to this authorization, consultation with the crash board president or flight surgeon should occur before remains are removed.

Disturb the scene as little as possible by securing the area and minimizing movement of personnel. Ensure that nothing is moved or removed. Take photographs beginning immediately, concentrating on the position and posture of remains and body-parts and their relationship to the wreckage. Close-up photographs of hands, feet, head and safety equipment are valuable. Film is inexpensive , so do not hesitate to take hundreds of photographs if necessary. While laboratory field tissue sample procedures are probably unnecessary, be prepared for that possibility if removal of remains is impractical or is unduly delayed. The scene should remain secured and undisturbed until the arrival of a flight surgeon or other members of the crash investigation board.

IV. GENERAL

In the absence of a flight surgeon, aviators may present to the medical department for care. The condition or illness itself, medications of any kind, psychological stresses and other problems may affect the aviator's ability to function in the flight environment. If there is any doubt about the aviator's fitness to fly, either due to the medical condition, or as a result of effects of treatment, a grounding notice or "down chit" (NAVMED 6410/1) should be issued recommending grounding. The aviator must see a flight surgeon before being re-cleared for flying duties.

V. SUMMARY

The Seabee medical department may be called upon to deal with aviation specific problems. The aviation environment is demanding and requires that aviators perform with high degrees of skill and knowledge. This performance is dependent on health and fitness, and medical support has an important role to play. Two special problems in aviation concern pressure changes and

acceleration during flight. Medical personnel responding to aircraft mishaps must preserve life as the first priority. Preservation of crash site evidence is another important priority. Seabee medical may ground an aviator, but a flight surgeon is needed to return an aviator to flying status.

VI. RECOMMENDED READING

1. Rayman RB. Clinical Aviation Medicine. Lea and Febiger, Philadelphia, 1990.

2. Dehart RL ed. Fundamentals of Aerospace Medicine. Lea and Febiger, Philadelphia, 1985.