Is the last inflight rest break really the best?

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As pilots experienced in augmented long-haul flights know, current FAA regulations limit options for scheduling in-flight rest periods, such that on many long-haul operations the landing pilot needs to use the final bunk period, closest to top of descent (TOD). However, the logistics of a particular flight (e.g., timing of the flight, timing of passenger service) and the pilot's own physiology may mean that the last rest break isn't always the best. To study this, we conducted a large survey of pilots flying these operations. Pilots completed the survey after eligible flights and provided us with information on which rest break they used, how much sleep they received, factors that disrupted sleep and ratings on the quality of their sleep, and they also provided fatigue and alertness ratings at top-of-descent. Pilots from another US-based carrier were also surveyed, in collaboration with our research partners at Washington State University, to increase the sample size and gather insights between operations.

A total of 500 pilots responded to the survey after eligible 787 flights from October 2016 until February 2018. Pilots reported that the rest break schedule was most often determined by "crew consensus" and that the majority of the breaks (82%) were taken in a Class 1 or Class 2 rest facility. The average flight duty period (FDP) was 9.9 hours and ranged between 6 and 14 hours.

Landing crew pilots reported getting more sleep (~1.55 hours) and reported better ratings of sleep quality during break 2 than those who used break 3 (~1.36 hours) [Figure 1].

Self-reports of fatigue and sleepiness at TOD were rated as significantly better by landing crew pilots who used the second break compared to those who used the third break. One factor that may have affected the pilot ratings at TOD following break 3 may have been sleep inertia, which is the grogginess that individuals experience following waking from sleep. Some pilots reported the third break as not being optimal due to "wake time too short between rest and landing/sleep inertia". Other research tells us that sleep inertia may linger for 20-30 minutes following sleep and impact performance during that period. Respondents indicated that all pilots were back on the flight deck about 40 minutes prior to landing, on average, thus only about 10 minutes before TOD in many cases. Despite this, ratings of sleepiness at TOD from those who took the third break averaged at about "rather alert" on the scale.

Pilots reported that the third rest break was more often disrupted by cabin service, while there were fewer disruptions reported during the second rest break. Further analyses revealed that relative to a pilot's home-base time, the longest sleep durations occurred during the morning hours and that ratings of fatigue and sleepiness showed a similar time of day influence [Figure 2]. These finding suggest that there are complex interactions between the timing of the rest break relative to a pilot's body clock time and opportunity for sleep in a disruption-free environment.

The survey findings provide a clear picture that the second break is at least equivalent and sometimes better than the third rest break in terms of the duration and quality of sleep obtained, and alertness at TOD. The findings are consistent with those from other studies that have found physiological readiness for sleep and minimizing noise disturbances promote better sleep during in-flight rest periods.

Both airlines have reported findings from the study to the FAA which has resulted in American Airlines FRMS approval under OpSpec A318, Authorization AALA-002 to allow the landing pilot of a 3-man crew operating an FDP of less than 14 hours the option to take the second or third rest break. The complete

study results will be published in an upcoming release of the journal Aerospace Medicine and Human Performance.

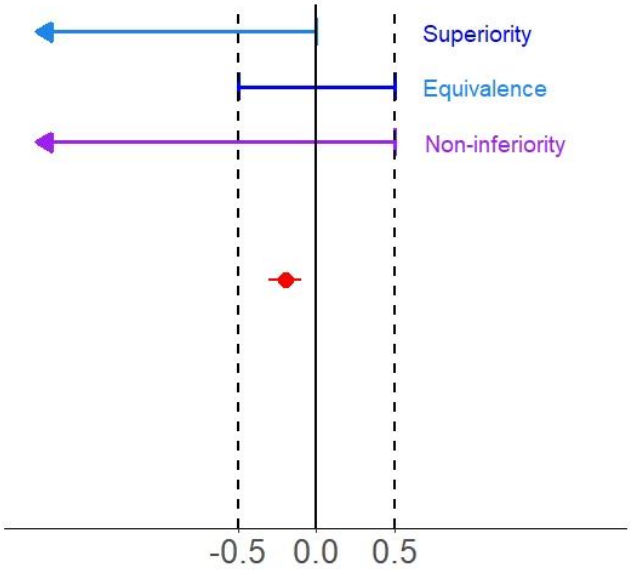

Figure 1. A non-inferiority analysis showed that reported sleep duration during break 2 was non-inferior, or superior, compared to sleep reported during break 3. The mean difference is presented by the red dot with a 95% confidence interval (red bars). The delta, or comparison, value of 30 minutes (0.5 hours) is indicated by the dashed lines on the plot.

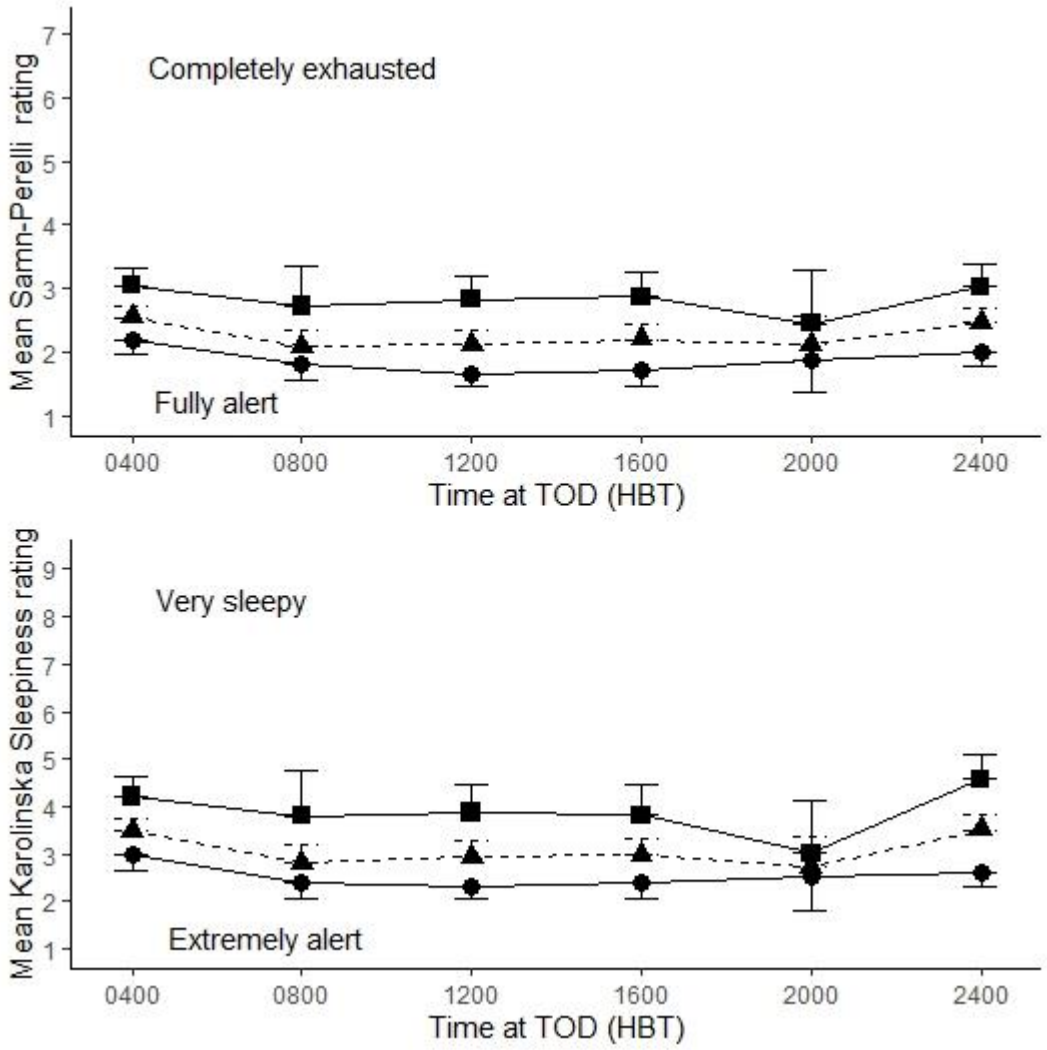

Figure 2. Ratings of fatigue (top) and sleepiness (bottom) by landing crew pilots at TOD for break 2 (circles, solid lines), break 3 (squares, solid lines), and both breaks combined (triangles, dashed lines) binned by pilot home-base time. Time bin labels represent the midpoint of a 4-hour period such that 0400 represents the time bin 0200-0600. Mean ratings are plotted with error bars representing a 95% confidence interval.