THE FACT THAT TIRED PEOPLE DO NOT PERFORM AS WELL AS WELL-RESTED PEOPLE DO IS A TRUISM THAT HAS BEEN LONG CONFIRMED BY CAREFUL EMPIRIC study in the laboratory.1 What is less obvious is the way in which fatigue manifests itself in performance changes. At one extreme, the fatigued subject may be in a microsleep (or, indeed, full sleep), in which case there will be a missed or tardy response. Such effects are often best detected by measuring lapses (unduly slow responses), for example, in the Psychomotor Vigilance Task. This was shown nicely in a study of repeated sleep restriction,2 in which the number of lapses increased as the week of restricted sleep progressed. However, even without microsleeps, there can be a general slowing in information-processing speed.3 Others4 have argued that sleep loss results in a loss of cognitive creativity, as indicated by a tendency to use old information processing strategies, even though they are no longer optimal or even practical. Certainly, from all viewpoints, the more extreme (and/or chronic) the sleep loss and the longer and more boring the task, the more likely performance decrements are to occur.5

In most real-world situations, the worst consequences of fatigue result not from a response slowing from 200 milliseconds to 750 milliseconds, for example, but from a major cognitive or attention failure—something many in the field refer to as a loss of situational awareness.6,7 This loss manifests itself in the operator no longer responding appropriately, or perhaps even responding completely inappropriately, to the situation. Thus, in hindsight, it is clear to the individual concerned that an error was made or that an important feature of the situation was missed. Sometimes this loss of situational awareness results in a catastrophe such as Three Mile Island or Exxon Valdez; at other times, the situation is saved by additional levels of safety control, resulting in only a near miss. A recent (4/10/2007) public letter from Mark Rosenker, the chairman of the U.S. National Transportation Safety Board (NTSB), to Marion Blakely, the Administrator of the Federal Aviation Administration (FAA), and to the Air Traffic Controllers' (ATC) union gives a useful insight into such real-world examples. The letter discusses one recent catastrophe and four recent near misses in the field of commercial aviation that may have resulted from a loss of situational awareness related to fatigue. It also gives the sleep community a compelling case for continuing their public campaign against chronic sleep loss and in furthering the study of the performance consequences of such loss. The full text of the letter is available on the NTSB public website at http://www.ntsb.gov/recs/letters/2007/A07_30_32.pdf.

In his letter, NTSB Chairman Rosenker expressed concern about accidents and near misses perhaps attributable to ATC personnel working while fatigued. He noted that the NTSB had long been concerned with the effects of fatigue in persons involved in critical functions and the dangers to safety that arose as a consequence. He also documented the large number of suggestions that the NTSB had made to the FAA over the years with the aim of improving the situation and noted that few of them appeared to have been acted upon. In the beginning of his letter, Chairman Rosenker discussed a recent (8/27/2006) fatal air crash at Kentucky.

The airplane had been cleared by air traffic control (ATC) for takeoff on runway 22, which is 7,003 feet long and equipped with high-intensity runway lights; however, the crew mistakenly taxied onto runway 26, which is 3,500 feet long and unlighted, and attempted to take off. The airplane ran off the end of runway 26, impacted the airport perimeter fence and trees, and crashed. Of the 47 passengers and 3 crew members on board the airplane, 49 were killed, and one received serious injuries. During its ongoing investigation of this accident, the Safety Board has learned that the air traffic controller who cleared the accident airplane for takeoff had worked a shift from 0630 to 1430 the day before the accident, then returned 9 hours later to work the accident shift from 2330 until the time of the accident at 0607 the next morning. The controller stated that his only sleep in the 24 hours before the accident was a 2-hour nap the previous afternoon between these 2 shifts.

The NTSB chairman also gave four examples of near misses from Chicago (3/23/2006), Los Angeles (8/19/2004), Denver (9/25/2001), and Seattle (7/8/2001), all potentially involving fatigued ATCs. In all four cases, a loss of situational awareness may have been to blame. In three cases, the ATC put two planes on a collision course on the same runway; in the fourth, the controller failed to notice that the pilot had selected the wrong runway (which was closed for repair). Here is the Los Angeles example.

A controller cleared a Boeing 737 passenger airplane to taxi onto and take off from runway 24L at the same time that another passenger airplane, a Boeing 747, had been cleared to land on the same runway and was on a short final approach. The pilots in the landing airplane saw the 737 taxi onto the runway and discontinued their approach about 12 seconds before the impending collision would have occurred, passing approximately 200 feet above the 737 during the go-around. The investigation determined that when the controller began working the local control position, he...
received a correct position-relief briefing that the 747 was approaching runway 24L. The controller later indicated that he subsequently developed a mistaken belief that the 747 was landing on the adjacent parallel runway 24R. The investigation determined that the controller had worked a shift the previous evening from 1530 until 2330, then went home and slept between 5 and 6 hours before returning to work the incident shift, which began at 0730. The controller described the portion of his shift before the incident as a “hard day” and attributed his error, in part, to fatigue.

Part of the problem may concern shift work and overtime, both of which can have a potentially negative impact on the amount of sleep obtained. It is perhaps no coincidence that all 5 incidents occurred immediately after a short return, i.e., a break of only 9 hours between the end of one shift and the start of another. Short returns have been cited as the major problem with regard to backward (phase advance) rotating shifts. Such issues can often be worsened by a shortage of qualified personnel to fill positions and an aging workforce. Many in the FAA undoubtedly care deeply about the ATC fatigue issue, and there has been some FAA research activity in this regard and have been a few attempts at employee education. However, as the NTSB letter notes, "The findings that controllers have minimal recollection of the FAA’s previously disseminated fatigue-related information and poor awareness of fatigue-related issues and that they inconsistently apply personal strategies for maximizing restorative sleep suggest that safety could be improved by providing more intensive training to controllers on shift-work and fatigue-related issues."

The examples given in the NTSB letter reinforce the need for the sleep community to continue to study the issue of insufficient sleep leading to a loss of situational awareness, even though such experiments may be difficult to design and execute. The NTSB letter also suggests a useful roadmap by which elected officials, the FAA, their employees, other government agencies and the traveling public can be better educated regarding the negative consequences of fatigue and the various ways in which such negative consequences can be ameliorated or avoided. The sleep community is ideally suited to take an active role in this endeavor by ensuring the development and implementation of scientifically accurate education and outreach tools.

ACKNOWLEDGMENTS

Partially supported by AG 13396 and AG 020677.

REFERENCES