2. Impact on well-being

There are no known studies that deal with the specific effect of fatigue on flight attendants' quality of life. Several studies do relate flight experience generally with cognitive effects and conclude that these effects are associated with fatigue/circadian factors. These studies suggest a higher-than-expected rate of neuropathology in flight attendants (Dalitsch, Fishback, Pannet, Bono, & Mayo, 2005), impaired memory performance and slower reaction time for international flight attendant crews when compared with ground crews (Cho, Ennaceur, Cole, & Suh, 2000) and the possibility of chronic neurological and performance deterioration following chronic circadian disruption that is unrelieved by adequate recovery periods (Cho, 2001). As mentioned previously, Cameron (1969) had 98 flight attendants participate in a questionnaire study before, during and after their flying careers, which resulted in reports of severe difficulty concentrating to increase from 0.0% prior to their flight attendants' career to 13.5% during their flight attendant career, and then a decrease to 3.2% after their flight attendants' career. It is noteworthy to point out that this is a survey conducted in 1969.

It seems clear that impacts related to performance and safety would have corollary impacts on well-being. One of the most commonly reported effects of fatigue is degradation of mood and motivation. Research has demonstrated that with increased sleepiness, there is an increase in reports of total mood disturbance (Dinges et al., 1997). Testiness and breakdown of social interactions are commonly reported among the fatigued. More specifically, sleepy people often report an increase in confusion, tension, anger and depression as well as a decrease in vigor. A recently released study of the impact of 9/11 on flight attendants' well-being (Corey et al., 2005) provides information on the stressors introduced by the attack and the mechanisms employed by flight attendants to cope with these new conditions.

Chapter X. Conclusions

The need for sleep is essentially a physiological response, which although varying among individuals, is universal. Offsetting fatigue requires sleep, rest and time to recover. The need for recovery is further influenced by the circadian cycle, which in turn is influenced by the time of day, time zones crossed, and lighting.

The off-duty or rest period for flight attendants includes time to wind down or fall asleep, actual sleep, and time to perform related tasks such as clear customs, get to and check into the hotel, procure meals, groom, call home, and the like. The time required for most of these tasks and the time devoted to fall asleep is unavoidable, with the result that reductions in off-duty time must be absorbed by the time that should be devoted to sleep.

A review of the evaluation materials available for this report, including a literature review on fatigue and circadian disruption, a sampling of schedules, incident/accident reports, and comments provided by a number of flight attendants, has suggested that some segments of this workforce were experiencing issues consistent with fatigue and tiredness. As such, flight attendant fatigue appears to be a salient issue warranting further evaluation. The Committee on Appropriations (House Rpt. 108-671) suggested that the practice of airlines to schedule closer to

the CFR minima on a more regular basis, and very short periods post-flight before the beginning of the rest period may be contributing to this effect. However, the limited nature of the study did not allow us to determine the extent to which scheduling practices either within a single carrier or across carriers were problematic. An additional factor is the difference between the *scheduled* work/rest periods and the *actual* work/rest periods as they play out in field operations. Aircraft-related and weather delays as well as other unforeseen operational events contribute to extending a duty period beyond what was originally scheduled.

The relevant CFRs have been in place since 1994, but from flight attendant reports and some bargaining unit concessions regarding staffing and scheduling has suggested that some airlines have recently been operating near the CFR minima. Just how widespread these near-CFR practices are cannot be determined at this time. Based on the incident reports, flight attendant comments, and the outcomes from the sampling of *actual* duty and rest times, it appears that the opportunities for adequate rest for flight attendants need to be further evaluated.

CFRs provide end points or not-to-exceed levels of regulation. But CFRs do not, and perhaps cannot, capture the multiple variables that impact fatigue and the individual's ability to tolerate fatigue. Taken from the standpoint of just the pre-determined dimensions of the flight itself, the CFRs do not distinguish among the number of segments flown, daytime versus nighttime flights, flights that are uni-meridianal vs. those that are trans-meridianal, regional versus domestic flights.

To truly address the fatigue issue, regulations must be combined with sound and realistic operational practices, and supplemented, as needed, by personal strategies. Air travel will always require flexibility in operations in order to adjust to unusual and/or non-routine circumstances. From the standpoint of flight attendant fitness and well-being, it is essential that work/rest practices address the exceptions and do not become the standard. One useful reference is the "Principles and guidelines for effective duty and rest scheduling" (Dinges, Graeber, Rosekind, Samel, & Wegmann, 1996). These principles were developed for pilots but should be a useful reference for flight attendants as well.

Chapter XI. Recommendations

This report was developed with data that became available before the study's deadlines. However, it became clear that not all information needed could be acquired during the time allowed for this report and that more time and additional research could contribute to the development of a more complete understanding of the phenomenon/problem of flight attendant fatigue. Some research recommendations could be accomplished in the near term. Others would require additional time and resources. Given the nature of the issue and the questions that remain unanswered, the following are a few suggestions offered for continued research to address the topic of flight attendant fatigue.

Survey of Field Operations. A survey of randomly-selected flight attendants could examine the rate of occurrence, and the field conditions, schedules, and practices related to flight attendant fatigue. A scientifically-based survey would assess the frequency with which fatigue is experienced, the situations in which it appears, and the consequences that follow.

Focused Study of Incident Reports. Incident reports provide a first-look at what, given different circumstances, might have become more serious events. A better understanding of the incident can be achieved by a follow-up interview. As practiced in the ASRS, an experienced analyst matching the expertise of the reporter (a former pilot, air traffic controller, mechanic, or flight attendant) engages the reporter by telephone to explore how the incident developed, what preceded it, how it was resolved, etc. This structured interview process can be directed towards a particular issue, in this case flight attendant fatigue.

Field Research on the Effects of Fatigue. Field research could explore the physiological and neuropsychological effects of fatigue, sleepiness, circadian factors, rest schedules, etc. on flight attendants. Such study would collect actigraphic data and light measurements to document flight attendants' sleep/wake schedules and exposure to zeitgeber cues from light. Flight attendants would also complete sleep diaries in order to verify estimates of sleep/wake schedules.

Validation of Models for Assessing Flight Attendant Fatigue. Reliable, predictive modeling of the effects of particular schedules on fatigue and performance would be an important tool for the aviation industry. The examples given above indicate that models offer promise for the proactive assessment of risk. Modeling provides a possible approach to understanding in advance the impact of the relevant variables. Validating the model(s) would be an important step to understanding whether and how models could be used in conjunction with field operations. This would be best accomplished by using data acquired through field studies in conjunction with laboratory experiments.

International Policies and Practices. The present investigation concentrated on domestic airlines. However, it is likely that there is much to learn from how other countries address these issues and with what results. It would be desirable to conduct an in-depth investigation of international flights rules, regulations, and schedules in comparison with CFRs and to assess the consequences they have experienced. For example, the Australian aviation industry has implemented a fatigue risk management system (FMRS). "The basic premise of the performance-based FMRS is to allow organizations to determine acceptable controls for safety and appropriate management styles for their own circumstances, rather than imposing rigid, inflexible rules" (McCulloch, Fletcher, and Dawson, 2005). International cabin crews could also be included in studies such as the Field research on the effects of fatigue mentioned above.

Training. With sufficient knowledge and planning, it is possible in some circumstances to reduce the level of fatigue experienced. Flight crews could benefit from exposure to information on fatigue, its causes and consequences, its interaction with circadian disruption, and how and when to employ countermeasures (scheduled naps, physical activity, social interaction, caffeine, etc.). It would be useful to develop and distribute training materials for flight attendants, schedulers, and their management that could be employed individually or organizationally.