Scheduling Assistant Software: A Tool for Airline Scheduling
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An initial biomathematical model capable of predicting alertness and performance specific to the aviation environment was used as the foundation for the development of the Scheduling Assistant Software, a software package to aid airline scheduling. The misalignment of the light/dark cycle and the sleep/wake cycle is often accompanied by increased subjective and physiological fatigue, adverse health effects, performance decrements and errors. These effects have been well documented and continue to be a safety concern in flight operations. Pilots on long-haul flight schedules with multiple flight legs and layovers often experience such misalignment of the light/dark cycle and sleep/wake cycle (circadian desynchrony). This desynchronization between the sleep/wake cycle and the local time zone coupled with fluctuations in the amount and timing of light exposure can affect pilots' ability to fall asleep, reducing sleep efficiency and resulting in fatigue and performance decrements. One method of predicting sleep/wake cycle and circadian rhythm misalignment effects is through a biomathematical model of the various factors that affect sleep and waking neurobehavioral performance. If packaged in user-friendly software, it could be used as a tool to design flight schedules and assist pilots in scheduling rest and sleep periods during layovers and long-haul flights. However, there have been few attempts to develop such biomathematical models capable of quantifying the effects of circadian and sleep/wake processes in the regulation of alertness and performance.

At Harvard Medical School Brigham & Women's Hospital, Dr. Megan Jewett and colleagues developed biomathematical modeling software capable of such alertness and performance predictions using light exposure measurements and habitual, circadian, homeostatic and sleep inertia components. A collaboration between this group and Ames resulted in the initial version of Scheduling Assistant Software, a biomathematical model that incorporates experimentally obtained data on sleep timing, quantity and quality; length of wake episodes; light exposure; circadian phase; and neurobehavioral and operational measures. The Scheduling Assistant Software is based are neurobehavioral, subjective, operational measurements collected during commercial long-haul flights. Light measurements collected in the cockpit were also used for algorithm development. These light data represent typical exposures for pilots at varying times throughout a long-haul flight, a fundamental component of the model. Based on the combined data, it will be possible to predict the impact of acute sleep loss, cumulative sleep loss, and circadian desynchrony on waking performance and to provide an indication of work/rest schedules that could minimize in-flight fatigue-related problems.

The final version of the Scheduling Assistant Software will be a developed, refined and validated biomathematical model in a user-friendly interface to be used as an aide in predicting pilots' levels of alertness and neurobehavioral performance under various schedules. In addition, this software can be used to estimate: the best timing of in-flight rest; indicate layover sleep conditions that mitigate sleepiness and fatigue in operational duty conditions; and assist airlines in scheduling flights that take into consideration pilots' circadian rhythms, flight duration, duties and the light/dark cycle at destinations. Inevitably, as the aviation industry grows, the length of long-haul flights will increase. The Scheduling Assistant Software will serve as an effective assistant that promotes natural sleep that is closer to pilots' homeostatic sleep schedule, thus reducing fatigue and neurobehavioral performance decrements in aviation, and increasing the safety margin.