POINTS FROM NATIONAL RESEARCH COUNCIL STUDY ON THE EFFECTS OF COMMUTING ON PILOT FATIGUE[1]

Aviation is an extraordinarily safe mode of transportation

"[A]irline travel is the safest form of passenger travel in the United States. Measured on the basis of fatalities per 100 million passenger miles, the fatality rate for both buses and trains was about 4 times higher than for airlines while the fatality rate for automobiles was about 75 times higher." Study at 3-1.

Little evidence that fatigue has caused aviation accidents

"There have been few aviation accidents in which fatigue was citied as a probable cause or a contributing factor by the National Transportation Safety Board (NTSB), the agency responsible for investigating all U.S. airline (and other transportation) accidents. Of the NTSB reports for the 863 relevant accidents that occurred between 1982 and 2010, only nine of the accidents for which the investigation was complete mentioned fatigue as a probable cause or contributing factor." Study at S-3. *See also* Study at 3-7 – 3-8.

Different types of airlines have different operating models, so, in regulating, one size does not fit all

"Most pilots work for four main types of airlines: mainline airlines that predominately operate scheduled service in jet aircraft with more than 90 seats and often provide intercontinental service; regional airlines that predominately operate scheduled service in aircraft, both jet and turboprop, with 90 or fewer seats; cargo airlines that deliver goods all over the world; and charter airlines that provide non-scheduled passenger flights. <u>Flight scheduling, commuting provisions, seniority systems, and length of duty time vary across these segments of the industry</u>. Study at S-1 (emphasis added).

"Many cargo airlines and charter airlines "have different basing policies so the data from their pilots [about commuting practices] are not directly comparable to the mainline and regional airlines." Study at S-2.

"[A]n analysis of changes in aircraft departures from the principal cities served by each of 30 mainline, regional and cargo airlines also found large differences in changes in flight patterns across airlines. Overall, the airline industry is heterogeneous, with great variability across the entire industry, in each segment of the industry, and for individual airlines, as well as among individual pilots." Study at S-2.

"In contrast to the practices of most major scheduled airlines, other airlines (most commonly those offering nonscheduled service), operate flight patterns in which their

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[1] National Research Council of the National Academies of Science, *The Effects of Commuting on Pilot Fatigue* (2011) ("Study").

airplanes may be routed in a highly variable manner in accordance with customer demand, rarely returning to a specified base. . . .   Many of these airlines . . . have no established pilot domiciles." Study at 2-6 – 2-7.

"All of the travel to and from the pilot's [first] operational [flight] is scheduled by, and the responsibility of, the company. As on-duty travel (as distinct from commuting travel), depending on the timing of the flights and as required by regulations governing flight time, duty time, and rest, the company may be required to provide adequate facilities and time for rest between the positioning flight to the duty location and the pilot's first operational flight. In another variant, gateway basing, the company establishes a number of gateway airport locations and assigns the pilot the gateway nearest his or her home. Pilots are then responsible for commuting between their homes and the gateway, which the companies are responsible for on-duty travel between the gateway and wherever in the world the pilot's first operational flights will begin and end." Study at 2-7.

In looking at home-to-domicile distances of pilots, "the distributions for the cargo and charter segments of the industry are different from both each other and from the schedule passenger segments. Given the differences in operating and base policies . . . , this is not surprising." Study at 3-8.

Paucity of scientific evidence about fatigue

"The committee was unable to obtain any systematic information about how frequently individual pilots experience domestic changes or how such changes affect pilot commuting behavior." Study at S-2.

"The safety risk posed by commuting-induced fatigue is unknown. There is a need to understand the extent to which the risk posed by fatigue resulting from some commutes may be mitigated by individual, airplane (e.g., flight deck systems), or aviation system (e.g., crew resource management) characteristics." Study at S-4.

"[T]here is a lack of evidence to support the basis for issuance of regulations pertaining to commuting." Study at S-4.

"A full understanding of the relationship between commuting and pilot fatigue is complicated by the fact that there are inadequate data on the timing, duration, and quality of pilots' sleep before and during commutes." Study at 4-2.

The extent of what is known

"Fatigue is not . . . a binary condition in which one is either rested with no negative effects on performance or fatigued with severe negative effects on performance. Moreover, the effects of fatigue on performance can vary substantially from one pilot to the next without any untoward effects on the safety of flight." Study at S-4.

"There are degrees of fatigue and degrees of the negative effects of fatigue on performance. Moreover, fatigue is highly variable and is influenced by a number of factors, including amount of sleep, time awake, workload, time on task, and time of day." Study at 1-1.

"The scientific literature shows fatigue as a risk of performance can result from: (1) being awake continuously for more than approximately 16 hours, or (2) sleeping too little (especially less than 6 hours on the day prior to work), or (3) when undertaking work at a time when the body is biologically programmed to be asleep (i.e., an individual's habitual nocturnal sleep period), which for most people is between 10:00 p.m. and 7:00 a.m." Study at S-4.

There is scientific evidence "that cognitive performance is adversely affected when sleep per 24 hours is cumulatively less than approximately 6 hours of sleep." Study at S-4 (emphasis added).

"[F]atigue can be exacerbated by cumulative sleep debt, the situation when sleep obtained over multiple days is too short in duration to maintain alertness." Study at 3-6.

Available evidence suggests "that pilots should not be awake beyond approximately 16 hours at the time a duty period ends, unless there are unexpected reasons for this to occur or adequate mitigation." Study at 4-3 (emphasis added).

"The threshold at which chronic sleep restriction adversely affects behavioral alertness and cognitive performance in the majority of healthy adults is when time in bed for sleep is 7 hours or less per 24 hours for a number of consecutive days." Study at 4-5 (emphasis added).

"[T]here is substantial evidence that nap sleep can help reduce the severity of fatigue during prolonged periods of work." Study at 4-6.

NPRM provision on obligation of airlines to assess pilot fatigue

"Although there are currently no agreed-on objective standards in the aviation industry to determine whether a pilot is reporting to duty fatigued, there are provisions in the proposed Notice of Proposed Rulemaking (NPRM) – Section 117.5 – for assessment by others of whether a pilot is fatigued. The validity and reliability of such assessments are unknown, as is the likelihood that they can result in either false positives or false negatives. Consequently it is uncertain whether they can result in effective prevention of fatigue." Study at S-5 (emphasis added).

"CONCLUSION: With regard to the proposed provisions in Section 117.5, there are no valid and reliable tools and techniques feasible to reach the goals of detecting fatigue and fitness for duty in an operational setting. To achieve these goals, further research would be needed to scientifically validate the tools and techniques, demonstrate that they are technically feasible in an operational environment, and evaluate their relationship to operational safety and the extent to which they can be integrated into an operational context." *Id.* *See also* Study at 6-10.

Mitigating measures

"For very long flights of more than 8 hours, crew augmentation, adding one or two additional crewmembers, can help mitigate fatigue risk particularly when inflight rest facilities such as bunks are provided for crewmembers to sleep when they are not on duty. Even on shorter flights, research has shown that short, controlled naps are a well established fatigue mitigation strategy." Study at 3-5.

"There are now several well-documented candidate technologies for managing fatigue and its negative effects on performance. These fall into two broad categories: fatigue detection technologies and mathematical models of fatigue risk. Substantial progress has been made in each of these areas." Study at 4-6.

However, "[t]he potential for practical application of the mathematical models in the commercial aviation context . . . has not yet been determined. . . . [T]here is considerable individual variability attributable to personal biology and task variables not included in current models. . . . Considerable research is needed to address how to use these models, and other knowledge in the design and implementation of staffing and work-scheduling programs in order to minimize fatigue. . . ." Study at 4-7.

Negative unintended consequences

"Negative unintended consequences often emerge <u>when a seemingly simple regulation is implemented in a complex system</u>. Regulators may not have enough knowledge about the detailed operations of the systems and so may adopt <u>seemingly simple regulations that fail to anticipate how the system will respond to those regulations</u>." Study at 6-8 (emphasis added).

"The committee is concerned that a rush to establish regulation regarding pilot commuting and fatigue without an adequate understanding of how pilot commuting and fatigue interact with the aviation system might trigger unanticipated and unintended consequences." *Id.*

"Such unanticipated and unintended consequences can reduce the effectiveness of the regulation in achieving its goal, and in some cases may even result in a regulation having the opposite effect of what had been intended. A noteworthy example occurred with the 55 mph speed limit, established in March 1974. . . . Following this adoption, highway fatalities dropped. Although multiple factors contributed to the decline in fatalities, the general consensus was that the reduced speed limits had resulted in fewer highway fatalities. . . . In 1987 40 states raised the speed limit to 65: many anticipated that highway fatalities would again increase due to the higher speeds. Although highway fatalities did increase, so did vehicle miles traveled. A study that examined statewide fatality rates . . . found that the higher 65 mph speed limit reduced the statewide fatality rates by 3.4 – 5.1 percent in comparison with other states." Study at 6-8.

"A regulation that increases costs to the airline industry will likely result in some portion of those costs being passed on to travelers in the form of higher airline ticket prices. Higher airline ticket prices would cause some travelers to switch their mode of travel from airplanes to automobiles. Since travel by private automobile is more dangerous than travel by commercial airline, the result of such a shift would be an increase in highway fatalities. Thus, however many airline passenger and crew lives are saved by the airline safety regulation, the net savings of life from the regulation would be less because of the increase in highway fatalities. In some cases, the net effect may actually be a net loss of lives from a regulation intended to save lives." Study at 6-9 (emphasis added).