FLYKITT

POWERED BY **FOUNT AI**

Technical White Paper

Overview

This white paper describes the FlyKitt system, a novel approach to enhancing performance during and after long-distance travel. Traversing multiple time zones causes a misalignment of the body's circadian rhythms — in the brain, the endocrine system, the gut, and beyond. Breakthrough research by the Fount team demonstrates that this disruption is complicated by an inflammatory response resulting from the pressure changes in air travel. Together, these can present as:

- Inability to fall asleep or stay asleep
- Excessive daytime fatigue
- Poor focus
- Stomach problems, such as constipation or diarrhea
- Mood shifts
- Propensity to get sick

These effects compound to degrade cognitive, physical, and social performance.

The FlyKitt system was designed to mitigate these physiological and performance challenges and dramatically improve how users feel and perform. It was developed based on extensive work with Navy SEALs, fighter pilots, and executives who undertake long-distance travel immediately before high-skill activities like military operations and high-stakes negotiations. By taking into account each of the causal factors underlying performance decrements in these situations, we have created a comprehensive, integrated solution that is effective in >93% of cases.[1]

The FlyKitt system is so effective that it does not require individuals to change their schedule before the day of departure, and it does not require any expertise by the user. It is also flexible enough to take into account flight schedules and work requirements to ensure maximum user friendliness.

Physiology of Jet Lag

The Canonical Understanding of Jet Lag

The sleep and wake cycle is governed by the central circadian rhythm, a roughly 24-hour cycle controlled in the brain by its internal pacemaker, the suprachiasmatic nucleus (SCN). The SCN comprises molecular oscillators, operating within individual neurons, governed by a precise transcriptional-translational feedback loop consisting of a set of core clock genes such as CLOCK and BMAL1 that influence its outputs, including melatonin production.

The SCN relies on internal and external cues — zeitgebers — to maintain synchronization between the internal pacemaker and the environment, which is what aligns us to be awake during the day and sleep at night. Zeitgebers induce changes in the concentrations of the molecular components within the SCN, and include cues such as temperature, food, and bright light, particularly in the blue-green wavelengths.

Most explanations of jet lag deal primarily with the central circadian rhythm, but peripheral circadian clocks play a critical role in the body's physiological regulation, from stress hormone production to metabolism. Peripheral circadian clocks are primarily regulated by hormones, such as cortisol and insulin, and activities, such as eating, psychosocial stress, and exercise.[15]

The body's innate circadian systems provide some flexibility, enabling individuals to shift their clocks by about two hours later or one hour earlier without major disturbance to sleep and performance, but shifting further without assistance causes a range of physiological effects that degrade performance.[2] Circadian misalignment causes mismatched melatonin and cortisol rhythms, leading to poor sleep. Insufficient sleep leads to fatigue, degraded cognitive functions, and inflammation. Along with misaligned cortisol rhythms, inflammation causes decrements in reaction time, accuracy, and mood, as well as degradation in intestinal permeability, the gut microbiome, and immunity.[3]

However, these effects do not explain all the symptoms seen in jet lag or the severity experienced by some individuals.

Novel Insights into Jet Lag: Pressure Change & Inflammation

Research initially funded by the Office of Naval Research and extended by our work with Navy SEALs and fighter pilots has identified a novel culprit leading to post-flight performance degradation. Over the past decade, Navy-funded research into dive physiology has demonstrated that rapid decreases in pressure cause an inflammatory process. This is the major driver of decompression sickness, despite decades of research pointing to nitrogen bubbles as the primary culprit. With rapid decompression, circulating microparticles, originating from cell wall fragments of white blood cells, activate an interleukin 1b (IL-1b) inflammatory cascade, in addition to other pathways. The importance of this mechanism is demonstrated by the fact that when interventions are used that decrease microparticle formation, divers see decreased negative effects from provocative dive profiles that might otherwise cause decompression challenges.[4]

The Fount team is the first to connect this work to air travel alone and to explain a number of well-known phenomena seen during and after air travel. While individuals sit at their desks or on the couch for just as many hours as they might sit on a plane, the risk of deep-vein thrombosis is substantially elevated in flight compared to in the office or at home.[5] The risk of relapse for auto-immune disorders is also substantially increased post air travel.[6] Finally, the Fount model aligns with many reports of benefits in how individuals feel and perform post-travel when they fast or work out, which are known to downregulate inflammation.

The importance of understanding and mitigating this inflammatory effect is even more important with transcontinental flights because sleep disruption itself causes pro-inflammatory changes in the body. This means that the pro-inflammatory effects of air travel will have synergistic effects with the pro-inflammatory effects of poor sleep from circadian misalignment, exacerbated by the amplifying effects of immune cascades. This explains the severity of symptoms seen in travelers who suffer for a week or more from jet lag. The centrality of the immune response also explains the high degree of variability seen in the effect jet lag has on different individuals, as pro-inflammatory insults are known to cause highly variable effects on different people, depending on factors ranging from diet to the state of the immune system, such as relative Th1/Th2 activation.

Why Attempts to Help Often Hurt

Beyond the detrimental physiological effects of travel, traditional approaches to alleviate these effects can also be counterproductive. For example, depending on the direction of travel, individuals often mismanage light exposure based on recommendations to “get sunlight during the daytime at your destination.” If individuals are exposed to bright blue light at their destination in the three hours before their typical wake time at their point of departure, their circadian clocks will shift backwards (earlier). Thus, for many trips, spending time outside or exposed to bright lights can unwittingly make the time change more difficult if you need to shift your circadian clock forwards.[7]

A Novel Countermeasure System – How It Works

Using our novel and patented approach, FlyKitt effectively mitigates each of the detrimental effects of long-distance travel. The FlyKitt system draws on the following combination dietary supplements and technologies and provides the user a personally tailored schedule to achieve optimal effects:

FlyKitt Protect Supplement: Ascorbic acid mitigates oxidative stress involved in microparticle formation and thus the subsequent inflammation caused by acute changes in pressure.[12] Tart cherry extract decreases the likelihood of microparticle production while also decreasing inflammation and accelerating recovery via NF-kB inhibition.[13]

FlyKitt Advance Supplement: The active methylcobalamin form of vitamin B12 and the active pyridoxal-5-phosphate form of vitamin B6 increase the circadian pacemaker’s light sensitivity, decrease plasma melatonin rhythm amplitude, and increase alertness and the speed of realignment.[8]

FlyKitt Sustain Supplement: Specially concentrated omega-3 fatty acids have anti-inflammatory properties through their ability to influence white blood cell activity and by acting as a substrate for anti-inflammatory leukotrienes, prostaglandins, resolvins, and protectins. These effects offset the pro-inflammatory effects of in-flight pressure change and insufficient sleep length and quality, enhancing function of the prefrontal cortex and improving cognitive performance and mood.[11]

FlyKitt Mellow Supplement: Melatonin acts as a *zeitgeber*, providing a timing signal to the brain and aiding in circadian resynchronization and sleep when used appropriately.[9] Magnesium glycinate can benefit the gut, calm nervous system

activity, decrease inflammation linked to poor quality sleep, and improve sleep quality.[10]

Circadian Control Glasses: These blue-light-filtering glasses reduce total light exposure and 99% of exposure to blue wavelengths that cause the greatest circadian phase response in humans, managing the circadian shift and enabling faster sleep onset and higher sleep quality.[14]

Circadian Reset Mix: This specially formulated mix of organic cane sugar, the methylcobalamin form of vitamin B12, and the pyridoxal-5-phosphate form of vitamin B6 synergistically set and solidify the circadian rhythm in both the brain and body via insulin signaling, influencing the suprachiasmatic nucleus's circadian pacemaker, and decreasing plasma melatonin. [8][15]

Circadian Control Algorithm: This artificial intelligence-driven algorithm uses sleep timing preferences, questions about the user's body, and flight information to optimize sleep-wake, meal, and supplement timing along with light-dark cycles to maximally mitigate inflammation and rapidly shift the circadian rhythm. Users get a simple, step-by-step plan via the FlyKitt app that gives them notifications with clear instructions when they need to take actions.

For the user's safety, all of the dietary supplements in the FlyKitt system are FDA cleared, NSF Certified for Sport for pro athletes, produced in the USA, and non-prescription.

The integration of these tools explains the exceptional benefits of the FlyKitt system. In typical studies, less than 10% of people can travel long distances without jet lag. In comparison, a retrospective review of 110 trips using FlyKitt showed that more than 93% of travelers experienced minimal to no jet lag.

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[1] Based on a retrospective analysis of the first 110 trips using FlyKitt.

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