



# National Transportation Safety Board

Washington, D.C. 20594

June 19, 1996

Office of the Chairman

Federal Aviation Administration  
Office of the Chief Counsel  
800 Independence Avenue, S.W.  
Washington, D.C. 20591

Attention: Rules Docket (AGC-200), Docket No. 28081

Dear Sir:

The National Transportation Safety Board has reviewed your Notice of Proposed Rulemaking (NPRM), "Flight Crewmember Duty Period Limitations, Flight Time Limitations and Rest Requirements," which was published in 60 FR 244 on December 20, 1995. The notice proposes to modify the rules governing mandatory rest periods and maximum flight and duty times for pilots and flight engineers conducting air transport flights under the provisions of Title 14 Code of Federal Regulations (CFR) Parts 121 and 135.

## Background

On May 10, 1994, the Safety Board met to consider the draft report of the accident that occurred on August 18, 1993, involving a DC-8-61 operated by American International Airways that crashed during an attempted landing at the U.S. Naval Air Station in Guantanamo Bay, Cuba.<sup>1</sup> The Safety Board determined that fatigue among the flightcrew members impaired their judgment and their decisionmaking and flying abilities, and that these impairments led to the mishandling of the approach and attempted landing. In addition, the Safety Board determined that, among other factors, "the inadequacy of the flight and duty time regulations applied to 14 CFR, Part 121, Supplemental Air Carrier, international operations..." contributed to the accident.<sup>2</sup>

The Safety Board, at that meeting, addressed the current flight and duty time rules, their role in this accident, and how deficiencies in the rules could allow additional fatigue-related accidents to occur. The Safety Board identified the need for a complete revision of the FAA's

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<sup>1</sup>Aircraft Accident Report, "Uncontrolled Collision With Terrain, American International Airways Flight 808, Douglas DC-8-61, N814CK, US Naval Air Station, Guantanamo Bay, Cuba, August 18, 1993," NTSB/AAR-94/04.

<sup>2</sup>The Safety Board subsequently cited fatigue in the probable cause of another air carrier accident. See Aviation Accident Report, "Uncontrolled Collision with Terrain, Air Transport International, Douglas DC-8-63, N782AL, Kansas City International Airport, Kansas City, Missouri, February 16, 1995," NTSB/AAR-95/06.

flight and duty time regulations. Dr. John Lauber, then a member of the Safety Board, said the following at that meeting:

I think we have a basis here for just throwing the whole problem out on the table. The regulations, as they exist, do not reflect our current state of understanding, scientific understanding, of the effects on human performance of fatigue and circadian problems and related kinds of things. They simply don't.

I think the time has come for the FAA to recognize that they're never going to be able to get consensus among the user community because every time you make a ruling on these issues that has enormous economic consequences, and you get involved in labor management issues and everything else. The FAA at some point is going to have to recognize that it has the authority to impose a set of regulations that will apply to everyone in a meaningful and rational fashion, that will take into account the productivity and economic issues adequately, and yet at the same time reflect what we know about human performance and these effects. I think it would be helpful to them in taking that stance if the Safety Board were to take and make that position . . . not only to review the flight and duty time regulations as it applies to supplemental air carriers and fix up that problem, but . . . to fix the underlying problem. The time has come . . . to include all [flightcrew member flight and duty time] regulations in a revision [of the applicable rules].

The Safety Board then voted unanimously to issue two recommendations that urged the FAA to do the following:

Revise the applicable subpart of 14 CFR, Part 121, to require that flight time accumulated in noncommercial "tail end" ferry flights conducted under 14 CFR, Part 91, as a result of 14 CFR, Part 121, revenue flights, be included in the flight crewmember's total flight and duty time accrued during those revenue operations. (A-94-105)

Expedite the review and upgrade of Flight/Duty Time Limitations of the Federal Aviation Regulations to ensure that they incorporate the results of the latest research on fatigue and sleep issues. (A-94-106)

In this NPRM, the FAA has, in part, addressed the Board's concerns expressed in the meeting of May 10, 1994, and in the referenced recommendations.<sup>3</sup>

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<sup>3</sup>The Safety Board has issued numerous other safety recommendations addressing the need to upgrade applicable rules governing transportation operators' rest and duty time.

### Comments on the NPRM—Favorable

The Safety Board believes that many of the proposed rules will enhance flight safety and should be implemented. Among these are the FAA's proposals to do the following:

- Eliminate the ability of carriers to schedule flightcrew member duty during scheduled rest periods;
- Include standby reserve time, deadheading time, and all duties performed for the airline as duty time in the determination of flight and duty time requirements;
- Include ferry, instructional, maintenance, check, and other flights in the determination of flight and duty time requirements;
- Mandate minimum daily rest periods of at least 10 consecutive hours, and 36 consecutive hours of rest within 7 consecutive calendar days of duty, for flightcrew members and flight engineers;
- Establish explicit standards for approving on-board flightcrew rest areas;
- Permit extensions of daily flight and duty intervals to periods of no more than 2 hours and only for operational reasons beyond the control of the airline; and
- Limit duty periods for crewmembers on reserve assignments depending on the amount of advance notification of reporting time.

The Safety Board believes that these proposed changes will enhance safety by removing several potential sources of fatigue from the flight and duty rules. In addition, the changes will also substantially clarify existing flight and duty rules and regulations so that operators and pilots can more easily understand, implement, and adhere to them. The proposed rules provide a common framework for flight and duty time limitations for all air transport operations regardless of the type of flight. They place air carrier flights conducted under 14 CFR Part 91, including training and inspection flights, within the overall flying limits required of 14 CFR Parts 121 and 135, and non-flying duties performed for an airline, such as ground school, baggage handling, etc., within the overall duty limits. These changes considerably expand the protection that the rules provide to flightcrew members from excessive and potentially fatiguing flight and duty periods.

More important, the proposed rules address a critical finding of human sleep research—that most people need about 8 hours of sleep per day<sup>4</sup>--by establishing a minimum rest requirement of 10 consecutive hours, with some exceptions. These exceptions allow reduced rest time of no more than 1 hour, and only under explicit conditions that are beyond the operator's control. The scheduling of flightcrews for a reduced rest period would be prohibited. Thus, even allowing for

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<sup>4</sup>Gander, P.H.; Myhre, G.; Graeber, R.C.; Andersen, H.T.; and Lauber, J.K., "Crew Factors in Flight Operations: I. Effects of 9-Hour Time-Zone Changes on Fatigue and the Circadian Rhythms of Sleep/Wake and Core Temperature" (NASA Technical Memorandum No. 88197). Moffett Field, CA: National Aeronautics and Space Administration, 1985.

transportation to and from airports, check-in delays at hotels, etc., the proposed rules establish a minimum daily rest that is consistent with the results of sleep research.

### Comments on the NPRM--Not Favorable

Although the Safety Board believes that the enactment of most of the provisions of the NPRM will enhance flight safety, it believes that several important requirements are absent from the proposed rule. In addition, the Safety Board believes that several provisions of the rules may not be necessary. The requirements that are absent from the proposed rules include the following:

- Effective mechanisms to address flight operations during the circadian night and the circadian trough; and
- Recognition of the fatiguing aspects of multiple takeoffs and landings.

Researchers have demonstrated that the circadian rhythms that influence many physiological and psychophysiological functions occur with remarkable consistency, and that these effects most adversely affect human performance between the hours of 0200 and 0500. Researchers have shown that human performance is often degraded during this period, which is referred to as the "circadian trough."<sup>5</sup> It is not uncommon among pilots who have crossed multiple time zones and have not yet adapted to the local time zones, or who are simply working during what would otherwise be their normal resting times, to be flying during the circadian trough. Because pilots routinely fly within hours after completing a trip crossing time zones, they are often unable to adapt to time zone changes before they must begin another flight. Adaptation to time zone changes can take days, depending on the difference between the local time and the time zone to which the person is adjusted.

The Safety Board believes that the proposed rules do not adequately address the effects of operations during a period of circadian "low" performance. Although a mandatory 48-hour rest is proposed following a return from a trip that has crossed at least six time zones, the Safety Board is not convinced that this proposal adequately addresses circadian effects on pilot performance. Rather, the Board believes that the number of hours flown and the number of takeoffs and landings conducted during a pilot's circadian night (i.e., the nighttime time zone to which the pilot is adapted) should be fewer than those permitted during the pilot's circadian day; adequate rest should be assured before pilot activity during circadian night intervals; and the amount of flight time should be limited after those intervals.

The Safety Board concludes that because of the additional workload required, flights with multiple takeoffs and landings are more fatiguing than those with few takeoffs and landings. Therefore, the Safety Board believes that the proposed rules should restrict the flight and duty times of pilots who are scheduled to conduct multiple takeoffs and landings within a 24-hour period.

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<sup>5</sup>*Ibid.*

The Safety Board supports the proposal of a minimum daily rest period and maximum permissible duty period. However, the weekly limit of 32 flight hours may not be necessary to prevent cumulative sleep loss because, on a daily basis, the proposed rules should assure that pilots are well rested and that neither acute nor cumulative sleep deprivation will occur. The Safety Board believes that the 32 flight hour limit could be deleted, provided that the following occur:

- Sufficient rest is assured within every 7 consecutive day interval;
- Adequate minimum daily rest and duty times are rigorously maintained; and
- Effective limitations on conducting flight operations during pilots' circadian nights are enacted.

#### **Comments Submitted to the FAA on the NPRM**

Safety Board investigators have reviewed hundreds of comments submitted to the FAA docket on this NPRM. Safety Board Members and staff have also met with representatives of airlines and pilot unions to hear first-hand their comments on the proposed rules. The comments appear to have been about evenly divided between those in favor of the proposed rules and those opposed.

Several of the comments asserted incorrectly that the Safety Board had never determined that fatigue had been involved in the probable cause of an aviation accident. In general, the following substantive points were raised against provisions of the proposed rules:

- The NASA research referred to in the NPRM was not designed to support FAA rulemaking efforts;
- The FAA failed to consider alternatives to the rule changes, such as the use of controlled napping;
- The NASA research demonstrated that crews actually performed better after having flown together for extended periods;
- The NPRM does not adequately address the different nature of the flight operations of the various carriers;
- There is no evidence that the proposed rules will result in reduced fatigue;
- The nature of the aviation system results in fatigue being less of a hazard than it is in other transportation modes;
- The proposed rules do not address commuting, second jobs, and other flightcrew member flying activities; and

- The increase in daily permissible flight hours to 10 hours poses a safety hazard.

Because of the importance of the NPRM to the FAA, pilots, airlines, and the traveling public, and because of its role in urging the FAA to modify existing pilot flight and duty time rules, the Safety Board believes that it should respond to these selected comments on the NPRM.

The Safety Board believes that with some exceptions, the proposed rules reflect contemporary scientific thinking on fatigue and methods of reducing the likelihood of its occurrence among pilots. Although much of this research has been conducted at the NASA Ames Research Center, considerable research on sleep and rest and circadian rhythms has also been conducted at academic and medical institutions in the United States, Europe, and Asia.<sup>6</sup> Although only specific NASA documents were cited in the NPRM, those documents represent a brief compilation of a considerable body of research and, as a result, the Safety Board believes that a scientific basis exists beyond the activities that NASA conducted to support upgrading the pilot flight and duty time rules.

The Safety Board recognizes the value of countermeasures, such as controlled napping, to temporarily mitigate the effects of fatigue. The Board is in favor of such countermeasures and, in fact, has urged the FAA to require that airlines employ a countermeasure in training pilots to safely traverse a microburst, in the event that they inadvertently encounter one. However, such training, which is now required, is not intended to encourage pilots to traverse microbursts. The Safety Board similarly believes that countermeasures, such as controlled napping, no matter how effective as a temporary mitigation of the effects of fatigue, have not been developed to be used, and should not be used, as a substitute for rules designed to reduce the likelihood that pilots will be fatigued from their flight and duty activities.

The Safety Board is aware of NASA research<sup>7</sup> that has demonstrated that pilots of short-haul air transport aircraft who have flown together for several days perform better at the end of a presumably fatiguing 3-day trip than pilots just beginning to fly comparably fatiguing trips. These differences were not found among pilots who had not flown together after completing similar 3-day trips. The researchers concluded "...that the positive effects on crew coordination of some unknown amount of recent operating experience can be an effective countermeasure to the levels of fatigue associated with the duty cycles examined in this study" (page 45). The authors then identified several limitations with the study, including the failure of the subject sample pool to allow for a close examination of the interaction of fatigue and crew familiarity and the inability to

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<sup>6</sup>E.G., Paley, M.J. & Tepas, D.I. (1994). Fatigue and the shiftworker: Firefighters working on a rotating shift schedule. *Human Factors*, 34, 269-284, and Summala, H. & Mikkola, T. (1994). Fatal accidents among car and truck drivers: Effects of fatigue, age, and alcohol consumption. *Human Factors*, 36, 316-326.

<sup>7</sup>Foushee, H.C.; Lauber, J.K.; Baetge, M.M.; and Acomb, D.B., "Crew Factors in Flight Operations: III. The Operational Significance of Exposure to Short-haul Air Transport Operations." (NASA Technical Memorandum No. 88322). Moffett Field, CA: National Aeronautics and Space Administration, 1986.

determine the "amount or degree of familiarity necessary to produce a desired level of crew coordination." Because of these limitations, as well as other factors, the authors concluded "Despite these rather compelling results, it would be a mistake to suggest a policy establishing the creation of relatively permanent crew assignments based on these data" (p. 45). The Safety Board concludes that this research does not demonstrate or even suggest that fatigue among pilots of short-haul flights does not exist, does not adversely affect flight safety, or can be mitigated by extended crew familiarity.

The Safety Board recognizes that the NPRM does not address different types of flight operations among U.S. operators, or acknowledge that U.S.-certificated carriers conduct a variety of types of flights, from on-demand charter flights to scheduled international service. However, with some exceptions, the daily rest requirements of crewmembers should not vary greatly as a function of the type of operation conducted. Although long-haul transpacific and transatlantic operators fly routes that can pose circadian difficulties that do not generally exist in short-haul operations, the needs of the pilots to be well rested do not change, and the challenges of maintaining a well-rested corps of pilots remain constant irrespective of the nature of the operation. Therefore, the Safety Board believes that rules that provide a common framework for flight and duty time limitations for all air transport operations regardless of the type of flight are appropriate.

The Safety Board believes that based on its findings in the investigation of the DC-8-61 accident at Guantanamo Bay, Cuba, the proposed rules will address the deficiencies in the existing regulations that permitted that crew to fly. Consequently, the Safety Board believes that sufficient evidence exists to support the contention that the proposed rules will enhance the ability of pilots to be well rested when performing the duties of flightcrew members on passenger- and cargo-carrying aircraft.

Further, until recently, clear and scientifically supportable markers with which to assess the presence of fatigue in transportation accidents were not available. As a result, in the past, it had been more difficult for the Safety Board to determine the presence of fatigue in transportation accidents and the extent to which it caused or contributed to accidents. Consequently, an assessment of the influence of fatigue in aviation safety that is carried out through an evaluation of the Safety Board's accident data base would underestimate its influence.

Moreover, the Safety Board does not believe that the safety record that the aviation system has enjoyed, as good as it is, should discourage regulators, operators, and flightcrew members from attempting to enhance its already commendable record. Notwithstanding the safety of any one transportation system relative to another, the Safety Board believes that regulations that will serve to reduce the presence of fatigue among flightcrew members should be promulgated.

The Safety Board agrees that the proposed rules do not address pilot commuting, second jobs, and other flightcrew member flying activities. Nevertheless, this does not imply that the proposed rules are deficient. While commuting pilots, particularly those commuting long distances and/or crossing time zones, and those engaged in fatiguing duties unrelated to those of the carrier,

can become fatigued despite the proposed rules, this does not diminish the rules' impact, relevance, or importance. Moreover, the fact remains that there is little, if any, data available to determine the extent to which pilot commuting, second jobs, or other flying activities present a threat to aviation safety. As a result, neither the Safety Board nor the FAA can gauge the extent to which these factors may be interfering with aviation safety, and therefore, the Safety Board does not believe that the NPRM should address these issues. The Safety Board believes that these issues may more properly be addressed by the air carriers, working together with organizations and unions representing the pilots, as at least one European carrier, Monarch Airlines, has done.

Finally, although the Safety Board has no evidence (and is aware of none) to suggest that expanding the daily flight limit to 10 hours will be hazardous to safety, it is concerned that such an expansion can interact with late night/early morning circadian effects, and an increased number of takeoffs and landings, either alone or in combination, to create additional safety hazards. Although modern turbojet air transport aircraft may not be as fatigue-inducing to pilots as are aircraft that were designed decades ago, unless the flight hours occur primarily during daylight and the pilots' circadian day, extended flight hour limits could contribute to fatigue.

Further, for flights involving aircraft that fly at low altitudes, and in unpressurized aircraft, an increase in daily flight and duty time limits can only take place safely with limits on the number of takeoffs and landings.

### **Conclusions**

Although the proposed changes to the flight and duty time rules will likely produce economic benefits to some in the aviation community and expenses to others, the Safety Board believes that the safety of crewmembers and the traveling public should be the overriding concern underlying the FAA's promulgation of rules and regulations. Scientists, regulators, members of the aviation community, and the traveling public acknowledge that flightcrew member fatigue poses a threat to aviation safety and that rules and regulations that allow fatigued crewmembers to serve on the flightdeck of aircraft should be revised.

The Safety Board commends the FAA on the issuance of its NPRM, "Flight Crewmember Duty Period Limitations, Flight Time Limitations and Rest Requirements." The Safety Board believes that implementation of many of the provisions of the proposed rules will have a positive effect on aviation safety. The Safety Board appreciates the opportunity to comment on this rule.

Sincerely,

**ORIGINAL SIGNED BY  
JIM HALL**

Jim Hall  
Chairman