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United States Navy Policy and Fatigue Management Relating to Long Haul Trans-Meridian Flights

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Abstract

In response to a worldwide terrorist threat, the United States Military is required to deploy aircraft to many overseas theatres. Consequently, flight crews must often fly long haul trans-meridian (multiple time zone) flights to airfields within these theatres. Pilots will be better prepared (for detachments lasting from between several days up to several months) if they know the physiological effects of these kinds of missions, the consequences of changes in circadian rhythms and how to better manage fatigue. Navy policy must also ensure that aircrews are properly trained in Alertness Management Strategies.

United States Navy Policy and Fatigue Management Relating to Long Haul Trans-Meridian Flights

One of the more challenging tasks a pilot can perform is a long haul trans-meridian flight (defined here as any flight which crosses more than five time zones within one 24 hour period). This seemingly ordinary mission flight profile actually has the potential to severely degrade the performance of an otherwise competent flight crew. Unlike normal missions, usually flown in close proximity to a fixed airfield or within a single time zone, the trans-meridian flight requires aircrews to mentally and physically prepare for the effects of sleep deprivation and changes in circadian rhythms (body functions such as hormonal, metabolic, digestive, cardiovascular, mental, etc.). Unless pilots are provided with effective techniques to manage fatigue, the hazards associated with long haul trans-meridian flights can become causal factors in aviation mishaps (Costa, 1999).

Civilian and Military Missions

The National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA) have conducted several relevant studies on the effects that long haul trans-meridian flights have on commercial pilots. Using the results of findings from these studies, the FAA creates crew day and crew rest policies for civilian air carriers. In the United States Military, each service branch maintains an aeromedical Staff, which similarly manages the implementation of flight duty limitations and crew rest periods for its respective aircrew. In order to understand the impact that this fact has on the amount of fatigue experienced by military aircrews on long haul trans-meridian flights, one should be familiar with the differences between civilian and military missions and policies.

Commercial Long Haul Missions

Commercial long haul trans-meridian missions are usually conducted with at least one flight (possibly up to 14 hours in duration) across several time zones (also up to 14 hours), a layover period of more than 24 hours (for aircrew rest) and a return flight similar to the first one. This entire mission is usually completed within two to three days. Civilian trans-oceanic flights crossing several time zones usually also maintain a steady schedule, possibly even allowing crews to maintain their routes and schedules throughout a long period of time.

Military Logistics Missions

While the United States Military maintains a schedule with flights similar to the commercial long haul mission described above, its operations require greater flexibility and adaptability. Missions are often scheduled with less than one week's notice to locations that are not routinely serviced. Aircrews actually remain in a constant state of readiness, as the missions may require immediate deployment to an overseas theatre. On one recent Navy logistics mission flown by this author for Fleet Logistics Support Squadron FOUR SIX (VR-46), two pilots logged over 40 hours, crossed eight time zones and returned to base within five days. While complying with all relevant regulations, the crew actually had to minimize rest time due to airfield hours and mission requirements. Each day, therefore, began at the "new" 7:00 AM and finished after sundown at the next overnight stop.

Of perhaps greater importance within the United States Military airlift command structure, detachments of aircraft for periods of several weeks to several months must be scheduled and executed despite the obvious major disruption on circadian rhythms. The Air Force and components of the Air National Guard usually conduct detachments spanning several months. The Fleet Logistics Support Wing (FLSW), which is responsible for nearly all of the

Navy's logistic flights, remains permanently based in the Continental United States (CONUS). Consequently, a Navy airlift detachment of a C-9, C-130 or C-40 requires transits of up to two days (two to three flights per day and crossing over more than six time zones) followed by nearly two weeks of flying within the new environment. This detachment must then return to its home station, using two further days of transit and requiring a similar change in time zones. The entire detachment is thus completed in less than three weeks. It should be noted that the primary reason for such a schedule is that many of the military personnel who are involved are Navy Reservists and therefore not permitted (either by law or by budgetary constraints) to be out of CONUS for more than seventeen days.

Adverse Effects

The problems most associated with long haul trans-meridian flights are shift work and jet lag. Even by themselves, each of these requires adjustment of an employee's normal biorhythm to the new work surroundings or schedule. Together, however, these problems seriously detract from the efficiency and safe performance of aircrews. Pilots on long haul trans-meridian flights eventually can experience de-synchronization, a condition that can lead to significant changes in sleep patterns, behavior and (probably most importantly) extreme fatigue. Such pilots will also then require re-synchronization of their circadian rhythms, finally returning them to safe and efficient flight operations (Costa, 1999).

The effects of the de-synchronization vary from person to person, but the chronic fatigue that can develop from the change in environment has been shown to be a contributing human factor in several aviation accidents (Costa, 1999). Conditions during the de-synchronization caused by jet lag and shift work may be exacerbated by use of medications or controlled substances, illness and any additional fatigue that already affected the individual before

experiencing the time zone changes. United States Navy aeromedical experts point out that "Aircrew are not grounded by can be expected to perform at a less than optimum level. Closer observation by the flight surgeon during the period may be desirable" (OPNAVINST 3710.7T, 2004, p. 8-7, ¶ 8.3.2.1.3).

Even removing the effects of long haul trans-meridian flights on pilots, fatigue is already a major factor in the alertness and performance of aircrews. Sleep deprivation caused by poor dietary and exercise habits, stress and chronic lack of recommended daily rest are all factors in determining the cumulative amount of fatigue that a person will experience before any mission. NASA defines flight crew fatigue as a combination of sleep loss acting with circadian rhythms and the "effect of flight operations on sleep and circadian physiology" (Rosekind, Grander, Connell & Co, 2001, p. 8). Effective management of flight crew fatigue is therefore always an important matter in the safe operation of aircraft, but even more during long haul trans-meridian flights.

Alertness Management Strategies

The results of NASA and FAA studies on aircrew fatigue have been used to create a comprehensive plan for airline executives, military officials and individual pilots to counteract the adverse effects of long haul trans-meridian flights. Classified as Alertness Management Strategies, NASA's recommended procedures include Preventative Strategies (used before flights and during the crew rest or layover period to minimize disruption of circadian rhythms) and Operational Strategies (used to optimize alertness and performance during flight). These are short term strategies designed to "conceal or attenuate underlying physiological sleepiness" (Rosekind, Grander et al, 2001, p.44).

Preventative Strategies may be used before flight duty and include the management of an individual's sleep quantity and scheduling as well as the taking of strategic naps (which should not include deep Rapid Eye Movement sleep). Additionally, an individual is encouraged to avoid alcohol, caffeine, heavy eating and significant exercise immediately before going to bed. The sleep environment (i.e. dark and quiet room) is also a major factor in maintaining good sleeping habits. Even suggestions such as to only use a bedroom for sleeping, not for eating or for watching television, are included in the strategies (Rosekind, Grander et al, 2001).

Operational Strategies are meant to be used in flight and to maintain alertness and performance. Suggestions include the use of conversation, proper nutrition and hydration and light exercise or stretching. Strategic caffeine consumption (i.e. don't use it when already alert) is also recommended. As a policy suggestion, NASA recommends a third pilot be added during long haul trans-meridian flights (Rosekind, Grander et al, 2001). NASA and the FAA continue to evaluate another element of this strategy, the in-flight or "NASA nap," in the hope that it might someday be used to further alleviate flight crew fatigue (Rosekind, Graeber, Dinges, Connell, Rountree, Spinweber, & Gillen, 1994).

Future considerations for possible countermeasures to add to the Alertness Management Strategies include the use of bright light and certain medications to aid in sleep and wakefulness. Bright light has been shown in studies to ease circadian rhythm adjustments if administered over a three-day period at an appropriate time (Rosekind, Grander et al, 2001). As for medications, the United States Air Force currently employs a program that allows aeromedical personnel to prescribe sleeping pills and stimulants to pilots to use as required. However, this policy was blamed as a causal factor in a 2002 "friendly fire" incident in Afghanistan (Walker, 2002).

Effective Military Policy

The United States Military must continue to ensure that its pilots are adequately prepared for the possible adverse effects caused by long haul trans-meridian flights. Currently, the Navy and Air Force train their pilots (in a classroom setting) to be aware of the physiological effects of changes in circadian rhythms. Throughout a pilot's career, this training is reinforced with unit specific instruction. In addition, aeromedical professionals are sent to individual units and bases to ensure that information and counseling is readily available. Each branch of the service encourages a high degree of physical fitness, which can further assist in fatigue management.

Military directives are also a significant way to foster awareness of the problems caused by long haul trans-meridian flights. At the current time, Navy flight publications contain a very thorough description of the duty limitations on aircrew and associated crew rest. Even the effects of circadian rhythm changes and fatigue on military pilots are discussed, but with no direct suggestions for dealing with such hazards (OPNAVINST 3710.7T, 2004). Conversely, the Air Force directives contain a more general discussion on biorhythms but a very concise description of the responsibilities of Air Force personnel for dealing with "the complex issue of aircrew fatigue" (AFI11-203v3, 2005, p. 72, ¶ 9.9). The Navy should follow the lead of its sister service and add a section to its directives discussing Alertness Management Strategies.

One way that the Air Force has managed to alleviate some circadian disruptions is to maintain a forward deployed presence in overseas locations (i.e. Japan and Germany), thereby minimizing the required number of long haul trans-meridian flights to bring personnel and equipment into the theatre. It may be advisable for the Navy's FLSW to consider extending the length of its missions to overseas bases to allow for a more controlled adjustment to new time zones without limiting the de-synchronization and re-synchronization process to a 17 day period.

Longer detachments would at least allow for adequate crew rest and circadian rhythm adjustment, as well as assist aircrews in their individual fatigue management. Similarly, the establishment of a definite policy for methods to achieve true re-synchronization would be useful.

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