

The Nature and Effects of Fatigue

By Dr. Donald Hudson, ALPA Aeromedical Advisor



As Capt. Woerth mentions in “Decision Point,” page 5, many people, including powerful members of the U.S. Senate, recognize that fatigue is a major

problem in the current aviation environment. Indeed, in 1996, then NTSB Chairman Jim Hall put it very succinctly: “Fatigue is the No. 1 factor that detrimentally impacts the ability of pilots to function in the cockpit and react quickly to emergencies. If we ever want to reach the ambitious goal of zero human-factors-related accidents, rest requirements are one of the first issues that have to be addressed.”

Unfortunately, despite voluminous scientific data on the subject, fatigue remains a somewhat ill-defined concept in a physiologic sense. In the scientific research literature, the parameters of fatigue are defined in terms of human performance deterioration as a consequence of numerous factors. In aviation, the most critical elements are generally agreed to be: (1) time on task, (2) time since waking, (3) acute and cumulative sleep debt, and (4) circadian desynchronization. In the regulatory arena, the first two factors encompass issues surrounding flight and duty time. The last two issues affect the issues of minimum rest, length of duty period, multiple time zone crossings, and back-side-of-the-clock flying.

The symptoms of excessive fatigue have both a physical and mental component, but the brain effects are the ones most critical to the ability of pilots to safely conduct flight operations. Some of the earliest insights into the effects of this condition on the human mind, and why fatigue is so dangerous in air transport flying when it becomes excessive, were re-

vealed in research conducted in the 1940s in Cambridge, England. Several conclusions from that research, conducted with professional pilot subjects, are as relevant today as they were half a century ago. The findings can be summarized as follows:

- As fatigue increased, a pilot’s motor responses slowed significantly.

Commercial aviation has long been a 24/7 enterprise but as we move into the 21st century—and deal with an expected 50 percent increase in airline flights in the next decade—we must acknowledge the reality of fatigue and make every effort to mitigate its detrimental effects. As our airspace becomes more crowded, this issue will become more relevant—not less.

- As fatigue increased, subjects became more complacent and willing to accept lower standards of accuracy and performance in executing flight maneuvers. They also allowed larger and more frequent deviations before initiating corrective action.
- With increasing fatigue, instrument cross-check slowed in speed, and accuracy degraded. The subjects increasingly neglected instruments outside their primary field of vision.
- Oral communication between crewmembers significantly decreased, and some mandatory “call-outs” were missed as tiredness increased.

These symptoms will be familiar to nearly every pilot reading this magazine. Astute nonpilot readers will also note that these symptoms are similar to those experienced when driving while tired. Indeed, a recent study demonstrated that, after “only” 17 hours of continuous wakefulness, task performance degradation was equivalent to that of subjects with a blood alcohol concentration (BAC) of 0.05 percent. This is above the FAA

violation level of 0.04 percent BAC from a DOT-mandated breathalyzer test!

No shortcuts exist for restoring acceptable performance in the workplace. We all need restorative sleep to allow our brains to function at peak performance. This is an area that has no “free lunch”—scheduled reduced

minimum rest, consecutive back-side-of-the-clock flight segments, and crossing four or more time zones *will* result in acute and cumulative sleep loss and resultant increasing fatigue. The flight time/duty time regulations urgently need to be revised to address these issues and to take advantage of increased scientific knowledge about the effects of fatigue on pilots (and all aviation industry workers).

Of course, we humans vary significantly in our response to fatigue, but ultimately, basic human physiology dictates the ability of our brains to adequately function in performing a complex monitoring and response task such as flying.

Commercial aviation has long been a 24/7 enterprise, but as we move into the 21st century—and deal with an expected 50 percent increase in airline flights in the next decade—we must acknowledge the reality of fatigue and make every effort to mitigate its detrimental effects. As our airspace becomes more crowded, this issue will become more relevant—not less. 🌐