

Warfighter Fatigue Countermeasures R&D



AFRL/HEPM 2485 Gillingham Drive, Bldg 170 Brooks City-Base, TX 78235
www.brooks.af.mil/AFRL/WFC

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Running on Empty

Increased areas of operation and pressure to sustain an around the clock tempo combined with the inability to fully staff three eight-hour shifts stretches the abilities of aviators. Fatigue has long been an adversary for flight crews, especially when 18-22 hours of sleep deprivation produces symptoms similar to a .05 to .10 blood alcohol level (the legal limit). Non-pharmacological (natural) methods to combat fatigue such as exercise, work breaks, and strategic naps are sometimes impractical and ineffective. The alternative is pharmacological methods, or drugs. Caffeine, a widely available and accepted drug, has been considered. However, heavy caffeine users may not receive the same benefit as others who rarely use the drug. Modafinil, a recently approved drug, seems to be a viable alternative due to its promising side-effects profile, but long-term effects of the drug have not yet been confirmed. Another widely used drug, Dextroamphetamine ("go pills") has had long term studies and is a very reliable alternative. The negative effects of dextroamphetamine are minor considering the fact that amphetamine has repeatedly been used to effectively counter aviator fatigue in every major conflict since World War II and is the only alertness-promoting compound that has been thoroughly proven in the laboratory and the operational environment for 50 years. There has never been an aviation mishap associated with the use of amphetamine, and there is no evidence that this compound has been abused by aviation personnel. Of course, sleep is the best combatant for fatigue, but with an increased operations tempo stimulants are becoming more and more necessary.

-- USAFA Cadet Baker

Summary of "Runnin' On Empty? - 'Go Pills,' Fatigue and Aviator Safety" article written by Dr. John Caldwell and Col Brown, MD from the USAF Flying Safety Magazine March 2003, pages 4-11

Eighty-Eight Hour Sleep Loss Study Evaluates Modafinil

An 88-hr sleep loss study was performed to evaluate the performance maintenance capability of modafinil (Provigil®). Two dose levels (100mg & 200mg) were selected for evaluation in a repeated dosing regimen (8-hr interval). Participants received both dose levels in two separate visits to the Chronobiology and Sleep Laboratory (CASL). During each visit the participants received a total of 9 doses of modafinil over 88-hrs of sustained wakefulness, beginning at 2200hrs the first night (2200, 0600, 1400...). Participants were required to recover for a night of sleep in the laboratory following each 88-hr period. A total of 8 participants completed both conditions.

This study represents a worst case test for modafinil by attempting to address the principle question, "Can modafinil maintain performance at or near baseline levels under conditions of sleep-loss?" To answer this question no placebo group is needed. Either sleep-loss performance is equal to baseline or not. Whether modafinil improves performance relative to no treatment is important but not if the improved performance falls below some acceptable level. Thus the principal comparisons made in analyzing the data from this study focused on performance changes relative to baseline. A full technical report for this effort is in preparation.

-- Mr. Whitmore
jeff.whitmore@brooks.af.mil

We bridge the gap between operational demands and physiological realities

Impact Of Fatigue Countermeasures On Acceleration Tolerance

Last year the Air Force Research Lab (AFRL) Human Effectiveness Division began conducting a study to assess impact of fatigue and circadian desynchronization using flight performance parameters while checking +Gz tolerance and endurance. The purpose was to assess the impact of four stimulant drugs on flight performance during circadian nadir, +Gz tolerance, and subjective fatigue while exploring the utility of a desktop flight simulator performance test battery.

The study design included 10 subjects (8 completed to date) tested after 19 hours of sustained wakefulness during physiological circadian nadir (2-5 a.m. local time). Individual subject performance was compared across conditions. Drugs were administered so that peak serum levels occurred during the circadian nadir. Performance was analyzed while using stimulants compared to night placebo and daytime baseline. The drugs that were administered during the study were dextroamphetamine, methylphenidate (Ritalin ®), pemoline (Cylert ®) and modafinil (Provigil ®). Cognitive test batteries were run at 10 p.m., before drug administration. The results were compared with tests administered between 2 a.m. and 5 a.m., at which time the drugs would have had some effects. The test results were also compared against daytime baseline and night placebo. Drug effects recorded during circadian nadir were compared with daytime baseline and night placebo. Our preliminary conclusions indicate that there was no clear advantage offered by any drug on the improvement of +Gz tolerance and endurance after 19 hours of sustained wakefulness during the circadian nadir. There was a suggestion of improved +Gz endurance with methylphenidate (not statistically significant). Methylphenidate also reduced the difficulty associated with performing the L-1 and lower body anti-Gz straining maneuvers. Dexedrine® and modafinil sustained accuracy and speed in grammatical reasoning tests through the circadian nadir. They also showed mild improvement on subjective measures of fatigue. Dexedrine protected against fatigue and circadian nadir decrements in complex and multi-tasking. Pemoline does not appear to be a promising performance-enhancing drug and the preliminary data results suggested that there were some troublesome side effects such as difficulty concentrating and sluggishness.

Possible future initiatives include research on chronic fatigue effects of longer periods of sleep deprivation and study of methylphenidate in pharmacologically equivalent dose to that of "Go Pill" dose of dextroamphetamine.

This study should be complete by September 2003. We will publicize the full report as soon as it is available. Part of the results from this study were presented in an oral presentation at the Aerospace Medical Association Annual Meeting in April, 2003.

-- 2dLt Schroeder
christina.schroeder@brooks.af.mil

Principal Investigator: Col Ramsey, D.O., M.P.H., AFRL/HEP Chief of Aerospace Medicine, Brooks City Base, TX 78235, carol.ramsey@brooks.af.mil

Associate Investigator: Dr. Werchan, AFRL/HEPM, Brooks City Base, TX 78235, paul.werchan@brooks.af.mil

FAQs

Why is shift work so difficult?

Individuals must alter their normal work and sleep hours from typical work/rest patterns. Biological, circadian and social factors all must be considered. Sleeping and working at nonstandard times interrupt the body's natural rhythm, and daily schedule. This creates fatigue, irritability and sometimes, physical discomfort.

How do circadian rhythms work?

The rhythms of wake and sleep, hormonal secretions, performance, and core body temperature rise and fall in predictable patterns over a 24-hour day. As the day begins, body temperature, alertness, and performance rise. This continues into the day, dipping slightly in mid-afternoon and then falling as the day ends and night begins. The lowest point in these measures occurs between 0200 and 0600.

Coming Events- July/August 2003

The Relationship Between EEG Data and Simulator Flight Performance During 37 Hours of Continuous Wakefulness Study was completed in May 2003 and data analysis is in process. The 49FW/CC at Holloman AFB, NM was briefed on July 9th.

2nd Annual C4ISR Summit 18-21 Aug 03 www.paulrevereafa.horizons.com

Phoenix Challenge 2003 Conference 9-12 Sept www.pc2003.org

SAFE 22-24 Sept www.safeassociation.com

Recent Events

16-20 June 2003, Dr. Elliott and Lt Barnes presented 2 papers at the 8th International Command and Control Research and Technology Symposium at the National Defense University in Washington, DC <http://www.dodccrp.org/>

Ambien-Melatonin Short Study started data collection May 2003.

The Fatigue Effects on Team Performance Study will be completing phase one by end of June 2003.

For over 30 years the WFC R&D Program has delivered counter fatigue products that enhance warfighter combat effectiveness in global mission extremes demanding night, sustained and 24/7 mental and physiological supremacy. We give American warfighters the "edge" to overcome physiological realities and win.