DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 117 and 121

Docket No. FAA-2009-1093; Notice No. 10-11

RIN 2120-AJ58

Flightcrew Member Duty and Rest Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: The FAA is proposing to amend its existing flight, duty and rest regulations applicable to certificate holders and their flightcrew members. The proposal recognizes the growing similarities between the types of operations and the universality of factors that lead to fatigue in most individuals. Fatigue threatens aviation safety because it increases the risk of pilot error that could lead to an accident. The new requirements, if adopted, would eliminate the current distinctions between domestic, flag and supplemental operations. The proposal provides different requirements based on the time of day, whether an individual is acclimated to a new time zone, and the likelihood of being able to sleep under different circumstances.

DATES: Comments are due [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

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SUPPLEMENTARY INFORMATION

Later in this preamble under the Additional Information section, we discuss how you can comment on this proposal and how we will handle your comments. Included in this discussion is related information about the docket, privacy, and the handling of proprietary or confidential business information. We also discuss how you can get a copy of this proposal and related rulemaking documents.

Authority for this Rulemaking

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code. This rulemaking is promulgated under the authority described in 49 U.S.C. 44701(a)(5), which requires the Administrator to promulgate regulations and minimum safety standards for other practices, methods, and procedures necessary for safety in air commerce and national security.

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I. Executive Summary

As discussed in greater detail throughout this document, this rulemaking proposes to establish one set of flight time limitations, duty period limits, and rest requirements for pilots in Part 121 operations. The rulemaking aims to ensure that pilots have an opportunity to obtain sufficient rest to perform their duties, with an objective of improving aviation safety.

Current Part 121 pilot duty and rest times differ by type of operation (domestic, flag, and supplemental). A general summary of current versus proposed flight time limits, duty time limits, and rest time requirements are included in the table below.

Scenario	Rest Time		Duty Time		Flight Time	
	Minimum Rest Prior to Duty - Domestic	Minimum Rest Prior to Duty - International	Maximum Flight Duty Time - Unaugmented	Maximum Flight Duty Time - Augmented	Maximum Flight Time - Unaugmented	Maximum Flight Time - Augmented
Current Part 121	Daily: 8-11 depending on flight time	Minimum of 8 hours to twice the number of hours flown	16	16-20 depending on crew size	8	8-16 depending on crew size
NPRM	9	9	9-13 depending on start time and number of flight segments	12-18 depending on start time, crew size, and aircraft rest facility	8-10 depending on FDP start time	None

A summary of the FAA estimates of the costs and benefits associated with the provisions in this rule can be found in the table below.

	Nominal Costs	PV Costs
	(millions)	(millions)
Total Costs (over 10 years)	$1,254.1	$803.5
Benefits	**Nominal Benefits**	**PV Benefits**
	(millions)	**(millions)**
$6.0 million VSL	$659.40	$463.80
$8.4 million VSL	$837	$589

The FAA began considering changing its existing flight, duty and rest regulations in June 1992, when it announced the tasking of the Aviation Rulemaking Advisory Committee (ARAC) Flightcrew Member Flight/Duty Rest Requirements working group.[1] The tasking followed the FAA's receipt of hundreds of letters about the interpretation of existing rest requirements and several petitions to amend existing regulations. While the working group could not reach consensus, it submitted a final report in June 1994 with proposals from several working group members. Following receipt of the ARAC's report, the FAA published a notice of proposed rulemaking in 1995 (1995 NPRM).[2] The FAA received over 2000 comments to the 1995 NPRM. Although some commenters, including the National Transportation Safety Board (NTSB), NASA, Air Line Pilots Association, and Allied Pilots Association, said the proposal would enhance safety, many industry associations opposed the 1995 NPRM, stating the FAA lacked safety data to justify the rulemaking, and industry compliance would impose significant costs. The FAA never finalized the 1995 rulemaking, and on November 23, 2009, the agency

[1] 57 FR 26685; June 15, 1992
[2] Flightcrew Member Duty Period Limitations, Flight Time Limitations and Rest Requirements notice of proposed rulemaking (60 FR 65951; December 20, 1995)

withdrew it because it was outdated and raised many significant issues that the agency needed to consider before proceeding with a final rule.[3]

On June 10, 2009, Federal Aviation Administration (FAA) Administrator J. Randolph Babbitt testified before the Senate Committee on Commerce, Science, and Transportation, Subcommittee on Aviation Operations, Safety, and Security on Aviation Safety regarding the FAA's role in the oversight of certificate holders. He addressed issues regarding flightcrew member[4] training and qualifications, flightcrew fatigue, and consistency of safety standards and compliance between air transportation certificate holders.[5] He also committed to assess the safety of the air transportation system and to take appropriate steps to improve it.

In June 2009, the FAA chartered the Flight and Duty Time Limitations and Rest Requirements Aviation Rulemaking Committee (ARC)[6] comprised of labor, industry, and FAA representatives to develop recommendations for an FAA rule based on current fatigue science and a thorough review of international approaches to the issue. The FAA chartered the ARC to provide a forum for the U.S. aviation community to discuss current approaches to mitigate fatigue found in international standards and make recommendations on how the United States should modify its regulations. The ARC consisted of 18 members representing airline and union associations. The members were

[3] 74 FR 61067.
[4] A "flightcrew member" is defined in 14 CFR § 1.1 as a pilot, flight engineer, or flight navigator assigned to duty in an aircraft during flight time.
[5] In this document, the terms "certificate holder" and "carrier" are used interchangeably. Technically, one could be a "certificate holder" under part 121 without also being an air carrier. Accordingly, the draft regulatory text only uses the term "certificate holder".
[6] See www.faa.gov/about/office%5Forg/headquarters%5Foffices/avs/offices/afs/afs200/ for the ARC Charter.

selected based on their extensive certificate holder management, direct operational experience, or both.

Specifically, the FAA asked the ARC to consider and address the following:

- A single approach to addressing fatigue that consolidates and replaces existing regulatory requirements for parts 121 and 135.[7]
- Generally accepted principles of human physiology, performance, and alertness based on the body of fatigue science.
- Information on sources of aviation fatigue.
- Current approaches to address fatigue mitigation strategies in international standards.
- The incorporation of fatigue risk management systems (FRMS) into a rulemaking.

The ARC met over a 6-week period beginning July 7, 2009. Early on, the FAA told the ARC members it was very interested in the ARC's recommendations, but that the agency retained the authority and obligation to evaluate any proposals and independently determine how best to amend the existing regulations. The agency reiterated that participation on the ARC in no way precluded the ARC members from submitting comments critical of the NPRM when it was published. On September 9, 2009, the ARC delivered its final report to the FAA in the form of a draft NPRM.[8]

The ARC's goal was to reach as much agreement as possible on the prospective regulation. However, the members recognized early on that they would not be able to reach consensus on all issues. They were, however, generally successful in agreeing

[7] While tasked to consider part 135 operations, the ARC did not consider these operations, and this proposal does not address them either.
[8] A copy of the ARC recommendations can be found in the docket for this rulemaking.

upon broad regulatory approaches and were able to reach consensus on two issues – how to address reserve[9] and the role of commuting in any proposed regulations.

The Cargo Airline Association (CAA) presented a separate proposal for FAA consideration to address the unique operations of its members.[10] According to the CAA, cargo operations are subject to different operational and competitive factors than scheduled passenger air carrier operations, including flight delays and schedule changes outside of the control of the certificate holder. The National Air Carrier Association (NACA) also submitted an alternate proposal to the ARC.[11] NACA proposed that the regulations contained in subpart S to part 121 continue to apply to certificate holders conducting unscheduled supplemental operations. In addition, it proposed to include a requirement that such operators develop and implement FRMS.

To assist the ARC with its goal of developing proposed rules to enhance flightcrew member alertness and employ fatigue mitigation strategies, the following experts in sleep, fatigue, and human performance research presented a brief overview of the existing science and studies on sleep and fatigue to the ARC:

- Dr. Gregory Belenky, M.D., Sleep and Performance Research Center, Washington State University and Dr. Steven R. Hursh, Ph.D., President, Institutes for Behavior Resources, Professor, Johns Hopkins University School of Medicine presented information on sleep, fatigue, and human performance.
- Dr. Thomas Nesthus, Ph.D., FAA Civil Aeromedical Institute (CAMI) presented an overview of the current FAA fatigue studies.

[9] See proposed § 117.3 (Definitions) were the term "Reserve Flightcrew Member" is defined.
[10] This proposal may be found in attachment 1 to the ARC report.
[11] This proposal may be found in attachment 2 to the ARC report.

- Dr. Peter Demitry, M.D., 4d Enterprises, addressed questions from the ARC but did not make a presentation.

The ARC members considered the information presented by the scientists as well as other available scientific information and used their substantial operational experience knowledge base to develop the ARC proposals.

Following their presentations, the scientific experts encouraged the ARC to consider the entire body of scientific studies in developing any proposed limitations and requirements, rather than any one scientific study.[12]

On August 1, 2010, the President signed the Airline Safety and Federal Aviation Administration Extension Act of 2010, P.L. 111-216 (the Act). In section 212 of the Act, Congress directed the FAA to issue regulations no later than August 1, 2011 to "specify limitations on the hours of flight and duty time allowed for pilots to address problems relating to pilot fatigue."

The Act directed the FAA to consider several factors that could impact pilot alertness including time of day, number of takeoffs and landings, crossing multiple time zones, and the effects of commuting. In addition, the agency was directed to review the available research on fatigue, sleep and rest requirements recommended by the NTSB and NASA, and applicable international standards. Finally, the agency was to explore alternate procedures to facilitate alertness in the cockpit, air carrier scheduling and attendance policies (including sick leave), and medical screening and treatment options.

The FAA has developed a proposal for addressing the risk of fatigue on the safety of flight based on an evaluation of the available literature, existing regulatory

[12] A bibliography of available studies has been placed in the docket for this rulemaking.

requirements in both the United States and other countries, and the broad personal, professional experience of the ARC members and FAA staff, as well as the recommendations of the NTSB and NASA. Today's proposal is consistent with the statutory mandate set forth in the Act and takes a new approach whereby the distinctions between domestic, flag, and supplemental operations are eliminated. Rather, all types of operations would take into account the effects of circadian rhythms, inadequate rest opportunities and cumulative fatigue.

The FAA believes its proposal sufficiently accommodates the vast majority of operations conducted today, while reducing the risk of pilot error from fatigue leading to accidents. In some areas, the FAA proposes to relax current requirements, while in others, it strengthens them to reflect the latest scientific information. The agency proposes to provide credit for fatigue-mitigating strategies, such as sleep facilities, that some certificate holders are currently providing with no regulatory incentive. The agency has also tentatively decided that certain operations conducted under the existing rules are exposing flightcrew members to undue risk.

Today's proposal sets forth a matrix that addresses transient fatigue (i.e., the immediate, short-term fatigue that can be addressed by a recuperative rest opportunity) by establishing a 9-hour minimum rest opportunity prior to commencing duty directly associated with the operation of aircraft (flight duty period, or FDP), placing restrictions on that type of duty, and further placing restrictions on flight time (that period of time when the aircraft is actually in motion – flight time is encompassed by FDP).

The proposal provides carriers with a level of flexibility not afforded today by permitting a limited extension of FDP and a limited reduction in the minimum rest

opportunity in circumstances that are neither within the carrier's control nor reasonably foreseeable. In order to assure that carriers are adequately scheduling flightcrew member's work days, so as not to overuse the extension, carriers would be required to report on both their overall schedule integrity and specific crew-pairing schedule integrity on a bi-monthly basis. Should a carrier fail to meet the required levels of integrity, it would have to adjust its schedule to make it more reliable.

The proposal addresses cumulative fatigue by placing weekly and 28-day limits on the amount of time a flightcrew member may be assigned to any type of duty, including FDP. Further 28-day and annual limits are placed on flight time. Flightcrew members would be required to be given at least 30 consecutive hours free from duty on a weekly basis, a 25 percent increase over the current requirements.

In addition, today's proposal addresses the impact of changing time zones and flying through the night by reducing the amount of flight time and FDP available for these operations. More flight time and FDP would be available for certificate holders that add additional flightcrew members and provide adequate rest facilities to allow flightcrew members an opportunity to sleep aboard the aircraft. Credit would also be available to certificate holders that provide sufficient ground-based rest facilities.

All carriers would have to develop training programs to educate all employees responsible for developing air carrier schedules and safety of flight on the symptoms of fatigue, as well as the factors leading to fatigue and how to mitigate fatigue-based risk.

For those operations that cannot be conducted under the proposed prescriptive requirements, today's proposal also allows a carrier to develop a carrier-specific fatigue risk management system (FRMS). An FAA-approved FRMS would allow a certificate

holder to customize its operations based on a scientifically-validated demonstration of fatigue-mitigating approaches and their impact on a flightcrew member's ability to safely fly an airplane beyond the confines of the proposed rule. Finally, today's proposal provides a limited exception for certain emergency operations or operations conducted under contract with the United States government that cannot otherwise be conducted under the prescriptive requirements proposed here. In order to assure there is no abuse, and that the exception is necessary, the proposal includes a reporting requirement.

II. Background

A. Statement of the Problem

Fatigue is characterized by a general lack of alertness and degradation in mental and physical performance. Fatigue manifests in the aviation context not only when pilots fall asleep in the cockpit while cruising, but perhaps more importantly, when they are insufficiently alert during take-off and landing. Reported fatigue-related events have included procedural errors, unstable approaches, lining up with the wrong runway, and landing without clearances.

There are three types of fatigue: transient, cumulative, and circadian. Transient fatigue is acute fatigue brought on by extreme sleep restriction or extended hours awake within 1 or 2 days. Cumulative fatigue is fatigue brought on by repeated mild sleep restriction or extended hours awake across a series of days. Circadian fatigue refers to the reduced performance during nighttime hours, particularly during an individual's window of circadian low (WOCL) (typically between 2 a.m. and 6 a.m.).

Common symptoms of fatigue include:

- Measurable reduction in speed and accuracy of performance,
- Lapses of attention and vigilance,
- Delayed reactions,
- Impaired logical reasoning and decision-making, including a reduced ability to assess risk or appreciate consequences of actions,
- Reduced situational awareness, and
- Low motivation to perform optional activities.

A variety of factors contribute to whether an individual experiences fatigue as well as the severity of that fatigue. The major factors affecting fatigue include:

- Time of day. Fatigue is, in part, a function of circadian rhythms. All other factors being equal, fatigue is most likely, and, when present, most severe, between the hours of 2 a.m. and 6 a.m.
- Amount of recent sleep. If a person has had significantly less than 8 hours of sleep in the past 24 hours, he or she is more likely to be fatigued.
- Time awake. A person who has been continually awake more than 17 hours since his or her last major sleep period is more likely to be fatigued.
- Cumulative sleep debt. For the average person, cumulative sleep debt is the difference between the amount of sleep a person has received over the past several days, and the amount of sleep they would have received if they got 8 hours of sleep a night. A person with a cumulative sleep debt of more than 8 hours since his or her last full night of sleep is more likely to be fatigued.

- Time on task. The longer a person has continuously been doing a job without a break, the more likely he or she is to be fatigued.
- Individual variation. Individuals respond to fatigue factors differently and may become fatigued at different times, and to different degrees of severity, under the same circumstances.

There is often interplay between various factors that contribute to fatigue. For example, the performance of a person working night and early morning shifts is impacted by the time of day. Additionally, because of the difficulty in getting normal sleep during other than nighttime hours, such a person is more likely to have a cumulative sleep debt or to not have obtained a full night's sleep within the past 24 hours.

Scientific research and experimentation have consistently demonstrated that adequate sleep sustains performance. For most people, 8 hours of sleep in each 24 hours sustains performance indefinitely. Sleep opportunities during the WOCL are preferable, although some research indicates that the total amount of sleep is more important than the timing of the sleep. Within limits, shortened periods of nighttime sleep may be nearly as beneficial as a consolidated sleep period when augmented by additional sleep periods, such as naps before evening departures, during flights with augmented flightcrews, and during layovers. Sleep should not be fragmented with interruptions. In addition, environmental conditions, such as temperature, noise, and turbulence, impact how beneficial sleep is and how performance is restored.

When a person has accumulated a sleep debt, recovery sleep is necessary to fully restore the person's "sleep reservoir." Recovery sleep should include at least one physiological night, that is, one sleep period during nighttime hours in the time zone in

which the individual is acclimated. The average person requires in excess of 9 hours of sleep a night to recover from a sleep debt. [13]

Several aviation-specific work schedule factors[14] can affect sleep and subsequent alertness. These include early start times, extended work periods, insufficient time off between work periods, insufficient recovery time off between consecutive work periods, amount of work time within a shift or duty period, number of consecutive work periods, night work through one's window of circadian low, daytime sleep periods, and day-to-night or night-to-day transitions.

The FAA believes its current regulations do not adequately address the risk of fatigue. Presently, flightcrew members are effectively allowed to work up to 16 hours a day, with all of that time spent on tasks directly related to aircraft operations. The regulatory requirement for 9 hours of rest is regularly reduced, with flightcrew members spending rest time traveling to or from hotels and being provided with little to no time to decompress. Additionally, certificate holders regularly exceed the allowable duty periods by conducting flights under part 91 instead of part 121, where the applicable flight, duty and rest requirements are housed. As the NTSB repeatedly notes, the FAA's regulations do not account for the impact of circadian rhythms on alertness, and the entire set of regulations is overly complicated, with a different set of regulations for domestic operations, flag operations, and supplemental operations.

[13] Recovery sleep does not require additional sleep equal to the cumulative sleep debt; that is, an 8-hour sleep debt does not require 8 additional hours of sleep.
[14] Rosekind MR. *Managing work schedules: an alertness and safety perspective.* In: Kryger MH, Roth T, Dement WC, editors. Principles and Practice of Sleep Medicine; 2005:682.

B. NTSB recommendations

The NTSB has long been concerned about the effects of fatigue in the aviation industry. The first aviation safety recommendations, issued in 1972, involved human fatigue, and aviation safety investigations continue to identify serious concerns about the effects of fatigue, sleep, and circadian rhythm disruption. Currently, the NTSB's list of Most Wanted Transportation Safety Improvements includes safety recommendations regarding pilot fatigue. These recommendations are based on two accident investigations and an NTSB safety study on commuter airline safety.[15]

In February 2006 the NTSB issued safety recommendations after a BAE–J3201 operated under part 121 by Corporate Airline struck trees on final approach and crashed short of the runway at Kirksville Regional Airport, Kirksville, Missouri. The captain, first officer, and 11 of the 13 passengers died. The NTSB determined the probable cause of the October 19, 2004 accident was the pilots' failure to follow established procedures and properly conduct a non-precision instrument approach at night in instrument meteorological conditions. The NTSB concluded that fatigue likely contributed to the pilots' performance and decision-making ability. This conclusion was based on the less than optimal overnight rest time available to the pilots, the early report time for duty, the number of flight legs, and the demanding conditions encountered during the long duty day.

As a result of the accident, the NTSB issued the following safety recommendations related to flight and duty time limitations: (1) modify and simplify the

[15] On February 2, 2010, the NTSB released a press release summarizing the results of its investigation into the Colgan Air crash of February 12, 2009, which resulted in the death of 50 people. The NTSB did not state that fatigue was causal factor to the crash; however, it did recommend that the FAA take steps to address pilot fatigue.

flightcrew hours-of-service regulations to consider factors such as length of duty day, starting time, workload, and other factors shown by recent research, scientific evidence, and current industry experience to affect crew alertness (recommendation No. A–06–10); and (2) require all part 121 and part 135 certificate holders to incorporate fatigue-related information similar to the information being developed by the DOT Operator Fatigue Management Program into initial and recurrent pilot training programs. The recommendation notes that this training should address the detrimental effects of fatigue and include strategies for avoiding fatigue and countering its effects (recommendation No. A–06–10).

The NTSB's list of Most Wanted Transportation Safety Improvements also includes a safety recommendation on pilot fatigue and ferry flights conducted under 14 CFR part 91. Three flightcrew members died after a Douglas DC–8–63 operated by Air Transport International was destroyed by ground impact and fire during an attempted three-engine takeoff at Kansas City International Airport in Kansas City, Missouri. The NTSB noted that the flightcrew conducted the flight as a maintenance ferry flight under part 91 after a shortened rest break following a demanding round trip flight to Europe that crossed multiple time zones. The NTSB further noted that the international flight, conducted under part 121, involved multiple legs flown at night following daytime rest periods that caused the flightcrew to experience circadian rhythm disruption. In addition, the NTSB found the captain's last rest period before the accident was repeatedly interrupted by the certificate holder.

In issuing its 1995 recommendations, the NTSB stated that the flight time limits and rest requirements under part 121 that applied to the flightcrew before the ferry flight

did not apply to the ferry flight operated under part 91. As a result, the regulations permitted a substantially reduced flightcrew rest period for the nonrevenue ferry flight. As a result of the investigation, the NTSB reiterated earlier recommendations to (1) finalize the review of current flight and duty time limitations to ensure the limitations consider research findings in fatigue and sleep issues and (2) prohibit certificate holders from assigning a flightcrew to flights conducted under part 91 unless the flightcrew met the flight and duty time limits under part 121 or other applicable regulations (recommendation No. A–95–113).

In addition to recommending a comprehensive approach to fatigue with flight duty limits based on fatigue research, circadian rhythms, and sleep and rest requirements, the NTSB has also stated that FRMS may hold promise as an approach to dealing with fatigue in the aviation environment. However, the NTSB noted that it considers fatigue management plans to be a complement to, not a substitute for, regulations to address fatigue.

C. International standards

There are a number of standards addressing flight and duty time limitations and rest requirements that have been adopted by other jurisdictions, as well as the International Civil Aviation Organization (ICAO), and these standards were reviewed by the ARC to determine if any of their philosophy or structures could be adopted by the FAA. While the ARC found many of the requirements useful, it also determined that the U.S. requirements would need to address the U.S. aviation industry and that the existing standards could not fully achieve that objective. The FAA agrees that none of the existing standards fully address the U.S. aviation environment. Nevertheless, the existing

standards do serve as the basis of many of the provisions proposed today. Accordingly, specific provisions of these standards are discussed throughout the rest of this document and a copy of each standard has been placed in the docket.

1. Amendment No. 33 to the International Standards and Recommended Practices, Annex 6 to the Convention on International Civil Aviation, Part I, International Commercial Air Transport—Aeroplanes (ICAO Standards and Recommended Practices (SARP))

The ICAO SARP for Contracting States (States) provide that a certificate holder should establish flight time and duty period limitations and rest provisions that enable the certificate holder to manage the fatigue of its flightcrew members. The ICAO SARP do not provide specific numerical values for these provisions but set forth a regulatory framework for member States to use as guidelines in establishing prescriptive limitations for fatigue management. Member States are required to base their regulations on scientific principles and knowledge with the goal of ensuring that flightcrew members perform at an adequate level of alertness for safe flight operations. The ICAO SARP do not address fatigue risk management programs currently; however, these programs are currently under development.

2. United Kingdom Civil Aviation Authority Publication 371 (CAP-371)

Air Navigation Order 2000, Part VI, as amended, requires a certificate holder to have a civil aviation authority-approved scheme for regulating the flight time of aircrews. CAP-371 provides guidance on this requirement and recognizes that the prime objective of a flight limitation scheme is to ensure flightcrew members are adequately rested at the beginning of each Flight Duty Period (FDP) and are flying sufficiently free from fatigue

so they can operate efficiently and safely in normal and abnormal situations. When establishing maximum FDPs and minimum rest periods, certificate holders must consider the relationship between the frequency and patterns of scheduled FDPs and rest periods, and the effects of working long hours with minimum rest.

3. Annex III, Subpart Q to the Commission of the European Communities Regulation No. 3922/91, as amended (EU OPS subpart Q)

EU OPS subpart Q prescribes limitations on FDPs, duty periods, block (flight) time, and rest requirements. Like the previous standards discussed, EU OPS subpart Q recognizes the importance of enabling flightcrew members to be sufficiently free from fatigue so they can operate the aircraft satisfactorily in all circumstances. In establishing flight and duty limitation and rest schemes, EU OPS subpart Q requires certificate holders to consider the relationship between the frequencies and pattern of FDPs and rest periods, and the cumulative effects of long duty hours with interspersed rest. Certificate holders must take action to revise a schedule in cases where the actual operation exceeds the maximum scheduled FDP on more than 33 percent of the flights in that schedule during a specified period.

III. General Discussion of the Proposal

A. Applicability

The FAA is proposing to limit this rulemaking to part 121 certificate holders and the flightcrew members[16] who work for them. While fatigue is a universal problem that applies to all types of operations and to all safety sensitive functions, the agency has decided to take incremental steps in addressing fatigue. Thus, future rulemaking

[16] A flightcrew member is a certified pilot or flight engineer assigned to duty aboard an aircraft during a flight duty period.

initiatives may address fatigue concerns related to flight attendants, maintenance personnel, and dispatchers.

In addition, part 135 certificate holders should pay close attention to both this NPRM and any final rule. This is because part 135 operations are very similar to those conducted under part 121, particularly part 121 supplemental operations. The FAA does not intuitively see any difference in the safety implications between the two types of operations, although it acknowledges there may be less overall risk to the flying public in part 135 operations than part 121 operations. Accordingly, the part 135 community should expect to see an NPRM addressing its operations that looks very similar to, if not exactly like, the final rule the agency anticipates issuing as part of this rulemaking initiative.

Today's proposal applies to all flights conducted by part 121 certificate holders, including flights like ferry flights that are historically conducted under part 91. While these types of flights can continue to operate under the general rules of part 91, the flight, duty, and rest requirements proposed here would also apply.

In addition, the FAA has tentatively decided against adopting different requirements based on the nature of the operation. The FAA has designed the flight, duty and rest scheme proposed today to enhance flightcrew member alertness and mitigate fatigue. The agency's existing regulatory scheme provides different rules for domestic operations, flag operations, and supplemental operations. This hodgepodge of requirements developed over time to address changing business environments and advances in technology that allowed for longer periods of flight. Thus, in domestic operations, flight time is essentially calculated based on time at the controls, while in

supplemental operations, the regulations contemplate restrictions based on "time aloft" since a flightcrew member may not be at the controls for the entire flight; crew augmentation is prohibited in domestic operations; and the regulations governing flag operations, where augmentation is largely assumed, allow certificate holders to liberally increase the amount of flight time based on the presence of additional flightcrew members, regardless of whether those individuals can actually fly the airplane.

Fatigue factors, however, are universal. The sleep science, while still evolving and subject to individual inclinations, is clear in a few important respects: most people need eight hours of sleep to function effectively, most people find it more difficult to sleep during the day than during the night, resulting in greater fatigue if working at night; the longer one has been awake and the longer one spends on task, the greater the likelihood of fatigue; and fatigue leads to an increased risk of making a mistake.

The FAA recognizes there are different business models and needs that are partly responsible for the differences in the current regulations. It is sympathetic to concerns raised within the ARC by cargo carriers and carriers engaged in supplemental operations that new regulations will disproportionately impact their business models. However, the FAA also notes that the historical distinction between the types of operators has become blurred. Cargo carriers conduct the vast majority of their operations at night, but passenger carriers also offer "red eyes" on a daily basis. Some carriers operate under domestic, flag or supplemental authority, depending on the nature of the specific operation. Additionally, in some instances, the FAA has authorized a carrier to conduct supplemental operations under the flag rules.

Today's proposal is designed to recognize the growing similarities between the kinds of operations and the universality of factors that lead to fatigue in most individuals. Thus, the proposal provides different requirements based on the time of day, whether an individual is acclimated to a new time zone, and the likelihood of being able to sleep under different circumstances. If today's proposal is adopted, the FAA expects that most part 121 operators will be required to make changes to their existing operations, and some will need to make more changes than others. However, the FAA also believes that the proposal is sufficiently flexible to accommodate the vast majority of operations conducted today without imposing unreasonable costs.

B. Joint responsibility

Fatigue mitigation is a joint responsibility of the certificate holder and the flightcrew member. Today's proposal recognizes the need to hold both certificate holders and pilots responsible for making sure flightcrew members are working a reasonable number of hours, getting sufficient sleep, and not reporting for flight duty in an unsafe condition. Many of the ways that carriers and flightcrew members will negotiate this joint responsibility will be handled in the context of labor management relations. Others will not. Today's proposal is drafted in a manner that directly imposes the regulatory obligations on both the certificate holders and the flightcrew members. It is unfair to place all the blame for fatigue on the carriers. Pilots who pick up extra hours, moonlight, report to work when sick, commute irresponsibly, or simply choose not to take advantage of the required rest periods are as culpable as carriers who push the envelop by scheduling right up to the maximum duty limits, assigning flightcrew members who have reached their flight time limits additional flight duties under part 91,

and exceeding the maximum flight and duty limits by claiming reasonably foreseeable circumstances are beyond their control.

One important element of this proposal is that flightcrew members may not accept an assignment that would consist of an FDP if they are too fatigued to fly safely. Likewise a flightcrew member may not continue subsequent flight segments if he or she has become too fatigued to fly safely. Certificate holders also must assess a flightcrew member's state when he or she reports to work. If the carrier determines a flightcrew member is showing signs of fatigue, it may not allow the flightcrew member to fly. Flightcrew members should be cognizant of the appearance and behavior of fellow flightcrew members, including such signs of fatigue as slurred speech, droopy eyes, requests to repeat things, and attention to the length of time left in the duty period. If a flightcrew member (or any other employee) believes another flightcrew member may be too tired to fly, he or she would have to report his or her concern to the appropriate management person, who would then be required to determine whether the individual is sufficiently alert to fly safely.

In addition, under today's proposal, carriers would need to develop and implement an internal evaluation and audit program to monitor whether flightcrew members are reporting to work fatigued. The FAA anticipates that the program would look at both the number of instances in which this happens as well as the reasons contributing to the problem. The FAA is aware of anecdotal reports of pilots flying when fatigued because they are short on sick leave, as well as instances when pilots have called in sick when the true problem was fatigue. As part of the internal audit, a carrier may need to delve into the reasons flightcrew members call in sick to make sure it is capturing

accurately incidents of pilot fatigue. It could choose to create a separate fatigue category to mitigate the risk of pilots calling in sick when in fact they are fatigued.

A carrier would be required to take steps to correct any fatigue problem that it identifies. For example, if the carrier became aware that flightcrew members were commuting during their WOCL, the carrier could require that all flightcrew members spend the night prior to starting a series of FDPs within the local commuting area. The carrier could also implement other measures to address problems associated not only with commuting, but any behavior that could lead to flightcrew members reporting for FDPs unfit for duty.

Several ARC members urged that these requirements be encapsulated in a non-punitive fatigue policy. While the FAA certainly supports such policies, it also recognizes that requiring carriers to develop and implement non-punitive fatigue policies is challenging from a regulatory perspective. Carriers are entitled to investigate the causes for an employee's fatigue. If a carrier determines that the flightcrew member was responsible for becoming fatigued, it has every right to take steps to address that behavior. To the extent the fatigue may be a function of the carrier not following the regulatory requirements, the FAA certainly would investigate and possibly initiate enforcement action. In addition, self-reporting could be encapsulated in a carrier's voluntary disclosure program under the FAA's Aviation Safety Action Program (ASAP), which has certain non-punitive provisions built into the program.

C. Fatigue training

The FAA believes fatigue-based training requirements are critical to informing flightcrew members how their personal behavior can unwittingly lead to fatigue, and how

to mitigate the risk of fatigue in an industry that does not follow a traditional 9-to-5 work day. Fatigue training is not currently required under any regulatory regime. In the presentation to the ARC by the sleep specialists, all specialists noted that people regularly underestimate their level of fatigue, often to dangerous levels. The ARC generally agreed that fatigue training was a good idea, and several members noted that such training should extend to all "stakeholders", e.g., employees of the certificate holder responsible both for scheduling and for safety of flight, rather than just flightcrew members.

The FAA agrees that flightcrew members do not bear sole responsibility for making sure they are adequately rested and that they are not the only employees of the carrier who need to be trained on the impact of fatigue on the safety of flight. The agency is proposing to require fatigue training for each person involved with scheduling aircraft and crews, all crewmembers and management personnel. The FAA is proposing to require 5 hours of initial training for all newly-hired, covered employees prior to starting work in that capacity and 2 hours of annual, recurrent training. This training would be approved through the agency's Operations Specifications (OpSpec) process.

The training curriculum would address general fatigue and fatigue countermeasures along with the following subject areas:

- FAA regulatory requirements for flight, duty and rest, and NTSB recommendations on fatigue management;
- The basics of fatigue, including sleep fundamentals and circadian rhythms;
- The causes of fatigue, including medical conditions that may lead to fatigue;
- The effect of fatigue on performance;

- Fatigue countermeasures, prevention and mitigation;
- The influence of lifestyle, including nutrition, exercise, and family life, on fatigue;
- Familiarity with sleep disorders and their possible treatments;
- The impact of commuting on fatigue;
- Flightcrew member responsibility for ensuring adequate rest and fitness for duty; and
- The effect of operating through and within multiple time zones.

In addition, the FAA recognizes that the study of fatigue and fatigue mitigation is on-going. Changes may need to be made to training programs even after approval by the FAA. Accordingly, whenever the Administrator finds that revisions are necessary for the continued adequacy of an approved fatigue education and training program, the certificate holder must, after notification, make any changes in the program that are deemed necessary by the Administrator. The FAA anticipates that such changes would be implemented through the agency's OpSpecs as provided for in 14 CFR 119.51, providing carriers with an opportunity to provide input and appeal rights.

D. Flight Duty Period

There are numerous studies that generally address fatigue, as well as models[17] that have been developed. The models predict fatigue-based performance degradation based on data input such as when a flight begins, how long it lasts, whether there is a rest

[17] Bio-mathematical modeling of fatigue and performance can assist in providing objective metrics, which are conspicuously lacking in fatigue science. The rationale for modeling is that conditions that lead to fatigue are well known. A model simulates specific conditions and determines if fatigue could be present. Models can estimate degradations in performance and provide an estimate of schedule-induced fatigue risk that considers many dynamically changing and interacting fatigue factors.

opportunity, and the local time of day at departure and landing. Only one of these models has been validated in the aviation context,[18] although there is general validation in the railroad and motor carrier industries. The available validations are not directly applicable to aviation because of the impact of relatively rapid movement within multiple time zones.

While there is ample science indicating that performance degrades during windows of circadian low and that regular sleep is necessary to sustain performance, there is no evidence that flying multiple segments is more fatiguing than flying one or two segments per duty period. However, multiple segments require more time on task because there are more take-offs and landings, which are both the most task-intensive and the most safety-critical stages of flight. Also, pilots appear to generally agree that flying several legs during a single duty period could be more fatiguing.

One approach to addressing fatigue is to link the length of duty directly related to flight to the time of day and the number of legs that are scheduled to be flown. This approach recognizes the additional fatigue introduced by night-time flying and by flying several legs, with multiple take-offs and landings. As discussed earlier, the current regulatory system in the United States provides variability based on whether a given operation is flown under domestic, flag or supplemental rules; but within each category of operation there is little to no variability in permissible flight time based on the particular operation.

Other jurisdictions have largely eliminated the concept of a uniform flight time in favor of a variable FDP that encompasses flight time but also includes other duties

[18] The SAFE model, developed by Mick Spencer of the United Kingdom, has been validated in the aviation context.

directly related to flight. An FDP is duty consisting of training required by the certificate holder's approved flight training curriculum and qualification segment to be conducted in a simulator, flight training device and aircraft training,[19] as well as pre-flight deadheads[20] without an intervening rest, and all duties from the time the flightcrew member is required to report for duty to fly until the last movement of the aircraft. An FDP begins when a crewmember is required to report for duty that includes a flight, series of flights, or positioning flights (including part 91 ferry flights) and ends when the aircraft is parked after the last flight and there is no plan for further aircraft movement by the same crewmember.

Under the UK's CAP-371 an FDP is limited to no more than 13 hours under a minimum crew pairing, but may be increased through augmentation or split duty rest, and is reduced based on flying in the WOCL or flying multiple legs. The minimum FDP is 9 hours, unless flying multiple night-time operations, when FDP is reduced to 8 hours. A pilot in command may extend the FDP up to 3 hours due to unforeseen circumstances. Any duty immediately preceding flight check-in is also considered FDP, as is simulator training conducted during the same duty period if prior to flying, regardless of whether there is a break.

Under EU-OPS subpart Q, the maximum FDP is 13 hours, reduced at 30-minute increments per segment after the second segment down to a 2-hour reduction. One hour extensions are permitted, except when an FDP has more than six segments, when no

[19] Training conducted in accordance with the certificate holder's approved ground training program would be considered duty outside of an FDP.
[20] *Deadhead transportation* means transportation of a crewmember as a passenger, by air or surface transportation, as required by a certificate holder, excluding transportation to or from a suitable accommodation.

extension is permitted. There is a more complicated formula that applies when encroaching on the WOCL. There are no more than two extensions during any 7-day period. Schedule robustness is addressed by requiring that actual operations not exceed FDP more than 33 percent of the time (i.e., actual flights are within the FDP limits at least 67 percent of a scheduling season). A 2-hour extension is permitted at the discretion of the entire crew for unforeseen circumstances.

The pending EASA proposal on flight duty and rest would adopt the same FDP concept as CAP-371 and EU-OPS subpart Q. Like those standards, the maximum FDP is 13 hours unless a mitigation strategy such as augmentation is adopted, and the FDP is reduced based on time of day and number of legs flown. Unlike the CAP-371, and similar to EU-OPS subpart Q, the EASA proposal contemplates that schedules that do not regularly meet the maximum-allowable FDP will be changed. The CAP-371 merely requires a pilot in command to report when the FDP is exceeded.

The ARC members generally agreed with the approach adopted in CAP-371 and by EASA; although they could not agree on how conservative maximum FDPs should be. Tables A(1) and A(2) depict the two ranges of FDP discussed by the ARC, with Table A(1) generally representing the labor position, and A(2) generally representing the carriers' position. Both tables reduce the amount of FDP during the nighttime hours to address flying during one's WOCL, and both reduce the amount of FDP once a flightcrew member has flown more than four legs. Flightcrew members would enter the table based on the time at their home base (i.e., the city where they regularly fly from) unless they have acclimated to a different time zone, at which point they would enter the table based on local time. In addition, the FDP would be reduced by 30 minutes for

unacclimated flightcrew members. Extensions no greater than 2 hours (possibly as many as 3 hours internationally or for augmented flights) beyond a scheduled FDP would be allowed for circumstances beyond a carrier's control. The decision to extend would rest on both the carrier and the pilot in command, although specific coordination might not be required in every instance. In addition, there would be limits on the number of times a crew pairing could be extended in any 168-hour period, with discussion of whether that limit should be once or twice, but general agreement that it should not be allowed on consecutive days. A flightcrew member could not continue an FDP beyond the extension except under emergency circumstances.

Table A(1)—Flight Duty Period: Un-augmented Operations

Time of Start (Home Base or Acclimated)	Maximum Flight Duty Period (hours) for Lineholders Based on Number of Flight Segments						
	1	2	3	4	5	6	7+
0000-0359	9	9	9	9.	9	9	9
0400-0459	10	10	9	9	9	9	9
0500-0559	11	11	11	11	10	9.5	9
0600-0659	12	12	12	12	11.5	11	10.5
0700-1259	13	13	13	13	12.5	12	11
1300-1659	12	12	12	12	11.5	11	10.5
1700-2159	11	11	10	10	9.5	9	9
2200-2259	10.5	10.5	9.5	9.5	9	9	9
2300-2359	9.5	9.5	9	9	9	9	9

Table A(2)—Flight Duty Period: Un-augmented Operations

Time of Start (Home Base)	Maximum Flight Duty Period (hours) for Lineholders Based on Number of Flight Segments						
	1	2	3	4	5	6	7+
0000-0159	9	9	9	9	9	9	9
0200-0459	10	10	10	10	9	9	9
0500-0659	12	12	12	12	11.5	11	10.5
0700-1259	13	13	13	13	12.5	12	11.5
1300-1659	12	12	12	12	11.5	11	10.5
1700-2159	11	11	11	11	9	9	9
2200-2259	10.5	10.5	10.5	10.5	9	9	9
2300-2359	9.5	9.5	9.5	9.5	9	9	9

In order to assure that the extensions are not abused and that carriers are creating schedules contemplating circumstances that may be beyond their control, but that are reasonably foreseeable (e.g., seasonal weather trends, planned runway construction, chronically-delayed airports or markets), a carrier would provide the FAA with scheduled FDPs for all its crew pairings and the actual FDPs, including any extensions, on a regular basis. Some argued this cycle should be as little as once a month, while others argued a quarterly reporting cycle was sufficient. Should the carriers' actual FDPs fail to meet the scheduled FDP too many times during the reporting cycle, they would be required to change the scheduled FDPs to more realistic levels. The ARC agreed that 95 percent of a carrier's schedules would need to fall within the maximum FDP depicted in Table A(1) or A(2). In order to identify specific crew pairings that were problematic, each crew pairing would need to fall within the limits in the tables for a lesser percentage of the time, somewhere between 70 percent and 85 percent.

The FAA has decided to propose the more conservative FDPs depicted in Table A(1), with a 2-hour extension for unforeseeable circumstances beyond the carrier's

control permitted once in a 168-hour period.[21] Since the entire flightcrew is impacted by the extension, only one flightcrew member needs to have utilized the extension in the previous 168-hours for it to no longer be available.

If the extension is less than 30 minutes, the FAA anticipates permitting multiple extensions during the 168-hour period. The FAA has tentatively determined that short incursions into the permissible extension are unlikely to be fatiguing given the other requirements of today's proposal and that limiting a flightcrew member to a single weekly extension that could be as small as five or ten minutes is unreasonable. However, the extensions are intended to address unforeseeable circumstances beyond the carrier's control. Such circumstances should be of sufficiently short duration that the carrier could not reasonably make schedule adjustments. Thus, while the FAA contemplates that adverse weather could fit within the criteria because it is beyond the control of the certificate holder, it would not always be considered unforeseeable. Carriers should anticipate thunderstorms in many parts of the United States during the summer months. Likewise, heavy snow in the northern parts of the country should be anticipated during the winter, and the jet stream follows basic seasonal patterns. By the same token, carriers are not responsible for air traffic delays; however, if they are operating out of chronically delayed airports, air traffic delays are clearly foreseeable. To the extent even small extensions are regularly occurring, the schedule reliability requirements discussed by the ARC should require schedule adjustments, even when encroachments beyond the times in the FDP table are very small.

The FAA recognizes that adopting the numbers in Table A(1) is a conservative approach. The FAA has decided to propose the more conservative numbers because it

[21] A 3-hour extension would be allowed for augmented operations.

has little experience with this type of regulatory regime. However, the numbers contemplated under both tables are very similar, and the FAA is open to arguments that a more expansive FDP is merited. The agency also recognizes that upon completion of an FDP, a flightcrew member could be assigned other duties as long as he or she is provided with a required rest opportunity prior to commencing his or her next FDP. The underlying premise of today's proposal is to ensure flightcrew members are adequately rested during the time they are responsible for the operation of aircraft. To the extent other duties are not directly related to the safe operation of flight, the FAA believes there is no need to reduce the current implied daily duty limit of 16 hours in un-augmented operations, as long as those duties do not introduce the potential for fatigue during flight.

The reduction in maximum FDP during nighttime hours is broadly supported by existing sleep science. Although not addressed by sleep studies, the FAA has also tentatively decided to reduce the amount of available FDP depending on the number of legs flown (flight segments) because of a general agreement among the ARC members and FAA staff previously employed as pilots by commercial air carriers that multiple take-offs and landings are more fatiguing. Much of the available science is based on laboratory studies, with exceptionally limited validation in the aviation context; accordingly, the FAA has tentatively decided to rely on the experience of these individuals rather than assuming no adverse impact on safety. The FAA is not proposing to make any adjustments for the first four flight segments based on this same experience. The linear reduction contemplated in the EASA regulations (which is used for multiple purposes) appears to have more to do with regulatory simplicity than with any actual experience or science.

As recommended by the ARC, a flightcrew member would enter the FDP table based on home base time, unless acclimated to a different time zone. Thus, if a flightcrew member ordinarily flies out of Chicago, the flightcrew member would enter an FDP as though he or she were in Chicago, regardless of where he or she is physically located.[22] A 10:00 a.m. crew pairing out of Heathrow would be treated as if it commenced at 4:00 a.m., because of the 6-hour time difference between Chicago and London. If the operation requires the flightcrew member to cross more than four time zones, he or she would be considered unacclimated, and there would be a 30-minute reduction in the maximum FDP.

The FAA has also decided to propose the reporting requirements discussed by the ARC to assure realistic scheduling. The agency has tentatively decided that reports be filed with the FAA every two months. The ARC discussed a range of one to three months. The FAA believes a monthly reporting requirement could be excessively burdensome to both the certificate holders and the FAA. By the same token, if the reporting interval is too long, carriers may avoid addressing common delay scenarios, simply waiting them out.

Under today's proposal, carriers must first demonstrate that 100 percent of the scheduled crew pairings fall within the limits in the FDP table. Actual system-wide FDPs should not exceed the maximum levels in the FDP table more than five percent of the time. Each crew pairing would need to fall within the FDP table 80 percent of the time. The agency believes a 20 percent variation for a specific crew pairing provides

[22] Some carriers have moved to virtual home bases, or have no home base. This is most common among supplemental operators. In those instances, the proposal contemplates that the carrier would name a home base somewhere within the continental United States, and that home base would be considered the flightcrew member's home base.

carriers with sufficient flexibility to address multiple yet small excursions beyond the FDP table, while still forcing the carriers to recognize when a particular crew pairing is problematic. Because no flightcrew member may exceed the limits in the FDP table beyond 30 minutes more than once in any 168-hour period, the FAA does not believe a 20 percent variation will result in any immediate adverse safety situation.

Should any of the three proposed reporting requirements be exceeded, a carrier would be required to readjust the problematic crew pairings to more realistic schedules. These adjustments, which could be seasonal in nature, would be on-going and would apply to subsequent years. To the extent a carrier could immediately implement measures to improve schedule fidelity, it should do so. However, the ability of carriers to immediately address the scheduling issue is difficult to evaluate without understanding the impact of published schedules on resolving the problem. The FAA has notionally proposed that changes be made within 60 days, but it is interested in better understanding the impact of such a requirement on carriers' schedules.

Below, and throughout this document, we invite commenters to address specific questions, along with any other matters they consider relevant. We are particularly interested in receiving recommendations that would provide the same or better protection against the problems of fatigue at lower cost. We may incorporate any such recommendation in a Final Rule in this proceeding.

With that in mind, the FAA seeks comment on the following:

1) Please comment on adopting maximum FDPs. Should the maximum FDP vary based on time of day? Should it vary based on the number of scheduled flight

segments? Should the proposed limits be modified up or down, and to what degree? Please provide supporting data.

2) Please comment on permitting flightcrew members and carriers to operate beyond a scheduled FDP. Is the proposed 2-hour extension appropriate? Is the restriction on a single occurrence beyond 30 minutes in a 168-hour period appropriate? Should a flightcrew member be restricted to a single occurrence regardless of the length of the extension? Please provide supporting data.
3) Please comment on the proposed schedule reliability reporting requirements. Should carriers be required to report on crew pairings that exceed the scheduled FDP, but not the maximum FDP listed in the FDP table?
4) Should carriers be required to report on more parameters, such as cumulative duty hours or daily flight time? If so, why?
5) What should be the interval between reporting requirements?
6) How long after discovering a problematic crew pairing should the carrier be afforded to correct the scheduling problem?

E. Acclimating to a new time zone.

Unlike other forms of transportation, where an individual moves gradually through multiple time zones over the course of the day, the nature of aviation allows an individual to traverse several time zones over a relatively short period of time. This phenomenon exposes flightcrew members to a greater sense of disorientation or jet lag than employees in other forms of transportation. For trips with short turn around times, a flightcrew member likely would not acclimate, and would simply enter the FDP table

based on his or her home base time. However, flightcrew members remaining in a new theater for longer periods of time may need to acclimate to the new theater.

During the question and answer session with ARC members, the sleep specialists explained how an individual acclimates to time zones when flying long range operations. They stated that having sleep opportunities during a physiological night is the most important fatigue mitigation strategy for global travel. They also noted that an individual attempting to acclimate to a new time zone will adjust his or her clock approximately 1 hour per day for each hour of time zone difference. The ARC members noted that based on their collective personal experience, one could acclimate much more quickly if one managed his or her sleep opportunity appropriately. The sleep specialists also noted that even if an individual consciously decided not to acclimate to a new time zone, given enough time, the individual would begin to acclimate anyway because of the differences in exposure to daylight.

The ARC discussed various approaches to determine whether a flightcrew member is acclimated before accepting an assignment for an FDP. The ARC originally defined the un-acclimated condition as flying across five or more time zones.[23] Moving beyond these constraints would qualify as moving into a new theater of operations. The ARC members agreed that the continental United States should constitute a single theater so that a flightcrew member would always be acclimated when flying domestically.

The ARC concluded that to reset from an un-acclimated condition to an acclimated condition a flightcrew member would require either three consecutive

[23] In some areas of the world, time zones change in one half hour increments rather than one hour increments. Accordingly, one would have to experience a time change of at least four hours as well as five time zones.

physiological night's rest,[24] during which period the flightcrew member could fly, or a 30 to 36 hour layover rest period. Some ARC members noted that a flightcrew member could be on duty during the period encompassing 3 local nights, but not during local nighttime hours.

As noted previously, sleep science has not been validated in the aviation context. The members of the ARC universally rejected the premise that it would take between six and 9 days to acclimate to a European time zone. The FAA is inclined to agree with the ARC members' experience, especially given the limited scientific information specific to aviation. The FAA also recognizes that assuring that length of time to acclimate to a new theater is impractical in the aviation context.

The FAA proposes to permit a carrier to adjust where the flightcrew member enters the FDP as an acclimated crew member if the individual has been in a new theater of operations for 72 hours or has been given at least 36 consecutive hours free from duty. Remaining in the same theater for 72 hours allows for three physiological night's rest. A 36 consecutive hour break in duty does not allow for the same amount of rest, but allows the individual to structure the available rest opportunity in a manner that best suits his or her personal sleep patterns. The FAA is not proposing to stipulate that an unacclimated flightcrew member will only become acclimated when continuing to fly within a new theater as long as that flightcrew member does not fly at night. This strikes the agency as an unnecessary constraint.

While the continental United States is considered a single theater, operations from one part of the United States could trigger the need to acclimate sooner than operations

[24] *Physiological night's rest* means the rest occurs between the hours of 0100 and 0700 local time. This definition assures an opportunity to sleep during the WOCL.

from another part of the United States. Thus, a flight from New York to Hawaii could trigger a need to acclimate in Hawaii, while a flight from Los Angeles to Hawaii would not.

The ARC discussed the amount of rest needed for flightcrew members returning to their home base after becoming acclimated in another theater. The ARC members noted that the flightcrew member is not truly acclimated to the new theater but also is no longer acclimated to his or her home base. Ultimately, the ARC members agreed that a flightcrew member must always find at least 30 to 36 continuous hours free of duty in any 168 consecutive hours and that once a flightcrew member is given this rest, the flightcrew member is considered acclimated to local time. Based on this discussion, the FAA has decided against imposing any unique restrictions on a flightcrew member simply because he or she has returned to his or her home base. Acclimation to a home base is treated the same as any other acclimation to a new theater.

However, the FAA is proposing to require a greater rest opportunity when a flightcrew member has been away from his or her home base for more than 168 hours. In this instance, the FAA proposes to require a rest period that includes 3 physiological nights, rather than 36 hours free from duty or permitting the flightcrew member to fly during that approximately 72-hour period. This decision is based on the ARC members' consideration of the amount of rest being dependent on how long the flightcrew member was away from home base. The ARC reviewed the current regulation, which requires a flightcrew member who exceeds 12 flight hours to receive twice the amount of rest upon return to home base.

The ARC members also discussed the impact of multiple consecutive round-trip flights where flightcrew members would fly consecutive flights to an international destination, lay over for a day, and then return to the home base (e.g., Houston, Texas, to Paris, France, and return to Houston).[25] These types of pairings are common, with a flightcrew member potentially flying three roundtrips in a week. The concern was that these types of flights will typically have layovers from 20 to 28 hours. The length of the layovers is primarily based on scheduling concerns.

The length of the layover does not initially appear problematic, particularly in light of the current regulations which only require one 24-hour break in duty in a 7-day period. However, when the flights are particularly long, a layover of approximately 24 hours becomes a problem because the flightcrew member is constantly flipping his or her internal clock. When one runs the scenario through the SAFTE/FAST model with a three-person augmented crew, the flightcrew member reaches high fatigue limits during the second round-trip flight and is dangerously fatigued during the third round-trip flight. However, when the flights are not particularly long flights, flightcrew members appear to have no problem flying three roundtrip flights, even with the 24-hour layovers.

The ARC developed a draft regulatory proposal to address operations so long that they almost trigger a fourth flightcrew member. Under that proposal, if the flight assignment is for a three pilot flight crew and the layover is between 20 and 28 consecutive hours and the two FDPs, separated by the layover rest, are greater than 22 to

[25] These pairings do not always involve a return to a home base, but could be a return to another city within the time zone for or adjacent to the flightcrew member's home base. They can also occur when the flightcrew member has adjusted to a new theater and an airport within that theater effectively becomes the home base.

24 hours, then the flight crew requires two physiological night's rest or one physiological night's rest with an 8-hour restriction on the next FDP.

Upon reflection, the FAA has decided that the ARC proposal is unduly complicated and only addresses a small number of potential operations. The agency has decided against proposing it. However, as part of the required training program proposed today, carriers should be educated on the risks associated with flipping a flightcrew member's internal clock, particularly when conducting operations that are on the cusp of requiring an additional flightcrew member.

The FAA requests comments on the following:

7) Is a 3-day adjustment to a new theater of operations sufficient for an individual to acclimate to the new theater?
8) Is a 36-hour break from duty sufficient for an individual to acclimate to a new theater?
9) Should flightcrew members be given a longer rest period when returning to home base than would otherwise be provided based on moving to a new theater?
10) Should the FAA have different requirements for flightcrew members who have been away from their home base for more than 168 hours? If so, why?
11) Should the FAA require additional rest opportunities for multiple pairings between two time zones that have approximately 24-hour layovers at each destination? What if the scheduled FDPs are well within the maxima in the applicable FDP table or augmentation table?

F. Daily flight time restrictions

Initial ARC discussion of FDPs assumed that, as is the case in CAP-371 and the EASA regulations, there would be no daily limit on flight time. Instead flight time would effectively be limited to approximately 2 hours less than the FDP because FDP assumes a flightcrew member will report for duty an hour and a half before flying and will spend approximately 30 minutes after completing all flying for the day completing paperwork. In that context, the maximum amount of time flying during the middle of the day could increase from the current 8 hours to as much as 11 hours, almost a 50 percent increase. The ARC noted that the FAA may decide that daily limits on flight time are still needed and proposed a variable flight time based on the hour of the day. Tables B(1) and B(2) represent potentially acceptable flight time limitations within FDPs. Table B(1) generally represents the position of the carriers, while Table B(2) generally represents the position of labor.[26]

Table B(1)—Maximum Flight Time Limits

Time of Start (Home Base)	Maximum Flight Time (hours)
0000-0159	**7**
0200-0459	**8**
0500-0659	**10**
0700-1259	**11**
1300-1659	**10**
1700-2159	**9**
2200-2259	**8.5**
2300-2359	**7.5**

[26] Some carriers argued that no limit should be placed on flight time and some labor representatives argued that the maximum limit should be variable, but should never exceed eight hours.

Table B(2)—Maximum Flight Time Limits

Time of Start (Home Base)	Maximum Flight Time (hours)
0000-0459	7
0500-0659	8
0700-1259	9
1300-1959	8
2000-2359	7

In addition, the CAA presented an alternate regulatory approach, whereby flight time limits for all-cargo operations would be more expansive and would differ dependent on whether the particular operation was a domestic operation or an international operation. The numbers proposed by the CAA are presented in Tables B(3) and B(4).

Table B(3) -- Maximum Flight Time Limits, Domestic All-Cargo

Time of Start (Home Base)	Maximum Flight Time (hours)1-4 sectors	Maximum Flight Time (hours)5+ sectors
0000-0459	8	7
0500-1459	11	9
1500-1659	10	8
1700-2359	8	7

Table B(4) -- Maximum Flight Time Limits, International All-Cargo

	Maximum Flight Time (2 pilot)	Maximum Flight Time (2 pilot, 1 engineer)
Flight time includes WOCL	**8**	**12**
Flight time does not include WOCL	**10**	**12**

The FAA has decided to propose a variation of the more conservative maximum daily flight time limits for un-augmented operations in Table B(2). The agency proposes to extend the number of hours reflected in Table B(2) by one hour. This approach melds the different approaches in Tables B(1) and B(2), allowing for slightly higher flight time limits during early morning and daytime hours than are currently allowed, but not permitting extensions that, at some hours, come close to a 50 percent increase over the current limits. Because current un-augmented operations are limited to 8 hours, the FAA's ability to evaluate the impact of significantly longer flight time limits on aviation safety is limited. Accordingly, the FAA believes it is appropriate to propose overall limits that are more conservative than those depicted in Tables B(1), B(3) and B(4).

The FAA recognizes that it has allowed up to 12 hours of flight time in circumstances that it has considered augmented operations, even though the third flightcrew member is not able to fly the plane. This has occurred in supplemental and flag operations when the flightcrew consists of two pilots and a flight engineer, and was more common when the fleet of aircraft requiring flight engineers was larger. Accordingly, this data set is much smaller than the set based on the 8-hour domestic limitation. Nevertheless, based on the safety history of these operations, it may be possible to demonstrate that longer flight time limits will not adversely affect safety,

particularly during daytime hours when the flightcrew had an opportunity to sleep through their WOCL the previous night.

The FAA also recognizes that daily flight time limits will have the greatest impact on crew pairings that consist of a single leg. This is because when flying multiple segments, more of the FDP will be spent on layovers. Thus, for a single segment pairing, almost all of the FDP will consist of flight time, while for a pairing with three or four legs, much of the FDP will not consist of flight time. As a carrier adds legs, the FDP becomes more of a constraint than the flight time limit.

The FAA has decided against proposing special rules for all-cargo operations because there are no physiological differences between pilots who fly cargo planes and pilots who fly passenger planes. As noted before, the FAA believes the distinctions between domestic and international operations are largely irrelevant. To the extent they are truly distinct (generally due to the length of the trip), those differences are better addressed through augmentation rather than simply by extending the allowable flight time. Augmentation is discussed in greater detail in the next section.

The FAA seeks comment on the following:

12) If the FAA adopts variable FDP limits, is there a continued need for daily flight time limits?

13) If the FAA retains daily flight time limits, should they be higher or lower than proposed? Please provide data supporting the answer.

14) Should modifications be made to the proposed flight time limits to recognize the relationship between realistic flight time limits and the number of flight segments in an FDP?

G. Mitigation strategies

1. Augmentation

Even with the variable FDP and flight time, there will continue to be a need to augment crews for longer flights. Ideally, augmentation should follow the same approach as FDP, i.e., circadian rhythms, acclimation to time changes, and multiple flight segments should be considered in determining how much augmentation is required. Further consideration should be given to the quality of the available rest facility.

Essentially, the current regulations require augmentation beyond 8 hours of scheduled flight time. Under the FAA's flag and supplemental rules, augmentation permits the following increases in flight time above the 8-hour limitation contemplated under the agency's domestic rules:[27]

- If there are three flightcrew members (one of whom may be an engineer), maximum flight time is extended to 12 hours. There is no requirement for a rest facility.
- If there are four pilots (or three pilots and two flight engineers), maximum flight time is extended to 16 hours. There must be an FAA-approved rest facility on board the aircraft (generally a bunk).

[27] Because the domestic rules do not allow for any extension of flight time, augmentation is not used domestically.

- There are no hard constraints on flight time that exceeds 16 hours. Instead, the FAA has addressed the carriers' fatigue mitigation practices on a case-by-case basis.

The FAA believes that its current approach to augmentation fails to consider several pertinent factors. It fails to adequately consider the qualifications of all of the flightcrew members, giving credit for individuals who are not qualified to operate the controls; it fails to consider the varying quality of sleep facilities below a 12-hour flight time limit; it fails to recognize that, provided an opportunity for sleep is provided, some domestic operations could benefit from augmentation; and, as is the case generally with the agency's flight and duty regulations, it fails to consider the impact of circadian rhythms.

The FAA proposes to amend the existing regulations by varying the levels of augmentation credit depending on the quality of the rest facility, except that no credit would be given for rest in coach seats. The level of extensions would also vary based on when the flight takes place to account for circadian rhythms and whether the flight crew is acclimated. Domestic augmentation would be permitted if a sufficient rest opportunity is provided. Finally, all flightcrew members would have to be type-rated as a second-in-command (SIC) or pilot-in-command (PIC) and throughout the flight at least one crewmember on the flightdeck would have to be type-rated as a PIC. The FAA would also continue to permit extensions in flight time based on the number of flightcrew members, with greater credit given for four-man flightcrews than for three-man crews.

The FAA believes this approach will provide carriers with a significant amount of flexibility. Should the carrier decide not to invest in superior rest facilities, it could opt to

provide a lesser quality rest facility and add additional, qualified flightcrew members to extend the augmentation period.

The FAA's proposal is largely based on the general recommendation of the ARC. In reaching its conclusions, the ARC members reviewed the scientific material regarding augmentation that was presented during its meetings. Following are key points made by the sleep specialists during their presentations.

- In-flight naps with augmented flightcrews are dramatically helpful in mitigating sleep debt.
- When extending the FDP with an augmented flightcrew, augmented flightcrew members are presented with an opportunity for in-flight sleep, however the flightcrew members must take advantage of this sleep opportunity because augmentation is of no value if the entire flightcrew is awake.
- The value of augmented flightcrew operations depends on the available sleep facility, with a quiet, flat bunk being the most desirable.
- In-flight sleep has restorative value, and the flatter one is able to lie, the more beneficial the sleep.[28]
- To divide in-flight duty and rest among the flightcrew appropriately, route guides for positioning of sleep should be developed for augmented flightcrews (i.e., not all crewmembers need to be provided for equal sleep opportunities; rather pilots responsible for more complicated duties such as take-offs and landings may need more of a sleep opportunity, and may need that opportunity at a more ideal time in the flight).

[28] Sitting up increases blood flow to the brain and causes emission of norephrenephrine, which is stimulative instead of relaxing.

In establishing the maximum scheduled FDP limitations for an augmented flightcrew, the ARC discussed the relative merits and safety of operations conducted with augmented flightcrews receiving in-flight rest, as compared to conventionally scheduled operations. The ARC noted that the type of rest facility needs to be addressed in the proposed rule and in advisory material.

The most comprehensive evaluation of available sleep facilities was conducted by the Dutch government in 2007 to provide science-based advice on the maximum permissible extension of the FDP related to the quality of the available onboard rest facility and the augmentation of the flightcrew with one or two pilots. Extension of Flying Duty Period by In-flight Relief, (July 29, 2007) (TNO Report). The TNO report benchmarked existing research in arriving at its recommended values. The TNO report evaluated the quality of existing sleep facilities to determine how much sleep a flightcrew member could reasonably expect to get. The evaluation ranged from coach seats (a class IV rest facility) to bunks that were isolated from the rest of the crew and passengers (a class I rest facility). Based on the quality of the facility, the TNO Report assigned different values that would allow for an extension of the FDP. Based on its research, TNO decided against giving any credit for class IV rest facilities.

The ARC noted that both the TNO Report and CAP-371, to varying degrees, assign value to in-flight rest opportunities that depend on the quality of the rest facility available on the aircraft. The ARC determined that there are approximately 20 different combinations of facilities among various certificate holders. The ARC members developed a rating system dependent on the ability to lie in a horizontal, flat position; control the amount of light and noise; and rest in a temperature-controlled environment;

as well as the flightcrew member's time off task. Depending on the amount of points assigned to these areas, the amount of credit for receiving rest in a type of seat could be calculated. The ARC members suggested a Type I, II, and III scheme, resulting in the following classes of sleep facilities:

- Class 1 rest facility: a bunk or other surface that allows for a flat sleeping position, is separated from both the flight deck and passenger cabin to provide isolation from noise and disturbance and provides controls for light and temperature.
- Class 2 rest facility: a seat in an aircraft cabin that allows for a flat or near flat sleeping position (around 80 degrees from the seat's vertical centerline),[29] is separated from passengers by a minimum of a curtain to provide darkness and some sound mitigation, and is reasonably free from disturbance by passengers and/or flightcrew members.
- Class 3 rest facility: a seat in an aircraft cabin or flight deck that reclines at least 40 degrees, provides leg and foot support, and is not located in the coach or economy section of a passenger aircraft.

Accordingly, the ARC revised the sleep credit for the class rest facility to more closely align the percentages with the TNO Report recommendations as follows:

- Class 1: 75 percent.
- Class 2: 56 percent.
- Class 3: 25 percent.

[29] This constraint would likely keep the rest facility out of the coach or economy section of the aircraft.

- No credit for coach seats.[30]

The ARC determined that augmentation should be required when either the maximum scheduled FDP or flight time hour limit depicted in Tables A and B of this document is insufficient for the planned operation. The ARC considered that longer flights crossing multiple time zones or overnight flights could be better indicators of the need to augment than flight times. For example, an 8-hour, 45-minute flight during the day could be safely operated by an un-augmented flightcrew, but a 7-hour, 30-minute overnight flight should perhaps be augmented. One ARC member proposed that any planned pairing with greater than 6.5 block hours where the FDP infringes on the normal sleep cycle require augmentation.

The ARC developed Table C, which combines the limits from the first (single flight segment) column of the proposed FDP table (Table A) with principles from the TNO Report.

Table C—Flight Duty Period: Acclimated Augmented Flightcrew

Time of Start (Home Base)	Maximum Flight Duty Period (hours and minutes) based on Rest Facility and Number of Pilots					
	Class 1 Rest Facility		Class 2 Rest Facility		Class 3 Rest Facility	
	3 Pilots	4 Pilots	3 Pilots	4 Pilots	3 Pilots	4 Pilots
0000-0559	13:50	16:05	12:55	14:20	11:45	12:15
0600-0659	15:10	17:40	14:10	15:40	12:55	13:25
0700-1259	16:30	19:20	15:25	17:05	14	14:30
1300-1659	15:10	17:40	14:10	15:40	12:50	13:20
1700-2359	13:50	16:05	12:55	14:20	11:45	12:15

[30] CAA would give partial credit for coach seats.

The ARC discussed placing an absolute cap of 16 or 18 hours (for a three- or four-man flightcrew, respectively) on the FDP, even though the TNO Report scheme results in a higher FDP. The ARC determined that higher FDPs could be achieved only by use of an FRMS. Under such a constraint, only augmented operations commencing between the hours of 7 a.m. and 1 p.m. would be constrained beyond Table C, and then only when the highest quality rest facility is provided. The ARC stated that its prescriptive approach could apply to most operations, but certificate holders engaged in ultra-long range operations could use an FRMS to develop an alternate means of fatigue mitigation tailored to their specific operations. The ARC members noted that some types of operations, such as air cargo operations, which operate under different demands and circumstances, might approach augmentation and fatigue differently than other types of operations.

The maximum scheduled FDP limitations for augmented flightcrew member operations with an unacclimated flightcrew are set forth in Table D.

Table D—Flight Duty Period: Unacclimated Augmented Flightcrew

Time of Start (Home Base)	Maximum Flight Duty Period (hours and minutes) based on Rest Facility and Number of Pilots					
	Class 1 Rest Facility		Class 2 Rest Facility		Class 3 Rest Facility	
	3 Pilot	4 Pilot	3 Pilot	4 Pilot	3 Pilot	4 Pilot
0000-0559	13:15	15:20	12:20	13:35	11:15	11:45
0600-0659	14:30	17	13:35	15	12:15	12:50
0700-1259	15:50	18:30	14:50	16:25	13:30	14
1300-1659	14:30	17	13:35	15	12:20	12:45
1700-2359	13:15	15:20	12:20	13:35	11:15	11:40

The ARC calculated the maximum scheduled FDPs in Table D for augmented flightcrew members who are not acclimated based on the same methodology provided for

acclimated flightcrew members in Table C above. However, for unacclimated flightcrew members there is a roughly 30-minute reduction in the planned maximum FDP for augmentation calculation. The absolute cap of 16 and 18 hours would correspondingly be reduced to 15.5 and 17.5 hours, respectively.

The FAA has decided to propose the augmentation levels proposed by the ARC in Table C, except that the numbers have been rounded up or down to the closest half hour for regulatory efficiency. As suggested by the ARC, acclimated operations are capped at 16 hours if only a three-man crew is available and 18 hours if a four-man crew is available. In addition, the FAA is not proposing to implement Table D into the regulatory text because it is essentially a thirty minute reduction from Table C. Rather, the regulatory text specifies that the numbers in Table C are reduced by 30 minutes if a crew is not acclimated. This approach is consistent with the one proposed for un-augmented operations.

The ARC noted that augmentation should be used strictly for long flights and not to extend the FDP for multiple short flight segments. The ARC discussed whether more than two flight segments should be permitted in augmented flight operations and, if so, should an FRMS be required to do so. Some members of the ARC cautioned that augmentation should not be permitted to facilitate unnecessary additional flight segments or eliminate crew swaps. These individuals argued that augmentation was initially permitted to address those flights that could not reasonably be conducted within the existing rules at that time because the distances involved prevented long layovers or crew swaps. This issue was particularly relevant to the discussion of whether augmentation should be used for domestic operations. The primary concern related to multi-segment

augmented flights was the available sleep opportunity for flightcrew members. Everyone acknowledged that flightcrew members are not going to sleep during take-off and landing. Accordingly, flight segments need to be sufficiently long to permit the flightcrew members to actually sleep. The ARC agreed that a flightcrew member assigned to a multi-segment trip needs a specific amount of available time to rest to fly the multiple segments.

The FAA agrees that short flight segments will not permit a flightcrew member to sleep. Thus, too many flight segments, even within an extended FDP, would not allow a meaningful sleep opportunity for the flightcrew. The FAA is proposing that a certificate holder not schedule an augmented crew pairing with more than three segments (including FDPs that include required technical stops such as stopping for fuel or to clear customs). In addition, two consecutive hours must be available for in-flight rest for the flightcrew member manipulating the controls during landing; a 90 minute consecutive period must be available for in-flight rest for each flightcrew member; and the last flight segment must provide a two consecutive hour rest period. The proposed requirement for the 2 hour rest opportunity on the last flight segment is designed to address a common recognition among the ARC members that, even on a flight with only two segments, the last segment is often of such duration that there is no realistic rest opportunity, even though this is when the crew is likely to be the most fatigued.

The ARC discussed the qualifications of the relief flightcrew member used in augmented operations. Some ARC members emphasized that there must be one type-rated flightcrew member on the flight deck at all times. One ARC member noted that current regulations require only one type-rated flightcrew member on the aircraft.

Another ARC member stated that under no circumstances should a flight engineer serve as a relief flightcrew member. The ARC proposed that at least one flightcrew member type-rated in the aircraft be on the flight deck at all times. The ARC largely deferred to the FAA in deciding whether to allow augmentation based on the presence of a flight engineer.

As mentioned earlier in this section, the FAA does not believe a flight engineer may serve as a relief flightcrew member unless he or she is qualified as a PIC or SIC and type rated. The purpose of a relief flightcrew member is to have someone available to help fly the airplane when another flightcrew member is at rest. In order for him or her to do this, the relief flightcrew member must know how to actually operate the aircraft.

The FAA seeks comment on the following:

15) Should augmentation be allowed for FDPs that consist of more than three flight segments? Does it matter if each segment provides an opportunity for some rest?
16) Should flight time be limited to 16 hours maximum within an FDP, regardless of the number of flightcrew members aboard the aircraft, unless a carrier has an approved FRMS?
17) Should some level of credit be given for in-flight rest in a coach seat? If so, what level of credit should be allowed? Please provide supporting data.
18) Is there any reason to prohibit augmentation on domestic flights assuming the flight meets the required in-flight rest periods proposed today?
19) Are the proposed required rest periods appropriate?
20) Should credit be allowed if a flightcrew member is not type-rated and qualified as a PIC or SIC?

2. Split duty rest

The concept of allowing mitigation for split duty sleep is similar to that for augmentation, in that a crewmember can regenerate to some extent because of the ability to sleep for a period of time during his or her FDP. In fact, the quality of the sleep facility may be significantly better than the quality of a sleep facility aboard an aircraft. However, the initial theory behind augmentation was that it was impossible to simply place a fresh crew aboard the aircraft. While that may be true in some instances where split duty rest is contemplated, it is not universally true. In any case, current regulations provide no incentive for a carrier to provide its flightcrew members with a rest opportunity outside of the mandatory rest requirements. Nevertheless, some carriers have spent considerable amounts of money developing rest facilities for their employees, and others provide hotel rooms, even though not required by the FAA. Carriers have taken these steps recognizing that, even though not required, providing the rest facilities increases the level of safety.

The ARC discussed the concept of split sleep with the sleep specialists to assess the value of the type of rest obtained on a split duty trip. The scientists noted that split sleep is an area of intensive work. All other factors being equal, if the total amount of actual sleep is the same, split sleep is theoretically as valuable as continuous sleep.[31] However, the presenters noted that the value of sleep is impacted by where it falls in the circadian cycle. They stated that split sleep with 4 hours sleep during a circadian night is better than 8 hours of continuous sleep during the day. However, the larger portion of split sleep ideally would fall during the WOCL, and they reiterated that split sleep with a

[31] However, they also noted that there is an overhead involved in getting to sleep, and that split sleep multiplies that overhead. Therefore, split sleep with 4 hours at night and 4 hours during the day would, over time, result in a cumulative sleep debt.

component at night is better than consolidated sleep during the day. This is because the ability to sleep effectively is diminished during daytime hours because it is very difficult to get continuous sleep during this time. They also stressed that actual sleep is important, and noted that a 4-hour sleep opportunity may only net 2 hours of actual sleep. [32]

The ARC discussed extending the FDP based on the opportunity for sleep during the duty period and the mitigations needed to extend the FDP. These mitigations would apply to split duty trip pairings (including continuous duty overnights, also known as CDOs), in which a flightcrew member has a downtime of several hours between flights within the same FDP.

Some members of the ARC rejected the concept of a regulatory credit for split duty sleep, while others noted that it is fully consistent with the concept of extending FDPs based on augmentation. The ARC considered allowing a certificate holder to extend the FDP up to 50 to 75 percent of time that a flightcrew member spent resting in a suitable accommodation up to a maximum FDP of 12 to 13 hours as long as certain conditions were met. First, the sleep facility should be a single occupancy, temperature-controlled facility with sound mitigations that provide a flightcrew member with the undisturbed ability to sleep in a bed and to control light. Second, the flightcrew member must be given an actual, not simply scheduled, sleep opportunity in the suitable accommodation. Some ARC members also suggested that there should be a requirement that the sleep facility be approved by the FAA, there be an employee feedback process to assure the facilities were adequate, and that the opportunity for rest coincide with the flightcrew member's circadian rhythms.

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[32] The presenters stated that it is less clear if a split sleep involving a 2-hour sleep segment and a 6-hour sleep segment is equivalent to eight hours of continuous sleep.

The FAA is proposing to permit credit for split duty sleep consistent with the proposal presented by those members of the ARC supporting credit. A reasonable sleep opportunity must actually be provided (as opposed to simply scheduled), and the sleep facility must be adequate to reasonably allow sleep. A carrier could extend an FDP by 50 percent of the actual available sleep opportunity if it provides at least 4 hours sleep opportunity. However, the FDP could not be extended beyond 12 hours.[33] The sleep opportunity is calculated from the time the flightcrew member actually reaches the sleep facility, rather than when it is scheduled. This is because a scheduled sleep opportunity may be reduced considerably if there are delays or an unanticipated need for further aircraft movement. As with all other instances when transportation to or from a rest facility is involved, the period of time engaged in transportation does not count as duty, but it also does not count as rest.

The rest facility must be adequate to reasonably permit the flightcrew member with an opportunity to rest. To that end, it must be quiet, temperature-controlled, and light-controlled. The FAA considered whether to require that it also be a single occupancy facility. The agency has tentatively decided against such a requirement because it understands that there are currently facilities where there may be more than one bed per room, and it believes this is fundamentally a labor-management issue. Flightcrew members regularly spend the night near their home base in houses or apartments where there may be multiple beds in a single room. If this dormitory-type

[33] As a practical matter, the 12-hour limitation on FDP makes split duty sleep desirable only for nighttime operations or operations that begin late at night and restart very early in the morning. The FAA believes it is unlikely a carrier would rely on split duty sleep opportunities in the middle of the day because there would be no additional credit.

housing is sufficient for full rest periods, it should, from a regulatory perspective, be sufficient for a split rest facility.

The FAA seeks input on the following:

21) Please comment on whether a single occupancy rest facility provides a better opportunity for sleep or a better quality of rest than a multiple occupancy facility such as a multi-bed crew sleeping facility or multi-bed living quarters. Please provide supporting data.

H. Consecutive nighttime Flight Duty Periods

There was a discussion among ARC members on whether there should be a limitation on the number of consecutive nights that a pilot could fly, based, in part, on a presentation to the ARC that performance falls off under the SAFTE/FAST model after the third night. Currently the FAA places no restrictions on the number of allowable consecutive nighttime operations, as long as the crewmember receives 24 consecutive hours free from duty in a 7-day period. CAP-371 provides a scheme whereby flight duty periods are reduced based on the number of previous consecutive nights flown. The FAA is unaware of the basis for this scheme, and it is not readily apparent from a reading of the requirement.

Modeling indicates that consecutive nights of nighttime work will lead to a decrease in productivity over a relatively short period of time (approximately 3 days). The modeling notes a steady deterioration in performance because it is very difficult for most people to sleep effectively during the day.[34] The members of the ARC who had

[34] A copy of the technical report evaluating the model has been placed in the docket. See also, Rosekind, M.R., Gander, P.H., Graeber, R.C., Connell, L.J., Gregory, K.B., Miller, D.L., & Barnes, R.M. (1998). Crew factors in flight operations: The initial ASA-Ames field studies on fatigue. Aviation, Space, and Environmental Medicine, 69 (2), B1-B60. Thomas, M.J.W., Petrilli, R.M., Roach, G.D. (2007). The

flown nighttime operations generally agreed that the first night of multiple nighttime operations was the most difficult because they were unaccustomed to being awake all night.

During the ARC discussion, the cargo contingent of the part 121 community asserted that if one changes the assumption in the SAFTE/FAST model and assumes that one can train oneself to sleep effectively during the day, it may be possible to work more consecutive nights without a significant degradation in performance. This may be particularly true if an individual is provided an opportunity to sleep during the night while packages are being sorted from one plane to the next. The cargo carriers asserted that higher levels of sleep pressure brought on by the longer period of wakefulness on day one of the pairing act to offset the general inability to sleep effectively during the day, particularly when people have been trained to understand the need to take advantage of the sleep pressure to improve their ability to sleep during the day. The FAA has asked Dr. Hursh, who developed the SAFTE/FAST model,[35] to input these assertions into the model. Dr. Hursh determined that, given a sufficient sleep opportunity at night, a person can sustain his or her performance at acceptable levels for five consecutive nights. However, the smaller the nighttime sleep opportunity, the lower level of performance, particularly by night five. In addition, training on how to maximize sleep opportunities is critical because an individual needs to get enough sleep during the day to make up for the

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Impacts of Australian Transcontinental "Back of Clock" operations on sleep and performance in commercial aviation flight crew (B2005/0121). Adelaide/Whyalla, Australia: University of South Australia, Centre for Applied Behavioural Science. Gander, P.H., Gregory, K.B., Connell, L.J., Miller, D.L., Graeber, R.C., & Rosekind, M.R. (1996). Crew factors in flight operations: VII. Psychophysiological responses to overnight cargo operations (NASA/TMm1996-110380). Moffett Field, CA: NASA Ames Research Center.

[35] This model is widely used, with approximately 14 major carriers and sixteen governmental agencies world-wide having used the model to evaluate fatigue in aviation and other industrial settings.

nighttime sleep deficit. A copy of Dr. Hursh's analysis has been placed in the docket for this rulemaking.

The FAA has decided to take a comprehensive approach towards consecutive nighttime operations that it believes addresses the concerns by both contingents within the ARC. The agency proposes to permit consecutive nighttime flying, constrained only by 30-hour consecutive rest required for any 168-hour period, as long as there is an opportunity to rest in a suitable facility during the flight duty period. As proposed, this sleep opportunity would have to comport with the proposed split duty requirements for extending a flight duty period. Should no such opportunity be provided, a carrier could not assign a flightcrew member to more than three consecutive nightime FDPs. While this approach is more restrictive than currently permitted, it permits cargo carriers who provide adequate rest facilities to continue their current operations. It also assures that flightcrew members are given an opportunity for limited nighttime rest.

The FAA has concerns that simply limiting nighttime operations to three consecutive nights could result in a significant increase in the number of first night operations, since presumably carriers will not change the nature of their operations, but simply will schedule more multiple-night crew pairings to accommodate the existing operations. Thus, a flightcrew member who is currently assigned two 5-night pairings in a 2-week period could potentially be assigned three 3-night pairings in the same 2-week period, increasing the risk associated with the first night of operations by 50 percent during that timeframe. Certainly long-standing industry practice has been to fly more than three consecutive nights. The FAA is concerned that taking an approach that may appear safer in modeling could lead to adverse safety impacts in the real world.

The ARC contingent advocating restrictions on consecutive night flight duty periods suggested a fourth night was acceptable as long as a 14-hour rest was provided between nights three and four. The FAA notes that a 14-hour rest opportunity would limit a flightcrew member to a maximum 10-hour duty period, excluding the time required for local commuting.[36] The FAA is not sure that this approach would provide a meaningful FDP for the fourth night.

The FAA requests input on the following:

22) Should there be any restriction on consecutive nighttime operations? If not, why?

23) If the nighttime sleep opportunity is less than that contemplated under the split duty provisions of this notice, should a carrier be allowed to assign crew pairing sets in excess of three consecutive nights? Why or why not?

24) If the nighttime sleep opportunity meets the split duty provisions of this notice, should the carrier be allowed to extend the flight duty period as well as the number of consecutive nighttime flight duty periods? Why or why not?

25) Should a fourth night of consecutive nighttime duty be permitted if the flightcrew member is provided a 14-hour rest period between nights three and four?

I. Reserve duty

While the term "Reserve" has been used for years in the air carrier industry, the term is not addressed at all in part 121. The agency has issued 11 legal interpretations on the subject of reserve, which range from examples of whether a crewmember is on duty and, if applicable, whether the required rest associated with that duty period is impeded by being in a reserve status.

[36] Although today's proposal does not contemplate a 24-hour day, the FAA assumes that consecutive nighttime operations would generally be scheduled at approximately the same time each day.

The ARC discussed various definitions of reserve and initially proposed that reserve means that a pilot that does not have a regular flying schedule and is available for flight when contacted by the company. That pilot has no telephone or reporting responsibility to the company. The ARC refined the definition of "reserve" to read "a flightcrew member that is required by a certificate holder to be available to receive an assignment for duty." In addition, the ARC established the following types of reserve duty: long-call, short-call, and airport/standby. The ARC noted that the policies that apply to reserve flightcrew members vary significantly between certificate holders, but also found that there are some relatively consistent conditions.

CAP-371 places restrictions on "Standby Duty", which is generally the equivalent of short-call reserve discussed below. When standby duty is undertaken at home, or in a suitable accommodation provided by the operator, during the period 2200 to 0800 hours local time and a crew member is given 2 hours or less notice of a report time, the allowable FDP starts at the report time for the designated reporting place. EASA recognizes "standby duty", but does not place any regulatory restrictions on this type of duty.

Reserve duty is inherently based on unpredictable events, such as covering trips for flightcrew members who become ill, have difficulty traveling to the airport for an assignment because of weather or other reasons, or are stranded due to severe weather creating flightcrew member shortages throughout a certificate holder's system. The very nature of reserve duty makes injecting predictability into a reserve flightcrew member's schedule a challenge.

The ARC set a goal to make reserve duty as predictable as possible, and to manage fatigue as much as possible. The proposal on how to address reserve limits was one of two areas of consensus by the ARC. The ARC concept includes defining limits associated with flight duty period, duty period and rest limitations.

One of the most fatiguing elements of reserve duty is the lack of predictability. Unlike a flightcrew member who has a set schedule (a line-holder), a flightcrew member on reserve may spend several hours on-call and then, once called, be expected to report to the airport ready to commence his or her duty day. The lack of predictability means the reserve crewmember cannot schedule naps or otherwise control his or her sleep opportunities to assure the reserve crewmember is adequately rested when he or she reports to work.

The ARC asked the sleep specialists what impact this lack of predictability has on a reserve flightcrew member compared to a line-holding flightcrew member. The presenters responded that depending on when a reserve flightcrew member is called and how much notice is given, he or she may not have the same opportunity to nap that a line-holder would have, because the line-holder would know about the trip and could plan his or her rest accordingly. A reserve flightcrew member also might not nap, even if he or she thought a call was unlikely, because this uncertainty may disrupt his or her sleep schedule. The ARC asked the scientists how a reserve flightcrew member could best prepare for a potential assignment, without knowing when he or she may be called. They recommended a normal night's sleep through the WOCL and a late afternoon nap in the minor WOCL. The ARC also asked the presenters if there was a maximum duty time that should be set for reserve duty. The scientific presenters noted that the ability to

successfully manage time-on-duty is dependent on rest. If 8 hours sleep in the WOCL is available, then 16 hours of duty is theoretically possible.

Short-Call and Airport/Hotel Standby Reserve

Airport/standby reserve[37] is known by several terms among various certificate holders, but ultimately involves a flightcrew member on call at an accommodation or other facility at or near an airport. The flightcrew member is not at home and is not resting. The purpose of such reserve duty is to have an available flightcrew member close to the operation in case of a schedule irregularity. Flightcrew members on these assignments can receive notice to report to work in as little as 1 hour before departure time, requiring them to be in a constant state of readiness. Because of the unique nature of these assignments, and the fact that the flightcrew member is not resting, an airport/standby reserve assignment is considered to be an FDP, regardless of whether a flying assignment is ultimately received by the flightcrew member.

Short-call Reserve

A short-call reserve flightcrew member typically receives an assignment on relatively short notice, meaning he or she would not be provided an adequate time for a legal rest period before reporting for duty. Report times are typically within two to 3 hours from notification. Short-call reserve differs from airport/standby reserve in that the flightcrew member is likely to be at home and available for contact by the certificate holder, rather than at the airport or a hotel actively awaiting an assignment. Although the flightcrew member may be at home, the opportunity for sleep before reporting for duty

[37] The word “airport” was added to standby to differentiate between the ICAO term “standby,” which is the equivalent of “reserve” in U.S. terminology

cannot be guaranteed. Therefore, the ARC deemed a limit on the amount of time spent on short-call reserve duty as necessary.

The ARC noted that a number of variables may impact the maximum FDP for a short call reserve.[38] These variables include:

- Timing of on-call period within a circadian day. Where an on-call period starts in relation to standard circadian rhythms can affect alertness and state of rest. Generally, short call availability periods may be classified as very early morning, daytime, or night. The ARC considered that daytime reserve flightcrew members can be presumed to be well-rested and alert at the start of their reserve period because they can get a regular night's sleep. For the other classifications, circadian factors may make flightcrew members less alert and rested than those on daytime reserve. One ARC member suggested that flightcrew members called to report during overnight hours should have a reduced maximum FDP.
- Length of on-call period. Not all carriers have the same reserve policies. Some certificate holders have relatively short on-call periods, lasting only a few hours, while other certificate holders may require flightcrew members to be on call for 12 hours or more.
- Timing of call and report time in relation to on-call period and length of duty day. One ARC member noted that during an on-call period, the time the flightcrew member is called and the time the flightcrew member is expected to report may affect the flightcrew member's alertness and rested state (e.g., called at 5 a.m. to report at 3 p.m. vs. called at 10 a.m. to report at noon).

[38] These same variables apply to airport/standby reserve but are addressed there by the maximum FDPs in the FDP table.

- Recent on-call history. The ARC noted that reserve flightcrew members with on-call schedules often change schedules from day to night, or vice-versa, within a short period of time. Such changes, especially if given with short notice, can result in reserve flightcrew members failing to obtain proper rest before their on-call periods.

Long-call Reserve

Long call reserve[39] pilots are given relatively substantial advance notice of when they are to fly. This notice may be from 9 hours to over 24 hours. A long-call reserve flightcrew member typically receives an assignment for duty well in advance and will have a sleep opportunity before reporting for duty, and may have enough notice of the assignment to plan his or her rest accordingly. The ARC recognized, however, that depending on the timing of notice and the report time in relation to circadian rhythms, reserve flightcrew members may not be able to obtain a full 8 hours of sleep, despite the opportunity to do so. The lack of predictability of when the flightcrew member will be required to report for duty makes it difficult for the reserve flightcrew member to plan ahead in his or her sleep rest cycles.

The ARC considered two reserve systems developed by working groups consisting of ARC members representing industry and labor groups.

One working group proposed a WOCL Aware Reserve System to the ARC. Some key points of the system are as follows:

- Any reserve flightcrew member called between 2200 and 0600 will receive a minimum of 10 hours of rest before reporting for duty.

[39] The ARC defined a long-call reserve as "a reserve flightcrew member whose obligation to report for an FDP following notification contains a legal rest period before report time."

- Any reserve flightcrew member called to fly into the WOCL would have to be contacted within the first 6 hours of his or her reserve duty.
- If normal sleep time is not interrupted and a reserve flightcrew member is not being called to fly into the WOCL, he or she would have the same FDP limit as a line-holder because they received similar rest.
- Airport/standby reserve is to be treated like a trip assignment and is considered as an FDP. No part of airport/standby reserve may be considered rest, even if the flightcrew member is at a hotel.

The proposal for a Predictable Reserve System with Circadian Stability (Predictable System) is based on three prongs: science, circadian stability, and adequate rest. The proposal incorporates provisions from CAP 371, and provides some recommendations from a reserve rest ARC that convened in 1999. The second proposal contained the following elements:

Reserve Limits

- Created several definitions applicable to reserve including "reserve availability period" (RAP), "reserve duty period" (RDP), "short call reserve", and "long call reserve."
- Maximum RDP is 16 hours.
- Maximum reserve availability period (RAP) for short call reserve is 14 hours.
- Carrier receives half credit for not calling a reserve crew member on phone availability between 0000 and 0600; maximum 3 hours.

Shifting RAP

- Later – 12 hour maximum in any 168 consecutive hours.

- Earlier – 3 hour maximum into the WOCL; 5 hour maximum otherwise.
- Not allowed on consecutive days.

Concerns were expressed regarding individuals on phone availability being called during the window of circadian low. However, it was noted that based on scientific modeling, for a reserve called during the window of circadian low, a 4-hour lookback (the period in which the carrier must contact the reserve from the start of the RAP to use the entire available FDP) actually would be better than the 6-hour lookback originally proposed under the WOCL Aware proposal.

A scenario was also posed of a pilot with a RAP starting during the window of circadian low, but not called until after the window of circadian low had passed. It was proposed that some credit be given for the sleep obtained before being called. After brief discussion, the ARC decided to move forward with a maximum FDP limit of 16 hours after the start of the RAP.

After considering the above proposals and other discussions, the ARC proposed the following requirements for reserve duty:

- "Scheduled" is defined as times assigned by a certificate holder when a flightcrew member is required to report for duty. "Assigned" is defined as scheduling by a certificate holder when a flightcrew member is required to report to duty.[40]
- Airport/standby reserve counts as part of the flightcrew member's FDP.
- RAP and RDP only apply to short call reserve.

[40] The ARC notes that "assigned" and "scheduled" are one in the same; therefore, when a certificate holder assigns a reserve flightcrew member a trip, that certificate holder has given that flightcrew member a schedule. This prevents a certificate holder from assigning a trip to a flightcrew member and stating that the term assigned does not fall under the definition of scheduled. It also prevents certificate holders from only assigning trips and not scheduling any trips.

- The maximum RDP for un-augmented operations is the flightcrew member's possible FDP under the FDP table plus 4 hours, or 16 hours, whichever is less.
- The maximum RDP for an augmented flight crew is the flightcrew member's possible FDP under the augmented FDP table plus 4 hours.
- A carrier receives half credit for not calling a reserve crew member on phone availability between midnight and 6 a.m. up to a maximum of 3 hours (e.g., if the crew member is on reserve starting at 1 a.m., but isn't called until 3 a.m., the RAP is extended by 1.5 hours).
- A short-call reserve duty period in which the crewmember is not called to report to work may not exceed 14 hours.
- Conversion from long-call to short-call reserve assignment must be preceded by a legal rest period.
- A long-call reserve flightcrew member must receive a legal rest prior to reporting for duty and at least 12 hours notice of an assignment of a trip pairing that will extend into the window of circadian low.
- A reserve flightcrew member's RAP may be shifted under the following conditions:
  - A shift to a later RAP may not exceed 12 hours.
  - A shift to an earlier RAP may not exceed 5 hours, or if the shift will move the availability into the flightcrew member's window of circadian low, it may not exceed 3 hours.
  - A shift to an earlier RAP may not occur on consecutive days.

- The total amount of shift in RAPs for a flightcrew member may not exceed 12 hours (regardless of direction) in any 168 consecutive hour period.

Tables E(1) and E(2) are visual depictions of the maximum RAP discussed above based on the two FDP tables contemplated by the ARC.

Table E(1) —Flight Duty Period Reserve: Two Flightcrew members, Option 1

Time of Start (Home Base)	Maximum Flight Duty Period Reserve (hours) based on number of flight segments						
	1	2	3	4	5	6	7+
0000-0359	13	13	13	13	13	13	13
0400-0459	14	14	13	13	13	13	13
0500-0559	15	15	15	15	14	13.5	13
0600-0659	16	16	16	16	15	15	14.5
0700-1259	16	16	16	16	16	16	15
1300-1659	16	16	16	16	15.5	15	14.5
1700-2159	15	15	14	14	13.5	13	13
2200-2259	14.5	14.5	13.5	13.5	13	13	13
2300-2359	13.5	13.5	13	13	13	13	13

Table E(2) —Flight Duty Period Reserve: Two Flightcrew members, Option 2

Time of Start (Home Base)	Maximum Flight Duty Period Reserve (hours) based on number of flight segments						
	1	2	3	4	5	6	7+
0000-0159	13	13	13	13	13	13	13
0200-0459	14	14	14	14	13	13	13
0500-0659	16	16	16	16	15.5	15	14.5
0700-1259	16	16	16	16	16	16	15.5
1300-1659	16	16	16	16	15.5	15	14.5
1700-2159	15	15	15	15	13	13	13
2200-2259	14.5	14.5	14.5	14.5	13	13	13
2300-2359	13.5	13.5	13.5	13.5	13	13	13

Because this was one of only two ARC consensus areas, the FAA has decided to propose the ARC recommendation with only a few changes.

First, the agency has decided against adding Table E to the regulatory text. The agency believes the regulatory text is sufficiently clear. Also, the table does not include the credit that could be given for not calling during the reserve crew member's window of circadian low and could be misleading. Carriers (and the pilot associations) are of course free to draft whatever tables they think are helpful to understand the regulatory requirements.

Second, the ARC did not consider time within the RAP to be duty. However, the FAA believes that it may be appropriate to designate time spent in a short-call reserve status as duty.[41] While in a short-call reserve status, the crewmember can expect that he or she will not receive an opportunity to rest prior to commencing a flight duty period. The crewmember also is required to limit his or her actions sufficiently so that he or she can report to his or her duty station within a fairly short timeframe. Accordingly, the FAA believes this time needs to be accounted for within the cumulative duty limits discussed later in this document.

While the FAA is proposing the ARC recommendation on reserve, it also notes some concern with the level of its complexity. The agency is particularly concerned that the partial credit given for not calling during the window of circadian low will be difficult to implement. It may make more sense to simply assign a credit for not calling during the window of circadian low. The agency also has some concern that the RDP for augmented operations could extend to 22 hours. While there would be some opportunity

[41] This issue was not discussed by the ARC and there appears to be a general agreement in the aviation community that reserve is neither rest nor duty. The FAA agrees this approach is appropriate for long-call reserve and acknowledges that calling short-call reserve "duty" could have adverse implications if there were a daily duty limit. However, the FAA also believes that some portions of industry have developed reserve policies that increase the likelihood of fatigue because the reserve crewmember can spend long periods of time on reserve with no anticipation of a rest opportunity prior to reporting to work.

to rest on board the aircraft, this proposal would permit some reduction in the overall rest opportunity.

The FAA seeks comment on the following:

26) Please comment on whether a 16 maximum hour FDP for long call reserve is appropriate when the maximum FDP for a lineholding flightcrew member is 13 hours.

27) Please comment on whether the proposed maximum extended FDP of 22 hours for an augmented flightcrew member is appropriate. If not, please provide an alternative maximum FDP.

28) Please comment on whether a certificate holder should receive credit for not calling a flightcrew member during the WOCL while on reserve.

29) Should minimum required rest while on reserve status be greater than the amount of rest required for a lineholding flightcrew member? If so, please provide supporting data, if not, please provide rationale.

30) Please comment on the level of complexity on the proposed reserve system.

J. Cumulative duty periods

The FAA's current regulations do not impose a cumulative restriction on duty, although as a practical matter, a flightcrew member engaged in domestic operations is effectively limited to a 16-hour duty day and all flightcrew members are entitled to 24 consecutive hours free from duty during a 7-day period. Rather, the FAA has historically placed limitations on the number of flight hours a flightcrew member may be assigned on a daily, weekly, monthly, and annual basis. Depending on whether one is operating

under domestic, flag or supplemental rules, flight time is limited to 30-32 hours a week, 100-120 hours a month, 300-350 hours a quarter, and 1,000 hours a year.

CAP-371 and EU-OPS subpart Q impose more restrictions on cumulative duty, with weekly limits ranging from 55 to 60 hours, biweekly limits of 95 hours (CAP-371 only), and slightly less than monthly limits of 190 hours (calculated against 28 days rather than an actual month). The ICAO SARP recommend that member states restrict duty hours within any seven consecutive days or a week and 28 consecutive days or a calendar month.

Scientific studies suggest that long periods of time on duty infringe upon an individual's opportunity to sleep, thus causing a "sleep debt" which is also known as cumulative fatigue.[42] Some conclusions are based on experiments in sleep labs, and there is limited data either supporting or refuting that the amount of cumulative duty has a direct effect on cumulative fatigue.

Despite the lack of validated data, the FAA believes it is appropriate to take a conservative approach and is proposing to impose cumulative limitations on duty, flight duty periods, and flight time. Not only are cumulative limits consistent with current regulations here and abroad, but they offer protections against practices common in the aviation industry, where pilots commonly work more than an 8-hour day, often at varying

[42] Krueger, G.P. (1989). Sustained work, fatigue, sleep loss and performance: a review of the issues. Work & Stress. 3, (2), 129-141. Galy, E., Melan, C., & Cariou, M. (2008). Investigation of task performance variations according to task requirements and alertness across the 24-h day in shift workers. Ergonomics, 51 (9), 1338-1351. Rosekind, M.R., Gander, P.H., Gregory, K.B., Smith, R.M., Miller, D.L., Oyung, R., Webbon, L.L., & Johnson, J.M. (1996). Managing fatigue in operational settings 1: Physiological considerations and countermeasures. Behavioral Medicine, 21, 157-165. Graeber, R.C. (1986). Crew factors in flight operations: IV. Sleep and wakefulness in international aircrews (NASA/TMm1986-88231). Moffett Field, CA: NASA Ames Research Center. Gander, P.H., Graeber, R.C., Connell, L.J., & Gregory, K.B. (1991). Crew factors in flight operations: VIII. Factors influencing sleep timing and subjective sleep quality in commercial long-haul flight crews (NASA/TMm1991-103852). Moffett Field, CA: NASA Ames Research Center.

times in a single week. The FAA proposes to set maximum duty limitations, flight duty periods, and flight time (block) periods based on specific time intervals. Fewer hours on duty can be equated to more opportunity for rest, which can mitigate the amount of cumulative fatigue experienced by a flightcrew member. The proposed limits decline over extended periods of time, i.e., the 28-day limits are less than four times the weekly limits. This approach would allow flightcrew members to work long hours over a relatively short period of time, but prevent long duty periods over extensive lengths of time.

The ARC defined duty as "any task that crewmembers are required by the certificate holder to perform including, but not limited to: flight duty, administrative work, ground training, ancillary training, positioning, and airport standby." The FAA believes this definition appropriately details the type of work commonly required of crewmembers except that, as discussed earlier, it believes that time spent on short-call reserve should apply to the cumulative duty limits proposed today.

Under today's proposal, duty time would be limited to 65 hours in any consecutive 168-hour period (7 days) and 200 hours in any consecutive 672-hour period (28 days). The FAA is proposing consecutive hourly limits that equate to 7 and 28 days because the current requirements assume that a day starts just after midnight, which is an arbitrary constraint that does not work well for carriers. As a result, carriers have been allowed to define when their "day" begins. This approach is unwieldy. As a practical matter, the FAA expects that carriers and flightcrew members will base their "week" on the time the flightcrew member reported for duty after completing his or her extended rest period.

The weekly limit could be extended by up to 10 hours to 75 hours during a rolling 168 hours and the 28-day limit could be extended to 215 hours if the duty period includes deadhead segments in a rest seat outside the flight deck meeting or exceeding the provisions of class 2 rest facility.[43]

Allowing an additional 10 hours duty time for non-FDP deadhead flights when adequate sleeping accommodations are provided seems to be a reasonable accommodation to that sector of the industry that relies on deadheading to position pilots to areas outside of the U.S. Since the extension is limited to no more than 10 additional hours, there should be sufficient fatigue mitigation.

Since short-call reserve periods are tentatively considered to be duty, the FAA also believes it is appropriate to allow carriers to increase the maximum cumulative duty periods to account for the time spent on short-call reserve, while still recognizing that time spent on reserve is less strenuous than time actively spent on duty.

The FAA also notes that it may be appropriate to provide the same accommodation to management personnel. The rationale for allowing longer duty periods based on deadhead segments centered on the fact that deadheading in a "rest seat" provided mitigation in the form of an opportunity to rest; office work would not allow for such mitigation, but limiting the duty period to 65 hours a week for management could have an adverse safety impact (e.g., force flying shorter, un-augmented flights) since the management workload likely will not be reduced.

The extension of the maximum duty limit would only be extended by the amount of time spent engaged in the type of duty allowing for an extension. Thus, if a flightcrew

[43] Except that no curtain need be provided if the crewmember is being deadheaded commercially, since this would be beyond the certificate holder's control.

member spent 5 hours on short-call reserve, the maximum weekly duty period would only be extended by 5 hours, to a total of 70.

The proposed cumulative limitation on flight duty periods is largely consistent with the approach already adopted by the British and EASA. Specifically, the ARC recommended that flight duty period be limited to 60 hours in any consecutive 168 hours (7 days) and 190 hours in any 672 consecutive hours (28 days). The ARC decided there was no need to implement a biweekly requirement, as exists in CAP-371, instead endorsing the approach adopted by EASA. The FAA agrees that a weekly and monthly approach sufficiently mitigates the effects of cumulative fatigue and is proposing the limits suggested by the ARC. The FDP is a sub-set of duty, and the maximum FDP limits are subsumed within the maximum duty limits. To the extent any duty other than that encompassed in the definition of a FDP cannot be completed within the time dedicated to non-FDP duty (typically 5 hours a week or 10 hours in a 4-week period), the amount of FDP is correspondingly reduced. Thus, during a 168-hour period, if a flightcrew member spent 30 hours in ground training, the available amount of FDP for that period would only be 35 hours.

"Flight time" retains the meaning in 14 CFR 1.1. While the ARC largely agreed on a 100 hour limitation in any 672 consecutive hours (28 days), it was unable to agree on a maximum annual limit. Some argued that the constraints on cumulative duty and flight duty periods obviated the need for any limit. This argument was particularly strong with regard to annual limits on flight time. However simple calculations of the proposed weekly and 28-day limits revealed that absent an annual limit, a flightcrew member could potentially accrue as many as 2,000 flight hours in a 12-month period. Based on this

assessment, those arguing against any limit conceded that some annual limit may be appropriate, but that in any case the current limit of 1000 hours per year could be relaxed to 1200 hours. Others argued that the current annual limit is too high and urged the FAA to consider a 900 hour limit. The FAA has tentatively decided to retain the current annual flight time limitation of 1000 hours in any 365 consecutive days because the ARC members were unable to agree and the current limit is within the limits presented by the ARC.

31) The FAA seeks input on the appropriate cumulative limits to place on duty, flight duty periods and flight time. Is there a need for all the proposed limits? Should there be more limits (e.g., biweekly, or quarterly limits)?

32) The FAA also asks for comments on measuring limits on an hourly rather than daily or monthly basis. Does this approach make sense for some time periods but not for others?

K. Rest requirements

1. Pre-flight duty period rest

Adequate rest is the most critical component of fatigue mitigation. As such, it is critical that the FAA implement unambiguous rest requirements that address both the potential for fatigue on a daily basis and the risk posed by cumulative fatigue. Currently, 14 CFR 121, subparts Q, R and S address rest limits within a 24-hour period. However, certificate holders conducting operations with airplanes having a passenger seat configuration of 30 seats or fewer and a payload capacity of 7,500 pounds or less, may comply with the less stringent requirements of 14 CFR sections 135.261 through 135.273. Perhaps the largest problem with the existing regulations is that there is no

mechanism to assure that rest is provided prior to flight, and there is no guarantee that the 9-hour rest requirement results in 8 hours of actual sleep opportunity.

In addition, the existing requirements do not adequately apprise the regulated community on what constitutes being free from duty. The FAA has issued 55 legal interpretations regarding rest that apply to pilots, flight attendants and dispatchers, many of which relate to whether a crew member is at rest when required to answer phone calls or pagers or otherwise be in contact with the carrier.

CAP-371 defines rest as a period of time before starting a flight duty period which is designed to give crew members adequate opportunity to rest before a flight. The minimum rest period must be as long as the preceding duty period, or 12 hours, whichever is greater. After being called out from reserve, the length of minimum rest is determined by the length of reserve duty, time spent on positioning, and any completed FDP.

EASA defines a rest period as a continuous and defined period of time, subsequent to and/or prior to duty, during which a crew member is free of all duties. Certificate holders are required to ensure that rest periods provide sufficient time for flightcrew members to overcome the effects of the previous duties and be well rested for the next FDP. In addition, a certificate holder must ensure that the effects on a flight crew passing through different time zones are compensated for with additional rest. As is the case with CAP-371, the EU OPS subpart Q requires that minimum rest for an FDP beginning at home base must be at least as long as the preceding duty period or 12 hours, whichever is greater. If the FDP begins away from home base, the rest must be as long as the preceding duty period or 10 hours, whichever is greater. Within this rest period, a

certificate holder must provide at least 8 hours of opportunity for sleep. EU OPS subpart Q also requires certificate holders to increase the minimum rest periodically to a weekly rest period. The pilot-in-command also may reduce rest in the event of unforeseen circumstances.

As discussed earlier, the study of sleep science is somewhat settled on the following points: the most effective fatigue mitigation is sleep; an average individual needs to have an 8-hour sleep opportunity to be restored; 8 hours of sleep requires more than 8 hours of sleep opportunity; and daytime sleep is less restorative than nighttime sleep.[44] For most people, 8 hours of sleep in each 24 hours sustains performance indefinitely.[45] There is a continuous decrease in performance as sleep is lost. Examples of this reduction in performance include complacency, a loss of concentration, cognitive and communicative skills, and a decreased ability to perform calculations. All of these skills are critical for aviation safety.[46]

The scientific presenters stated that during long pairings with significant time zone shifts, a minimum of 24 hours off would be necessary for flightcrew members to

[44] Akerstedt, T., & Gillberg, M. (1981). The circadian variation of experimentally displaced sleep. Sleep, 4 (2), 159-1659. Akerstedt, T., & Gillberg, M. (1990). Subjective and objective sleepiness in the active individual. International journal of neuroscience, 52 (1-2), 29-37. Gander, P.H., De Nguyen, B.E., Rosekind, M.R., & Connell, L.J. (1993). Age, circadian rhythms, and sleep loss in flight crews. Aviation, Space, and Environmental Medicine, 64 (3), 189-195.
[45] Rosekind, M.R., Gander, P.H., Gregory, K.B., Smith, R.M., Miller, D.L., Oyung, R., Webbon, L.L., & Johnson, J.M. (1996). Managing fatigue in operational settings 1: Physiological considerations and countermeasures. Behavioral Medicine, 21, 157-165.
[46] Caldwell, J.A., Mallis, M.M., Caldwell, J.L., Paul, M.A., Miller, J.C., & Neri, D.F. (2009). Fatigue countermeasures in aviation. Aviation, Space, and Environmental Medicine, 69 (1), 29-59.

find an adequate sleep opportunity, and sufficient time free from duty.[47] A minimum of two nights of sleep might be necessary to acclimate to a different time zone.[48]

The scientific presenters noted that an individual's circadian clock is sensitive to rapid time zone changes. They added that long trips present significant issues requiring mitigation strategies.[49] Twenty-four or 48 hours of rest may not be adequately restorative during a trip pairing where a flightcrew member is working 20 days separated by 24-hour layovers. In some cases, shorter rest periods, such as 18 hours or less, may be more restorative because of circadian issues.

In defining a rest period, the ARC included the condition that a flightcrew member be free from all contact during a rest period. The proposed definition means that the certificate holder cannot contact a flightcrew member nor can the flightcrew member be required to contact the certificate holder during a rest period.

The ARC members agreed on a general approach towards rest without agreeing on the number of hours one needed to be free from duty to assure an 8-hour sleep opportunity. On the lower end, they developed a domestic rest requirement of 10 hours by working out in each direction from an 8-hour sleep opportunity, with 30 minutes on each end for transportation, and 30 minutes on each end for physiological needs such as

[47] Gander, P.H., Myhre, G., Graeber, R.C., Anderson, H.T., and Lauber, J.K. (1985). 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/TMm 1985-88197). Moffett Field, CA. NASA Ames Research Center.

[48] Lamond, N., Petrilli, R.M., Dawson, D., and Roach, G.D. (2006). Do short international layovers allow sufficient opportunity for pilots to recover? Chronobiology International, 23(6), 1285-1294. Lamond, N., Petrilli, R.M., Dawson, D., and Roach, G.D. (2005). The impact of layover length on the fatigue and recovery of long-haul flight crew. Adelaide/Whyalla, Australia: University of South Australia, centre for Sleep Research.

[49] See also, Gander, P.H., Graeber, R.C., Connell, L.J., and Gregory, K.B. (1991). Crew factors in flight operations: VIII. Factors influencing sleep timing and subjective sleep quality in commercial long-haul flight crews (NASA/TMm 1991-103852). Moffett Field, CA: NASA Ames Research Center. Rosekind, M.R., Gander, P.H., Gregory, K.B., Smith, R.M., Miller, D.L., Oyung, R., Webbon, L.L. and Johnson, J.M. (1996). Managing fatigue in operational settings 2: An Integrated Approach. Behavioral medicine, 21, 166-170.

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eating, exercising and showering. Others on the ARC noted that a longer rest period was required to assure an 8-hour sleep opportunity.

For international operations, some members of the ARC suggested this rest requirement should increase to 12 hours. They noted that flightcrew members may require a longer rest period at international layovers because of issues with time zone changes and possible difficulties obtaining sleep because the flightcrew member is non-acclimated. There were also concerns raised with a potential for increased stress associated with communicating with air traffic control in countries where English is not the native language. Some ARC members acknowledged that the minimum period captures the same elements as the 10-hour requirement discussed above but includes an additional 2 hours to transit customs and immigration or travel a long distance to hotel accommodations in foreign destinations.

The ARC discussed permitting the minimum rest time to be reduced to a lower level due to unforeseen circumstances. On the one hand, this would allow the carrier to recover a schedule; on the other hand, the need for reduced rest may be based on factors, such as poor weather or mechanical problems with the aircraft, which are potentially more fatiguing than normal operations. Ultimately, the ARC members proposed to allow certificate holders to reduce a minimum rest period from 10 to 9 or 12 to 11 hours for operational flexibility in unforeseen circumstances, but to limit the number of times rest could be reduced to once in a 168-hour period. In addition, the decision to reduce minimum rest would be a joint decision between the pilot in command and the certificate holder.

The FAA is proposing flightcrew members be provided with a minimum of 9 hours rest prior to commencing a flight duty period. The agency has tentatively decided against proposing different requirements for domestic and international operations. Time associated with clearing customs and immigration or traveling longer distances to a hotel has been addressed by refining the time at which the rest requirement begins and ends, as discussed below. While the FAA agrees that changes in time zones and the need to acclimate require additional safeguards, the agency believes that it has already accommodated that additional risk in other provisions to the proposed rule. As to concerns raised with air traffic controllers who do not speak English as their primary language, the FAA is unconvinced that providing an additional 2 hour sleep opportunity after the flight has ended would have any impact on the stress associated with communicating with air traffic control after entering foreign air space. Based on the available sleep studies, it does not appear that a longer rest period immediately prior to commencing a flight in non-U.S. airspace would be necessary since presumably the flightcrew member has received the requisite amount of sleep to report to duty refreshed and well-rested.

As suggested by the ARC, the rest opportunity could be reduced by 1 hour once in any 168-hour period, but only if agreed to by the pilot in command. Under no circumstances may the opportunity to rest be reduced by more than 1 hour because such reductions would seriously encroach upon the 8-hour sleep opportunity. Should the time period between the beginning of the rest period and the time the flightcrew must report for transportation to the airport be less than 8 hours, the carrier would need to delay the next day's flight or make other crewing arrangements.

This proposal does not exactly mirror the ARC recommendation, because the FAA is proposing that transportation time to or from a duty station not be included in the minimum rest periods; nor would it be considered duty. Rather, the rest period would begin once the flightcrew members reach the hotel. The FAA's proposal does not change the intent of the ARC to generally assure an 8-hour sleep opportunity. However, the FAA believes that time in transit is not rest. In addition, the agency is concerned that allowing this time to be included in the rest period could result in a reduction in actual rest opportunity below 8 hours. The ARC members recognized this possibility and considered an approach whereby any time exceeding 30 minutes would not be considered in the rest period. Ultimately, the impact is the same; it is simply clearer from a regulatory perspective to acknowledge that time in transit is not rest. The FAA has decided against treating this time as duty because it recognizes that the permissible amount of cumulative duty is only nominally higher than the permissible amount of FDP and that the location of a rest facility is a lifestyle issue that is typically negotiated between the carriers and their unions.

The FAA seeks comment on the following:

33) If transportation is not considered part of the mandatory rest period, is there a need for a longer rest period for international flights?

2. Cumulative rest requirements

Much as there should be cumulative limits on the amount of work a flightcrew member can be expected to perform in a week, there also needs to be an opportunity for rest that exceeds the amount of rest required on a daily basis. The scientific presenters to the ARC stated that cumulative fatigue is fatigue brought on by repeated mild sleep

restriction or extended hours awake. They noted that the repeated infringement of duty time on the opportunity to sleep results in accumulated sleep debt and that the operative factor in recovery from cumulative fatigue is sleep. When a person has accumulated a sleep debt, recovery sleep is necessary. Recovery sleep requires an opportunity to obtain sufficient sleep to fully restore the person's "sleep reservoir." Recovery sleep should include at least one physiological night, that is, one sleep period during nighttime hours in the time zone in which the individual is acclimated.

The ARC discussed what would constitute rest sufficient to act as a restorative rest reset for the 168 consecutive hour rolling window. The ARC noted that current regulations require 24 hours free of duty in any 7 consecutive days dependent on the type of operation. The ARC considered whether reset rest should (1) incorporate a minimum of two physiological nights' rest, which would be variable based on when the FDPs began and ended, or (2) be a fixed number of hours ranging from 30 to 48 hours. The ARC proposed that a 30 to 36 hour rest during any 168 consecutive hours constitutes a restorative rest period. Those arguing for a 36 hour rest period noted that the 30 hour period would only rarely afford one the opportunity for two physiological nights rest. Those supporting 30 hours noted that this time frame would allow for one physiological night's rest and at least one additional sleep opportunity, albeit less than a full 8 hours.

The FAA is proposing to impose a 30 hour continuous rest requirement for each rolling 168-hour period. This approach does not guarantee two consecutive physiological nights rest in a 7-day period. Rather, it provides for a single physiological night rest and a rest opportunity immediately preceding or following that night. Although this is less rest than suggested by some members of the ARC, it still represents a 25 percent increase

over current requirements. In addition, the FAA believes the cumulative limits on duty and FDP during the same 7-day period should adequately mitigate the effects of cumulative fatigue.

L. Fatigue Risk Management Systems

A Fatigue Risk Management System (FRMS) is a carrier-specific method of evaluating how to best mitigate fatigue based on active monitoring and evaluation by the carrier and flightcrew members. This cooperative approach has the potential to provide a cooperative and flexible means of monitoring and mitigating fatigue during operations when the prescriptive approach is not optimal. An FRMS requires a carrier to develop numerous processes and structures within an operation. These measures lead to an effective management and mitigation of fatigue on the part of both the carrier and its employees that might affect the operation.

An FRMS requires that a baseline of fatigue effects be identified for the affected population, scientific modeling of respective work schedules, education and management of the process for all stakeholders, and effective evaluation and validation of the instituted policies. As a continuously improving system, the knowledge gained in developing and validating fatigue data should result in regular improvements in how the certificate holder and its employees manage and mitigate fatigue.

No country has adopted FRMS as a regulatory alternative. However, ICAO is actively considering requiring member states to implement some alternative means of compliance with existing rules, and EASA has proposed requiring FRMS as an integral part of an operator's management system. Permitting FRMS as a regulatory alternative to today's proposal is widely supported by industry, with several organizations requesting

that the FAA adopt FRMS as a means of addressing fatigue. Theoretically, a carrier could apply its FRMS to all of its operations. Realistically, it would likely only be used when the carrier cannot meet the more prescriptive rules because of the nature of the specific operations.

The FAA has decided to include an FRMS option in today's proposal. A certificate holder may utilize this option when it has developed an FAA-approved equivalent level of safety for monitoring and mitigating fatigue specific to those operations.[50] The proposed regulatory text provides broad performance requirements that a certificate holder would need to demonstrate it met prior to the FAA granting approval. These requirements include an additional FRMS-specific training element above and beyond the general requirement proposed today. The extent of the additional training would be determined as part of the overall approval process.

While FRMS is not fully matured, the general concepts are well understood and have been developed in other contexts. For example, the approach used to obtain ultra-long range OpSpecs is essentially an FRMS, except that it does not contemplate flightcrew members providing feedback to the certificate holder or a system of accountability. The FAA's Advanced Qualification Program, which has been in place since 1990, also incorporates many aspects of an FRMS. In addition, ICAO is currently working on developing FRMS standards. The FAA is actively engaged in the development of these standards, as are at least two members of the ARC. Accordingly, the FAA believes that FRMS will be sufficiently robust to be implemented for operations that cannot otherwise be accommodated under the rule by the time the rule takes effect.

[50] The FAA anticipates that all FRMS proposals would be evaluated and approved at headquarters by individuals within AFS-200 dedicated to overseeing FRMS.

Generally, a certificate holder would need to demonstrate that its FRMS has an education and awareness training program; a fatigue reporting system; a system for monitoring flightcrew fatigue; a performance evaluation; and possibly an incident reporting process. The FAA issued advisory circular (AC) 120-103 entitled Fatigue Risk Management Systems for Aviation Safety[51] on August 3, 2010 outlining the types of data and processes a certificate holder would need to develop to receive FRMS approval from the agency. I

As is the case with the proposed training requirements, whenever the Administrator finds that revisions are necessary for the continued adequacy of an FRMS, the certificate holder would have to make any changes in the program deemed necessary by the Administrator after being notified that such changes are needed. This would likely be done through the OpSpec process.

The FAA requests comment on:

34) Whether some elements of an FRMS, such as an incident reporting system, would be better addressed through a voluntary disclosure program than through a regulatory mandate?

M. Commuting

The impact of commuting to a duty station has been linked to increased fatigue, most recently in the crash in Buffalo, New York. Commuting is common in the airline industry, in part because of lifestyle choices available to pilots by virtue of their being able to fly at no cost to their duty station, but also because of economic reasons associated with protecting seniority on particular aircraft, frequent changes in the

[51] You may veiw the AC at http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/319218

flightcrew member's home base, and low pay and regular furloughs by some carriers that may require a pilot to live someplace with a relatively low cost of living. While commuting to a duty station can be handled responsibly (particularly assuming one has the means), it is also subject to abuse.

The only current impediment to irresponsible commuting in the FAA's regulations is the general requirement in part 91 that pilots report to work fit for duty. CAP-371 provides that if journey time from home to normal home base is more than 1.5 hours, crew members should consider making arrangements for temporary accommodation nearer to base. This provision is not mandatory.

The ARC unanimously recommended that pilots be reminded of their existing obligations under part 91 to report to work fit for duty, but that the FAA impose no new requirements. The FAA has tentatively rejected this approach.

Commuting is fundamentally a fitness for duty issue. If a flightcrew member commutes irresponsibly, it is possible that he or she may become fatigued. A responsible commuter plans his or her commute to minimize its impact on his or her ability to get meaningful rest shortly before flying, thus fulfilling the proposed requirement that he or she reports for an FDP rested and prepared to perform his or her assigned duty.

The FAA considered proposing a requirement similar to the one in CAP-371 mandating that pilots arrive at the pilot's domicile airport in time to receive the pre-flight rest period in that area prior to commencing flight. At first blush, this approach has appeal, in that it would require a flightcrew member to have an opportunity for rest immediately prior to commencing an FDP. However, because commuting constitutes an activity conducted by a pilot on his or her own time, it is difficult to regulate. In addition,

a strict commuting regulation, such as one that requires a pilot to report to a duty station area well in advance of the scheduled flight, would not necessarily result in more responsible commuting. A pilot could choose to commute during times that interfere with his or her WOCL (for example, taking a red eye for an afternoon flight), leaving him or her less rested for flight. This approach could also discourage responsible commuting. For example, today a flightcrew member can catch a mid-morning flight to his or her duty station and then commence his or her flying shortly after arrival a couple of hours later. The flightcrew member would have received a full night of sleep, and would be in a much better position to work than the individual who had taken an overnight or very early morning flight. While the irresponsible commuter would be available to fly by mid-afternoon, the mid-morning commuter would not be available to fly until late evening, just as he or she is beginning to tire.

The FAA does believe that it is unreasonable to assume that an individual is resting while commuting. Accordingly, time spent commuting, either locally or long-distance, is not considered rest, and a certificate holder will need to consider the commuting times required by individual flightcrew members to ensure they can reach their home base while still receiving the required opportunity for rest. This approach is consistent with that taken for transportation to and from a sleep facility other than home discussed earlier in this document.

The FAA also believes it is inappropriate to simply rely on the existing requirements in part 91 to report to work fit for duty. The FAA believes a primary reason that pilots may engage in irresponsible commuting practices is a lack of education on what activities are fatiguing and how to mitigate developing fatigue. The FAA has

developed a draft fitness for duty AC that elaborates on the pilot's responsibility to be physically fit for flight prior to accepting any flight assignment, which includes the pilot being properly rested. Additionally, the AC outlines the certificate holder's responsibility to ensure each flightcrew member is properly rested before assigning that flightcrew member to any flight. That document has been placed in the docket for this rulemaking. Additionally, the proposed training program discussed earlier contains an element on the impact of commuting on fatigue.

N. Exception for emergency and government sponsored operations

The ARC discussed various types of supplemental operations that may not be adequately addressed by the proposed requirements.[52] These operations range from moving armed troops for the U.S. military and conducting humanitarian relief, repatriation, Civil Reserve Air Fleet (CRAF), Air Mobility Command (AMC), and State Department missions. Many of these types of supplemental operations fly into hostile areas, while others are conducted into politically sensitive, remote areas without rest facilities. The ARC recognized the uniqueness of these operations and noted that today some AMC and emergency operations are conducted under a deviation authority contained in 14 CFR 119.55 and 119. 57.

Currently, all flights operated by an air carrier under contract with a U.S. Government agency must comply with part 121 or part 135, including flight and duty time regulations. These operations include, but are not limited to:

- AMC contracts and other Department of Defense (DOD) contracts;

[52] The FAA notes that cost is not the critical factor since a regulatory impact on crew costs would more than likely be passed on the Department of Defense via the uniform rate process, resulting in no increase in cost to the carrier. While crew costs are typically based on historical costs, the FAA has been informed that the uniform rate process is sufficiently flexible to allow projected costs when the cost increase is the result of a regulatory action.

- State Department contracts;
- Department of Homeland Security contracts, including FEMA, humanitarian flights and Immigration and Customs Enforcement deportations; and
- Department of Justice contract flights.

Activation of the CRAF would allow military use of civil aircraft. CRAF is activated by presidential order in a time of war.[53] Under CRAF, air carriers are required to operate their aircraft at the direction of DOD. However, the activation of CRAF does not obviate the air carrier's responsibility to operate under part 121, including the flight and duty time regulations.

14 CFR 119.55 allows the FAA Administrator to authorize an air carrier who has a contract with AMC a deviation to any part of part 119, 121, or 135 for the operation under that contract. AMC reviews an air carrier's request for a deviation and either supports it or does not support it before AMC forwards the request to the FAA for a final decision.

14 CFR 119.57 allows the FAA Administrator to authorize deviations during an emergency under certain conditions. The FAA has used this authority in the past. For instance, an OpSpec was used during Hurricane Katrina to allow humanitarian flights into and out of New Orleans. This authority is issued on a case by case basis during an emergency situation as determined by the Administrator.

Neither of these current regulatory options fully address the needs of carriers who occasionally need to exceed the allowable FDP (with extensions) or who are operating under contract to a U.S. government agency other than AMC. These operations are

[53] CRAF is currently not activated.

distinguishable from tourism operations or operations where cargo shows up late to the aircraft for loading.

The FAA recognizes that all carriers could encounter circumstances that would require a flightcrew member to exceed the limits in the FDP, including extensions. The most likely scenario probably would be a diversion into an area where, for whatever reason, it would not be safe for the crew or passengers to stay. In addition, the FAA recognizes that there is a public policy interest in permitting the United States government to contract out certain operations to air carriers. If these operations were conducted on military aircraft, the pilots would generally be subject to a 16-hour duty day, almost all of which could be flight time.

Currently, if a military pilot flies a similar operation into a hostile area and must fly an aircraft out of theater due to a military exigency, and doing so would cause that pilot to exceed the military-mandated flight and duty time limits, that pilot can call his or her or her central command for permission to do so. A similar system, with FAA involvement, seems to make sense. In the event that there is no time to call back to the air carrier, the captain's emergency authority would allow the captain to move the airplane to safety, with a report to the FAA. Likewise, the pilot in command is always authorized to address emergency situations.

The concern of the FAA is not that circumstances may arise that require pilots to take emergency action, but rather that air carriers should know that delays in certain operations for the U.S. government are possible and plan accordingly. Air carriers should mitigate the chances of such an event, for instance by staging crews at other airports or installing rest facilities on the aircraft to allow augmentation, in order to ensure that flight

crews will not exceed FDP limits. Fundamentally, a carrier needs to have performed adequate planning for the mission, including having the appropriate onboard rest facilities or number of flightcrew members for the length of the duty day, and the emergency should not be self-induced. If a certificate holder chooses not to equip an aircraft with adequate rest facilities, then the certificate holder should not be able to claim an inability to comply with requirements because of the lack of those facilities.

The FAA proposes to allow air carriers operating commercial flights and who are not under contract with a U. S. government agency to ask for a "one time deviation" to the FDP limits under part 121 for a one time event in exceptional circumstances. Each event of this type would be reported to the FAA. The number of "one time deviations" would be tracked by the FAA, as would the rationale for needing the deviation. If the Administrator determines that the carrier is relying excessively on this deviation authority, the air carrier would have to change its operations or develop an FRMS in order to mitigate the chances of such events happening in the future. There would be extra rest requirements after such an event.

For operations under contract with a U. S. government agency that cannot be conducted consistent with the general rules because of unique circumstances (such as when operating into an SFAR area, or when there is a declared military exigency that necessitates operations outside the scope of what the regulation contemplates), a different approach is proposed. Such operations could be conducted under an exception to the FDP and flight time limits, but not to the cumulative restrictions on FDP, flight time and duty. In addition, additional rest would be required and the carrier would have to

demonstrate why the operations could not have been adjusted to prevent exceeding the daily limits. This could be done with a bi-monthly reporting requirement.

By tracking these events, the FAA can determine if the air carrier is properly planning its operations and mitigating the chances of its flight crews exceeding the FDP limits. The proposed regulation contemplates that the air carrier will develop an FRMS if it cannot restructure its operations so that only very few of those operations continue to need the exception. Sections 119.55 and 119.57 would remain unchanged and used as they are today.

35) Are there other types of operations that should be excepted from the general requirements of the proposal? If so, what are they, and why do they need to be accommodated absent an FRMS?

IV. Regulatory Notices and Analyses

Regulatory Impact Analysis, Regulatory Flexibility Determination, and Unfunded Mandates Assessment

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Public Law 96-354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Public Law 96-39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Agreements Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Public Law 104-4) requires

agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this proposed rule. The FAA suggests readers seeking greater detail read the full regulatory impact analysis, a copy of which the agency has placed in the docket for this rulemaking.

In conducting these analyses, the FAA has determined that this proposed rule: (1) has benefits that justify its costs, (2) is an economically "significant regulatory action" as defined in section 3(f) of Executive Order 12866, (3) is "significant" as defined in DOT's Regulatory Policies and Procedures; (4) would have a significant economic impact on a substantial number of small entities; (5) would not create unnecessary obstacles to the foreign commerce of the United States; and (6) would impose an unfunded mandate on state, local, or tribal governments, or on the private sector by exceeding the threshold identified above. These analyses are summarized below.

Benefits of the Rule

During the past 20 years, there have been over 18 aviation accidents caused by pilot error where pilot fatigue was a factor. NTSB has identified five accidents where the flight crew started the day in a state of fatigue. We statistically identified 4.6 accidents where the flight crew became fatigued during a long flight-duty period (NTSB cited pilot fatigue as a contributing factor in three of those accidents). We have also statistically estimated that some of the 6.2 accidents that occurred between midnight and 6:00 am involved some degree of pilot fatigue. Two of these have already been accounted for in

the previously discussed analyses. There were also three accidents where the pilot became fatigued due to being awake for many hours. Lastly, there were two accidents were chronic fatigue was a contributing factor. In summary, we project there would be at least 18.8 accidents (13 passenger airplane accidents and 5.8 cargo airplane accidents) during the next 20 years where pilot fatigue would be a contributing factor to the accident.

Having projected the possible extent of fatigue based on the historical record, we estimate the likelihood of accidents happening in the future using simulation techniques. We also use simulation techniques to estimate future casualties, which we monetize. In this way, we estimate the potential benefits of the proposed rule. Finally, we model risk of fatigue for current pilot schedules, and compute the number of hours in higher risk categories with and without the rule. The projected reduction in fatigue exposure is corroborating evidence supporting this proposal. Pilot fatigue is a serious problem. If nothing is done about this problem, we can expect from one to possibly six aviation accidents a year where pilot fatigue will be a contributing factor. Pilot fatigue will be a contributing factor in many accidents that could potentially cost billions of dollars.

Using simulation analysis, the mean is 28.9 airplane accidents in a ten-year period. These accidents would result in a mean of 174.7 deaths. The estimated cost of these accidents would be a mean value of $1.581 billion ($1.121 billion, present value). These numbers represent an estimate of the likely number of future accidents, deaths, and costs from future accidents with fatigue as a factor.

The above analysis establishes an estimate of the number and range of fatigue related accidents if no action is taken to address the problem. It is seldom the case that a rule is 100 percent effective at addressing an identified problem. In particular, fatigue is rarely a primary or sole cause of an accident, and therefore this rule, if adopted, is not likely to prevent all future accidents that include fatigue as a factor.

FAA reviewed all NTSB accident reports on Part 121 accidents that occurred from 1990 through 2009 to assess the likely capacity of the NPRM to have averted those accidents. The FAA's Office of Accident Investigation & Prevention assessed the effectiveness of this rule to prevent accidents like those in the historical database. Most reports on major accidents (hull losses or non-hull losses that resulted in multiple fatalities) provided extensive data on flight crews' duty tours and recent rest periods, which facilitated relatively strong assessments.

The FAA's Office of Accident Investigation and Prevention (AVP) rated each accident by conducting a scoring process similar to that conducted by the Commercial Aviation Safety Team (CAST), a well documented and well understood procedure. All the accidents that have had final National Transportation Safety Board (NTSB) reports published have been scored against the CAST safety enhancements. When these accidents were not well defined in the probable cause or contributing factors statements of the NTSB reports, AVP used a Joint Implementation Monitoring Data Analysis Team (JIMDAT)-like method.

Following this scoring, the proposed rule would be 40 percent effective at preventing passenger airplane accidents where pilot fatigue was a contributing factor and

would be 58 percent effective at preventing cargo airplane accidents where pilot fatigue was a contributing factor. Accordingly, the above estimate of the benefits of avoiding passenger airplane accidents where pilot fatigue was a causal factor have been reduced from their above stated values. The revised estimated benefits of avoiding passenger and cargo airplane accidents would be a mean value of $659.4 million ($463.8 million, present value).

Cost of the Rule

The total estimated cost of the proposed rule is $1.25 billion ($804 million present value using a seven percent discount rate) for the ten year period from 2013 to 2022. The FAA classified costs into four main components and estimated the costs for each component. We obtained data from various industry sources; the sources of the data used in cost estimation are explained in each section. We were very fortunate that several carriers ran two alternatives to the proposed rule through their crew scheduling programs. Their estimates provided some comparison data to calibrate and validate our costing approach. Without their help, we would have likely missed some cost elements. The table below provides a summary of the four main cost components. Flight operations cost makes up about 60 percent of the total cost of the rule. Each of the main cost components are explained in-depth in the following sections of this document.

Summary of Costs

Cost Component	Nominal Cost (millions)	PV Cost (millions)
Flight Operations	$ 760.3	$ 484.2
Schedule Reliability	$ 4.9	$ 3.0
Fatigue Training	$ 262.3	$ 167.2
Rest Facilities	$ 226.6	$ 149.1
Total	**$ 1,254.1**	**$ 803.5**

In addition to the costs presented in this table, there may be costs of a fatigue risk management system (FRMS). The FAA is not imposing an FRMS program requirement on Part 121 carriers, but is allowing them the option of developing and implementing such a program. Operators might do this for ultralong flights, which have flight time over 16 hours. Operators might develop an FRMS program as an alternative to the flight and duty period rules proposed by this rulemaking when the crew scheduling cost savings equal or exceed the costs of the FRMS program. The FAA estimates that an FRMS program would cost between $0.8 and $10.0 million for each operator over ten years. The FAA believes that about 35 operators have at least partially adopted an FRMS program at this time. The FAA estimates the total cost would be $205.7 million ($144.9 million present value), which would be more than offset by a reduction in crew scheduling costs. Accordingly, the cost is not added to the total costs imposed by this rule. The FAA calls for comment on this aspect of the proposal as it has not assigned a cost to the cumulative maximums.

Summary of Benefits and Costs

Following NTSB recommendations regarding pilot fatigue, labor and industry worked together to provide the basis of this rulemaking. Furthermore, Congress has directed the FAA to issue a rule addressing pilot fatigue. We have validated the need for this rule in the benefit discussion. Based on the expected effectiveness of this proposed rule at preventing fatigue accidents with an averted fatality valued at $6 million, the simulation methodology produced benefits of $659.4 million with $463.8 million in present value. The total estimated costs of the proposed rule over 10 years are $1.25 billion ($804 million at present value). There is over a 7 percent probability that undiscounted cost of avertable passenger airplane accidents would exceed $1.25 billion and over a 10 percent probability the present value of the cost of avertable passenger airplane accidents would exceed $804 million. The benefits from a near term catastrophic accident in a 150-passenger airplane with average load factor exceeds the cost of this rule. If $8.4 million were used for VSL, the undiscounted benefits would be $837 million and the present value of those benefits would be $589 million. When the value of an averted fatality increases to $12.6 million, the present value of the benefits equals the present value of compliance costs. In addition, the FAA has identified two additional areas of unquantified benefits: preventing minor aircraft damage on the ground, and the value of well rested pilots as accident preventors and mitigators. Due to data limitations, the FAA was unable to estimate the cumulative effect of preventing minor aircraft damage on the ground, but if the rule were to reduce damage by about $600 million over 10 years ($340 million present value) it would break even in terms of

net benefits using a $6 million VSL. These considerations lend weight towards moving ahead with this proposal. FAA invites comment on this issue.

Alternatives Considered

FAA examined a number of alternatives to the proposed rule, scheduling alternatives and a training alternative. Since crew scheduling costs comprised the largest share of costs, most of the alternative analysis focused on these costs and these will be discussed first. Alternatives were selected using industry-proposed limits resulting from the ARC, as well as FAA-proposed limits. The table below summarizes each of the alternatives. For each of the scheduling alternatives, FAA developed a crew scheduling cost estimate using the same methodology as was used to determine the crew scheduling costs of the proposed rule.

Summary of Crew Scheduling Alternatives

Scenario	Rest Time		Duty Time		Flight Time	
	Minimum Rest Prior to Duty - Domestic	Minimum Rest Prior to Duty - International	Maximum Flight Duty Time - Unaugmented	Maximum Flight Duty Time - Augmented	Maximum Flight Time - Unaugmented	Maximum Flight Time - Augmented
Current Part 121	Daily: 8-11 depending on flight time	**Minimum of 8 hours to twice the number of hours flown**	16	16-20 depending on crew size	8	8-16 depending on crew size
Proposed Rule	9	9	9-13 depending on start time and number of flight segments	12-18 depending on start time, crew size, and aircraft rest facility	8-10 depending on FDP start time	None
Scenario A	10	12	9-13 depending on start time and number of flight segments	12-18 depending on start time, crew size, and aircraft rest facility	7-9 depending on FDP start time	16
Scenario B	9	11	9-13 depending on start time and number of flight segments	12-18 depending on start time, crew size, and aircraft rest facility	8-10 depending on FDP start time	None

Scenario A

FAA provided a sample of carriers with a draft version of the proposed rule in fall 2009. The carriers estimated the cost of this version of the proposed rule using their own crew scheduling models and processes. FAA also estimated the costs of the same version of the proposed rule for the entire industry using the crew scheduling model and process outlined in the crew scheduling costs sub-section of the flight operations cost section described in the full regulatory evaluation. Scenario A table below presents the annual crew scheduling resource costs for the Scenario A alternative. As we were able to accomplish our safety objectives at a lower cost, we rejected this alternative.

Scenario A Crew Scheduling Resource Costs

Year	Nominal Cost (millions)	PV Cost (millions)
2013	$ 375.7	$ 306.7
2014	$ 354.3	$ 270.3
2015	$ 320.9	$ 228.8
2016	$ 314.0	$ 209.2
2017	$ 307.0	$ 191.2
2018	$ 300.1	$ 174.7
2019	$ 293.2	$ 159.5
2020	$ 286.3	$ 145.5
2021	$ 279.4	$ 132.7
2022	$ 272.5	$ 121.0
Total	**$ 3,103.3**	**$ 1,939.6**

Scenario B

FAA examined another, more restrictive version of the proposed rule. The main difference was that the minimum required rest for international duty periods was eleven hours. Scenario B table presents the final, adjusted crew scheduling resource costs of the Scenario B alternative.

Scenario B Crew Scheduling Resource Costs

Year	Nominal Cost (millions)	PV Cost (millions)
2013	$ 254.7	$ 207.9
2014	$ 240.2	$ 183.2
2015	$ 217.5	$ 155.1
2016	$ 212.8	$ 141.8
2017	$ 208.2	$ 129.6
2018	$ 203.5	$ 118.4
2019	$ 198.8	$ 108.1
2020	$ 194.1	$ 98.7
2021	$ 189.4	$ 90.0
2022	$ 184.7	$ 82.0
Total	**$ 2,103.9**	**$ 1,314.9**

Summary of Crew Scheduling Alternatives

The summary table below provides the ten-year total crew scheduling resource costs for the proposed rule and each of the alternatives. The proposed rule represents the lowest-cost alternative and achieves the FAA safety objectives.

Alternative Scenarios Crew Scheduling Resource Cost Summary

Scenario	Nominal Cost (millions)	PV Cost (millions)
Proposed Rule	$ 1,366.7	$ 854.2
Scenario A	$ 3,103.3	$ 1,939.6
Scenario B	$ 2,103.9	$ 1,314.9

Fatigue Training Cost Analysis of Alternatives to the Proposed Rule

Fatigue training costs account for approximately 20 percent of the total cost of the proposed rule. The FAA examined two scenarios for fatigue training requirements, ultimately selecting the lower-cost scenario for the proposed rule. The table below shows the different fatigue training requirements for each of the two scenarios.

Table 44: Summary of Fatigue Training Requirements Alternatives

Scenario	Initial Fatigue Training (hours)	Annual Recurring Fatigue Training (hours)
Proposed Rule	5	2
Scenario C	8	4

Scenario C

The fatigue training requirements of Scenario C differed significantly from the fatigue training requirements of the proposed rule. The required number of both initial and annual recurring fatigue training hours was substantially higher. Fatigue training was to take place in a classroom rather than through distance learning, which would result in higher costs due to the need to pay instructors, and the need to provide hotel and per diem compensation to flightcrew members receiving the fatigue training. As a result the costs are substantially higher. The FAA reviewed the recommended training requirements and decided to reduce the initial training requirements from 8 hours to 5 hours and reduce the recurrent training hours from 4 to 2 hours.

Alternative Scenario Fatigue Training Cost Summary

Scenario	Nominal Cost (millions)	PV Cost (millions)
Proposed Rule	$ 262.3	$ 167.2
Scenario C	$ 474.2	$ 333.7

The FAA seeks comments on the alternatives analysis conducted to develop this proposal. In addition, it is requesting comments on possible approaches designed to reduce the costs of this rule while maintaining or increasing the benefits.

Regulatory Flexibility Determination and Analysis

The Regulatory Flexibility Act of 1980 (RFA) establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the RFA requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule would have a significant economic impact on a substantial number of small entities. If the determination is that it would, the agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The FAA believes that this proposed rule would have a significant economic impact on a substantial number of small entities and therefore has performed an initial regulatory flexibility analysis as required by the RFA. The Small Business Administration small entity criterion for small air carrier operators is 1,500 or fewer employees. The FAA invites comment from affected small entities and others to aid us to make an assessment of these impacts. In particular, the FAA invites more information on the financial stability and competitive positions of small entities.

Initial Regulatory Flexibility Analysis

Under Section 603(b) of the RFA, the initial regulatory flexibility analysis must address:

- Description of reasons the agency is considering the action
- Statement of the legal basis and objectives for the proposed rule
- Description of the record keeping and other compliance requirements of the proposed rule
- All federal rules that may duplicate, overlap, or conflict with the proposed rule
- Description and an estimated number of small entities to which the proposed rule will apply
- Analysis of small firms' ability to afford the proposed rule
- Conduct a disproportionality analysis

- Conduct a competitive analysis
- Estimation of the potential for business closures
- Description of alternatives considered

Reasons the Rule is Proposed

The objective of the proposed rule is to increase the margin of safety for passengers traveling on U.S. part 121 air carrier flights. Specifically, the FAA wants to decrease diminished flight crew performance associated with fatigue or lack of alertness brought on by the duty requirements for flightcrew members.

The Legal Basis and Objectives

The legal basis for the proposed rule is found in 49 U.S.C. Section 44701 *et seq.* Specifically 49 U.S.C. Section 44701 (a)(4) requires the Administrator to promote safe flight of civil aircraft in air commerce by prescribing regulations in the interest of safety for the maximum hours or periods of service of airmen and other employees or air carriers. Among other matters the FAA must consider as a matter of policy the maintaining and enhancing of safety in air commerce as its highest priority (49 U.S.C. section 40101(d)).

The Projected Reporting, Record Keeping, and other Compliance Requirements of this NPRM

This proposed rule would increase reporting and record keeping. In addition to changes in crew schedules, there would be a minor increase in documenting crew rest.

All Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rule

There are no Federal Rules that may duplicate, overlap, or conflict with the proposed rule.

Description and an Estimated Number of Small Entities

The proposed rule would apply to all certificate holders operating under part 121. There are 96 such operators of which 45 operators have fewer than 1,500 employees. Among these 45 operators, 25 are small entities that provide all air-cargo scheduled service competing with larger operators, code-share passenger service for large operators, and charter service.

Affordability

The FAA expects wide variability in cost impacts on small entity operators. The sample crew scheduling changes provide only a rough proxy for the impact on pilots' time and availability. Current crew schedules vary by operator, labor contract, and size of pilot pools. The agency understands that many smaller operators have maximized their pilot time in the cockpit and may have little flexibility with potential new flight and duty regulations. Operators needing to hire more pilots would incur the cost of hiring, wages, overhead, and training. Some captains from smaller operators could be lured away by other operators, especially the larger operators with better benefit packages. That outcome might be mitigated by the recent extension of pilots being able to work to age 65 and the inherent flexibility of the larger carriers.

The FAA requests that small entity operators provide estimated impacts of the proposed changes on their existing crew schedules. The FAA requests that all comments be accompanied by clear supporting data. For now the agency expects some small operators would likely need to hire more pilots. This increase in the demand for pilots may eventually raise pilot wages. Based on small operators who would need to hire more

pilots and the resulting pressure on overall wages, there could be a significant economic impact.

Disproportionality Analysis

Part 121 operators would need to provide more rest for pilots which overall could result in the need to hire more pilots. The proposed changes to flight and duty time would be more difficult to accommodate for operators with small pilot staffs. While the changes to flight and duty may be measured in hours per week for operators with small, fully employed staffs, such changes can be difficult to accommodate. To be in compliance with the proposed changes small airlines may need a fraction of a new pilot's time to meet requirements. In this case, the airline would need to hire and train an additional pilot or reduce the number of operations. This added pilot would account for a larger percentage of the cost of pilots for the small airline than is likely to be the case for a major airline. The FAA believes that this may be the case for many small operators. Moreover, the smaller the operator, the more likely this situation will occur. Thus, the proposed rule is likely to have a disproportionate economic impact on small entities.

Competitiveness Analysis

The competitiveness analysis examines whether a small airline is under a competitive disadvantage from the implementation of the proposed rule. This proposed rule would impose significant costs on some small entities, and as a result it is likely to worsen such entities relative competitive position.

A major criterion in a competitiveness analysis is the ability of an airline to pass on the costs imposed by the rule to their customers. The extent to which an airline can pass costs on to its customers is determined by the elasticity of demand of the service by

the customer. The elasticity of demand for a product is a measure of the responsiveness to price that consumers have in their buying habits. The elasticity of demand is defined as the percentage change in quantity demanded resulting from a 1 percent change in price. If the demand for airline travel is relatively elastic, then the airlines would have less capacity to transfer the added cost of the rule to their passengers without losing significant revenue. For operators with a niche market, the demand for their services will be less elastic and more of the cost can be transferred. For instance, specialty cargo carriers have niche markets and some ability to pass on costs. Other operators would have little flexibility. In the most extreme case are operators who provide scheduled service for larger carriers generally under contract. Overall the disproportionate impact is likely to weaken small entity operators' competitive situation, but the FAA is unable to provide a measure of how much.

While the preceding discussion points out potential impacts of the proposed rule on the competitiveness of small entities, the FAA is uncertain about impact this on the level of competition within the U.S. airline industry. The FAA has very little firm-specific flight crew schedule data and route structure market data to refine this analysis and asks commenters to provide information on the impact this proposed rule would have on the continued capacity of small airlines to compete in their current markets. The FAA invites comment from affected airlines and other parties that might better inform the agency on this competitiveness issue.

Business Closure Analysis

Even if there is a disproportionate impact and a loss in competitive positioning does not mean a firm would have to close because of this proposed rule. While small

entity operators are likely to experience a significant economic impact, changes to crew schedules are difficult to assess. Further complicating this business closure analysis are the external changes as upswings in traffic demand or declines in the price of fuel quickly improve the bottom-line.

The FAA solicits comments from the aviation community regarding the likelihood of business closure. As noted previously, the FAA requests that all comments include supporting data.

Alternatives Considered

In accordance with the RFA, the FAA considered alternatives to the proposed rule to mitigate or eliminate significant economic impacts on small entities.

Alternative One – The FAA is promulgating this rule because the status quo alternative subjects the society to an unacceptably high aviation accident risk.

Alternative Two – The FAA considered extending the compliance time, but again the purpose of this proposed rule is to reduce the accident risk and postponing the compliance period extends this risk.

Alternative Three – The FAA did consider expanding the rule to include part 135 operators. All or nearly all of these operators are small entities. As the economic impact may be more severe, the agency wants to study the impact on these operators before proposing a rulemaking.

The FAA has tentatively determined that there are no reasonable alternatives to this rulemaking that would lessen the potential impact on a substantial number of small entities. The agency seeks comment on this assessment.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Public Law 104-4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a "significant regulatory action." The FAA currently uses an inflation-adjusted value of $143.1 million in lieu of $100 million. This proposed rule contains such a mandate; therefore, the requirements of Title II apply. The alternatives considered by the FAA are discussed above in the Summary of Benefits and Costs section.

Paperwork Reduction Act

This proposal contains the following new information collection requirements. As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA has submitted the information requirements associated with this proposal to the Office of Management and Budget for its review.

Title: Flightcrew Member Duty and Rest Requirements

Summary: The FAA is proposing data collection from air carriers certificated under Title 14 Code of Federal Aviation Regulations (14 CFR) part 121 as prescribed in 14 CFR part 117, Flight and Duty Limitations and Rest Requirements: Flightcrew Members. Two sections in the proposal drive this requirement, 14 CFR part 117, § 117.7 Schedule Reliability and § 117.31 Operations in Unsafe Areas. In accordance with these two sections, each affected air carrier is required to submit a report to the FAA detailing:

- Schedule reliability for each air carrier ongoing reportable of 2-month intervals,

- For those air carriers conducting operations under contract for the United States Government and exceeding the proposed requirements, ongoing reportable periods of 2-month intervals, and
- For those air carriers conducting operations not under contract for the United States Government and exceeding the proposed requirements, within 14 days of each occurrence, the air carrier relied on the relief granted under § 117.31 to reposition the aircraft to a safe region.

Use of: Maintaining schedule reliability is a critical element to fatigue mitigation. Air carriers build flight schedules projected to meet the constraints of individual FDP. If, however, actual flight time exceeds the projected (scheduled) flight time, the validity of the air carrier's scheduling process may come into question. This proposal places accountability upon each air carrier with regard to their scheduling practices and provides a means for the FAA to oversee the reliability of air carrier's scheduling process relative to the flightcrew members actual FDP as opposed to the flightcrew member's scheduled FDP.

The proposal defines a flight duty period as a period that begins when a flightcrew member is require to report for duty that includes a flight, a series of flights, or positioning flights, and ends when the aircraft is parked after the last flight and there is no intention for further aircraft movement by the same flightcrew member. If the air carrier's system-wide actual FDPs exceed the scheduled flight by more than five (5) percent or any actual FDP that exceeds the pairing-specific schedule by more than twenty (20) percent, the air carrier will be required to make adjustments to its schedule factoring in the actual time exceeded in order to reflect a more realistic schedule based upon actual

data. Under the proposal, each air carrier must make scheduling reliability adjustments to its schedule any time the aforementioned limitations have been exceeded. Additionally, each air carrier must submit an ongoing report on 2-month intervals detailing its overall schedule reliability and pairing-specific reliability.

This proposal provides relief for air carriers conducting operations into unsafe areas and repositioning the aircraft to another region for safety or a safe location where another crew can relieve the current crew from duty. As a result, these circumstances may result in a flightcrew member's FDP being exceeded for the day. The proposed section grants the air carrier authority to operate beyond the limits of the flightcrew's FDP to the extent of reaching a safe location where the crew must be relieved and/or go into required rest. However, by exercising such relief, the air carrier must report the occurrence to the FAA. The reporting requirements are different for air carriers operating under a contract with the United States Government and those who are not.

Air carriers under contract with the United States Government must submit a report every sixty (60) days detailing the number of times during the reporting period the air carrier relied on this relief, and for each occurrence, the reason for exceeding the FDP, the extent the FDP was exceeded and the reason the operation could not be completed consistent with part 117. If an air carrier does not rely on the proposed relief, there would be no obligation to report. If the air carrier is not under contract with the United States Government and relies on the proposed relief, it must submit a report within fourteen (14) days of each occurrence detailing the reason the FDP was exceeded, the extent the FDP was exceeded and the reason the operation could not be completed consistent with part 117.

Respondents (including number of): The number of likely respondents is 92. The likely respondents to this proposed information requirement are part 121 certificate holders.

Frequency: The FAA estimates each part 121 certificate holder will need to provide schedule reliability data every two months. Certificate holders regularly providing service to the United States government into unsafe areas may need to file reports as often as every two months. The FAA anticipates that certificate holders would only rarely need to fly into unsafe areas for reasons other than in support of U.S. government operations and estimates that fewer than five such reports would be filed each year.

Annual Burden Estimate:

This proposal would result in an annual recordkeeping and reporting burden as follows:

a. Number of respondents: 92

Scheduling and Schedule Reliability Reporting: 92

b. Total annual responses: 552

(92 carriers reporting 6 times each year: 92 x 6 = 552)

Scheduling and schedule reliability reporting: 552

1. Percentage of these responses collected electronically: 100%

Scheduling and Schedule Reliability Reporting: 100%

c. Total annual hours requested: 4,416 hours

(92 air carriers requiring 1 employee 8 hours to complete report:

92 x 1 x 8 = 4,416 hours)

Scheduling and schedule reliability reporting: 4,416

d. Current OMB inventory: 0 hours

Scheduling and schedule reliability reporting: 0

e. Difference: 4,416 hours

Scheduling and Schedule Reliability Reporting: 4,416

Annual reporting and recordkeeping cost burden (in thousands of dollars)

a. Total annualized capital/startup costs: $20,645

Scheduling and Schedule Reliability Reporting: $15

Fatigue Training

Fatigue Risk Management Systems: $20,630

b. Total annual cost ((O&M): $23,902

Scheduling and Schedule Reliability Reporting: $482

Fatigue Training: $23,420

Fatigue Risk Management Systems: $0

c. Total annualized costs requested: $44,547

Scheduling and Schedule Reliability Reporting: $497

Fatigue Training: $23,420

Fatigue Risk Management Systems: $20,630

d. Current OMB inventory: $0

Scheduling and Schedule Reliability Reporting: $0

Fatigue Training: $0

Fatigue Risk Management Systems: $0

e. .....Difference: $ 44,547

Scheduling and Schedule Reliability Reporting: $497

Fatigue Training: $23, 420

Fatigue Risk Management Systems: $20,630.....

The agency is soliciting comments to—

(1) Evaluate whether the proposed information requirement is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

(2) Evaluate the accuracy of the agency's estimate of the burden;

(3) Enhance the quality, utility, and clarity of the information to be collected; and

(4) Minimize the burden of collecting information on those who are to respond, including by using appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Individuals and organizations may send comments on the information collection requirement by [**Insert date 60 days after publication in the Federal Register**], and should direct them to the address listed in the Addresses section at the end of this preamble. Comments also should be submitted to the Office of Management and Budget, Office of Information and Regulatory Affairs, Attention: Desk Officer for FAA, New Executive Building, Room 10202, 725 17th Street, NW, Washington, DC 20053.

According to the 1995 amendments to the Paperwork Reduction Act (5 CFR 1320.8(b)(2)(vi)), an agency may not collect or sponsor the collection of information, nor may it impose an information collection requirement unless it displays a currently valid

OMB control number. The OMB control number for this information collection will be published in the Federal Register, after the Office of Management and Budget approves it.

Executive Order 13132, Federalism

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. The agency has determined that this action would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, would not have federalism implications.

Environmental Analysis

Environmental Analysis FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this proposed rulemaking action qualifies for the categorical exclusion identified in paragraph 312f and involves no extraordinary circumstances.

Regulations that Significantly Affect Energy Supply, Distribution, or Use

The FAA has analyzed this NPRM under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The agency has determined that it is not a "significant energy action" under the executive order because while a "significant regulatory action" under Executive

Order 12866, it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

Additional Information

Comments Invited:

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. It also invites comments relating to the economic, environmental, energy or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. To ensure the docket does not contain duplicate comments, please send only one copy of written comments, or if filing comments electronically, please submit your comments only one time.

The FAA will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. Before acting on this proposal, the agency will consider all comments we receive on or before the closing date for comments. It will consider comments filed after the comment period has closed if it is possible to do so without incurring expense or delay. The FAA may change this proposal in light of the comments we receive.

Proprietary or Confidential Business Information

Do not file in the docket information that you consider to be proprietary or confidential business information. Send or deliver this information directly to the legal contact person identified in the FOR FURTHER INFORMATION CONTACT section of

this document. You must mark the information that you consider proprietary or confidential. If you send the information on a disk or CD ROM, mark the outside of the disk or CD ROM and also identify electronically within the disk or CD ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), when the FAA is aware of proprietary information filed with a comment, the agency does not place it in the docket. It is held in a separate file to which the public does not have access, and a note is placed in the docket that the agency has received it. If the agency receives a request to examine or copy this information, it treats it as any other request under the Freedom of Information Act (5 U.S.C. 552). The FAA processes such a request under the DOT procedures found in 49 CFR part 7.

Availability of Rulemaking Documents

An electronic copy of rulemaking documents may be obtained using the Internet by—

1. Searching the Federal eRulemaking Portal (http://www.regulations.gov);
2. Visiting the FAA's Regulations and Policies web page at http://www.faa.gov/regulations_policies/; or
3. Accessing the Government Printing Office's web page at http://www.gpoaccess.gov/fr/index.html.

Alternatively, a copy may be requested directly from the FAA by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1,

800 Independence Avenue S.W, Washington, DC 20591, or by calling (202) 267-9680. Make sure to identify the docket number or notice number of this rulemaking.

All documents the FAA considered in developing this proposed rule, including economic analyses and technical reports, are located in the docket for this rulemaking and may be viewed on the internet through the Federal eRulemaking Portal referenced in paragraph (1).

List of Subjects

14 CFR Part 117

Airmen, Aviation safety, Reporting and recordkeeping requirements, Safety.

14 CFR Part 121

Air carriers, Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements, Safety.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend Chapter I of Title 14, Code of Federal Regulations, as follows:

1. Part 117 is added to read as follows:

PART 117—FLIGHT AND DUTY LIMITATIONS AND REST REQUIREMENTS: FLIGHTCREW MEMBERS

Sec.

117.1 Applicability.
117.3 Definitions.
117.5 Fitness for duty.
117.7 Fatigue risk management system.
117.9 Schedule reliability.
117.11 Fatigue education and training program.
117.13 Flight time limitation.
117.15 Flight duty period: Un-augmented operations.

117.17 Flight duty period: Split duty.
117.19 Flight duty period: Augmented flightcrew.
117.21 Reserve status.
117.23 Cumulative duty limitations.
117.25 Rest period.
117.27 Consecutive nighttime operations.
117.29 Deadhead transportation.
117.31 Operations into unsafe areas.
Table A to Part 117 – Maximum Flight Time Limits for Un-augmented Operations
Table B to Part 117 – Flight Duty Period: Un-augmented Operations
Table C to Part 117 – Flight Duty Period: Augmented Operations

Authority: 49 U.S.C. 106(g), 40113, 40119, 44101, 44701-44702, 44705, 44709-44711, 44713, 44716-44717, 44722, 46901, 44903-44904, 44912, 46105.

§ 117.1 Applicability.

This part prescribes flight and duty limitations and rest requirements for all flightcrew members and certificate holders conducting operations under part 121 of this chapter. This part also applies to all flightcrew members and part 121 certificate holders when conducting flights under part 91 of this chapter.

§ 117.3 Definitions.

In addition to the definitions in §§ 1.1 and 119.3 of this chapter, the following definitions apply to this part. In the event there is a conflict in definitions, the definitions in this part control.

Acclimated means a condition in which a crewmember has been in a theater for 72 hours or has been given at least 36 consecutive hours free from duty.

Airport/standby reserve means a defined duty period during which a crewmember is required by a certificate holder to be at, or in close proximity to, an airport for a possible assignment.

Augmented flightcrew means a flightcrew that has more than the minimum number of flightcrew members required by the airplane type certificate to operate the aircraft to allow a flightcrew member to be replaced by another qualified flightcrew member for in-flight rest.

Calendar day means a 24-hour period from 0000 through 2359.

Certificate holder means a person who holds or is required to hold an air carrier certificate or operating certificate issued under part 119 of this chapter.

Crew pairing means a flight duty period or series of flight duty periods assigned to a flightcrew member which originate or terminate at the flightcrew member's home base.

Deadhead transportation means transportation of a crewmember as a passenger, by air or surface transportation, as required by a certificate holder, excluding transportation to or from a suitable accommodation.

Duty means any task, other than long-call reserve, that a crewmember performs on behalf of the certificate holder, including but not limited to airport/standby reserve, short-call reserve, flight duty, pre- and post-flight duties, administrative work, training, deadhead transportation, aircraft positioning on the ground, aircraft loading, and aircraft servicing.

Duty period means a period that begins when a certificate holder requires a crewmember to report for duty and ends when that crew member is free from all duties.

Fatigue means a physiological state of reduced mental or physical performance capability resulting from lack of sleep or increased physical activity that can reduce a

crewmember's alertness and ability to safely operate an aircraft or perform safety-related duties.

Fatigue risk management system (FRMS) means a management system for an operator to use to mitigate the effects of fatigue in its particular operations. It is a data-driven process and a systematic method used to continuously monitor and manage safety risks associated with fatigue-related error.

Fit for duty means physiologically and mentally prepared and capable of performing assigned duties in flight with the highest degree of safety.

Flight duty period (FDP) means a period that begins when a flightcrew member is required to report for duty with the intention of conducting a flight, a series of flights, or positioning or ferrying flights, and ends when the aircraft is parked after the last flight and there is no intention for further aircraft movement by the same flightcrew member. A flight duty period includes deadhead transportation before a flight segment without an intervening required rest period, training conducted in an aircraft, flight simulator or flight training device, and airport/standby reserve.

Home base means the location designated by a certificate holder where a crew member normally begins and ends his or her duty periods.

Lineholder means a flightcrew member who has a flight schedule and is not acting as a reserve flightcrew member.

Long-call reserve means a reserve period in which a crewmember receives a required rest period following notification by the certificate holder to report for duty.

Physiological night's rest means the rest that encompasses the hours of 0100 and 0700 at the crewmember's home base, unless the individual has acclimated to a different

theater. If the crewmember has acclimated, the rest must encompass the hours of 0100 and 0700 at the acclimated location.

Report time means the time that the certificate holder requires a crewmember to report for a duty period.

Reserve availability period means a duty period during which a certificate holder requires a reserve crewmember on short call reserve to be available to receive an assignment for a flight duty period.

Reserve duty period means the time from the beginning of the reserve availability period to the end of an assigned flight duty period, and is applicable only to short call reserve.

Reserve flightcrew member means a flightcrew member who a certificate holder requires to be available to receive an assignment for duty.

Rest facility means a bunk, seat, room, or other accommodation that provides a crewmember with a sleep opportunity.

(1) Class 1 rest facility means a bunk or other surface that allows for a flat sleeping position and is located separate from both the flight deck and passenger cabin in an area that is temperature-controlled, allows the crewmember to control light, and provides isolation from noise and disturbance.

(2) Class 2 rest facility means a seat in an aircraft cabin that allows for a flat or near flat sleeping position; is separated from passengers by a minimum of a curtain to provide darkness and some sound mitigation; and is reasonably free from disturbance by passengers or crewmembers.

(3) Class 3 rest facility means a seat in an aircraft cabin or flight deck that reclines at least 40 degrees and provides leg and foot support.

Rest period means a continuous period determined prospectively during which the crewmember is free from all restraint by the certificate holder, including freedom from present responsibility for work should the occasion arise.

Scheduled means times assigned by a certificate holder when a crewmember is required to report for duty.

Schedule reliability means the accuracy of the length of a scheduled flight duty period as compared to the actual flight duty period.

Short-call reserve means a period of time in which a crewmember does not receive a required rest period following notification by the certificate holder to report for a flight duty period.

Split duty means a flight duty period that has a scheduled break in duty that is less than a required rest period.

Suitable accommodation means a temperature-controlled facility with sound mitigation that provides a crewmember with the ability to sleep in a bed and to control light.

Theater means a geographical area where local time at the crewmember's flight duty period departure point and arrival point differ by no more than 4 hours.

Unforeseen operational circumstance means an unplanned event beyond the control of a certificate holder of insufficient duration to allow for adjustments to schedules, including unforecast weather, equipment malfunction, or air traffic delay.

Window of circadian low means a period of maximum sleepiness that occurs between 0200 and 0559 during a physiological night.

§ 117.5 Fitness for duty.

(a) Each flightcrew member must report for any flight duty period rested and prepared to perform his or her assigned duties.

(b) No certificate holder may assign and no flightcrew member may accept assignment to a flight duty period if the flightcrew member has reported for a flight duty period too fatigued to safely perform his or her assigned duties or if the certificate holder believes that the flightcrew member is too fatigued to safely perform his or her assigned duties.

(c) No certificate holder may permit a flightcrew member to continue a flight duty period if the flightcrew member has reported himself too fatigued to continue the assigned flight duty period.

(d) Any person who suspects a flightcrew member of being too fatigued to perform his or her duties during flight must immediately report that information to the certificate holder.

(e) Once notified of possible flightcrew member fatigue, the certificate holder must evaluate the flightcrew member for fitness for duty. The evaluation must be conducted by a person trained in accordance with § 117.11 and must be completed before the flightcrew member begins or continues an FDP.

(f) As part of the dispatch or flight release, as applicable, each flightcrew member must affirmatively state he or she is fit for duty prior to commencing flight.

(g) Each certificate holder must develop and implement an internal evaluation and audit program approved by the Administrator that will monitor whether flightcrew members are reporting for FDPs fit for duty and correct any deficiencies.

§ 117.7 Fatigue risk management system.

(a) No certificate holder may exceed any provision of this part unless approved by the FAA under a Fatigue Risk Management System that provides at least an equivalent level of protection against fatigue-related accidents or incidents as the other provisions of this part.

(b) The Fatigue Risk Management System must include:

(1) A fatigue risk management policy.

(2) An education and awareness training program.

(3) A fatigue reporting system.

(4) A system for monitoring flightcrew fatigue.

(5) An incident reporting process.

(6) A performance evaluation.

(c) Whenever the Administrator finds that revisions are necessary for the continued adequacy of an FRMS that has been granted final approval, the certificate holder must, after notification, make any changes in the program deemed necessary by the Administrator.

§ 117.9 Schedule reliability.

(a) Each certificate holder must adjust within 60 days —

(1) Its system-wide flight duty periods if the total actual flight duty periods exceed the scheduled flight duty periods more than 5 percent of the time, and

(2) Any scheduled flight duty period that is shown to actually exceed the schedule 20 percent of the time.

(b) Each certificate holder must submit a report detailing the scheduling reliability adjustments required in paragraph (a) of this section to the FAA every two months detailing both overall schedule reliability and pairing-specific reliability. Submissions must consist of:

(1) The carrier's entire crew pairing schedule for the previous 2-month period, including the total anticipated length of each set of crew pairings and the regulatory limit on such pairings;

(2) The actual length of each set of crew pairings, and

(3) The percentage of discrepancy between the two data sets on both a cumulative, and a pairing-specific basis.

§ 117.11 Fatigue education and training program.

(a) Each certificate holder must develop and implement an education and training program, approved by the Administrator, applicable to all employees of the certificate holder responsible for administering the provisions of this rule including flightcrew members, dispatchers, individuals involved in the scheduling of flightcrew members, individuals involved in operational control, and any employee providing management oversight of those areas.

(b)(1) Initial training for all individuals listed in paragraph (a) of this section must consist of at least 5 programmed hours of instruction in the subjects listed in paragraph (b)(3) of this section.

(2) Recurrent training for all individuals listed in paragraph (a) of this section must be given on an annual basis and must consist of 2 programmed hours of instruction in the subjects listed in paragraph (b)(3) of this section.

(3) The fatigue education and training program must include information on—

(i) FAA regulatory requirements for flight, duty and rest and NTSB recommendations on fatigue management.

(ii) Basics of fatigue, including sleep fundamentals and circadian rhythms.

(iii) Causes of fatigue, including possible medical conditions.

(iv) Effect of fatigue on performance.

(v) Fatigue countermeasures.

(vi) Fatigue prevention and mitigation.

(vii) Influence of lifestyle, including nutrition, exercise, and family life, on fatigue.

(viii) Familiarity with sleep disorders and their possible treatments.

(ix) Responsible commuting.

(x) Flightcrew member responsibility for ensuring adequate rest and fitness for duty.

(xi) Operating through and within multiple time zones.

(c) Whenever the Administrator finds that revisions are necessary for the continued adequacy of a fatigue education and training program that has been granted final approval, the certificate holder must, after notification, make any changes in the program that are deemed necessary by the Administrator.

§ 117.13 Flight time limitation.

No certificate holder may schedule and no flightcrew member may accept an assignment or continue an assigned flight duty period if the total flight time:

(a) Will exceed the limits specified in Table A of this part if the operation is conducted with the minimum required flightcrew.

(b) Will exceed 16 hours if the operation is conducted with an augmented flightcrew.

§ 117.15 Flight duty period: Un-augmented operations.

(a) Except as provided for in § 117.17, no certificate holder may assign and no flightcrew member may accept an assignment for an unaugmented flight operation if the scheduled flight duty period will exceed the limits in Table B of this part.

(b) If the flightcrew member is not acclimated:

(1) The maximum flight duty period in Table B of this part is reduced by 30 minutes.

(2) The applicable flight duty period is based on the local time at the flightcrew member's home base.

(c) In the event unforeseen circumstances arise:

(1) The pilot in command and certificate holder may extend a flight duty period up to 2 hours.

(2) An extension in the flight duty period exceeding 30 minutes may occur only once in any 168 consecutive hour period, and never on consecutive days.

§ 117.17 Flight duty period: Split duty.

For a split duty period, a certificate holder may extend and a flightcrew member may accept a flight duty period up to 50 percent of time that the flightcrew member spent in a suitable accommodation up to a maximum flight duty period of 12 hours provided the flightcrew member is given a minimum opportunity to rest in a suitable accommodation of 4 hours, measured from the time the flightcrew member reaches the rest facility.

§ 117.19 Flight duty period: Augmented flightcrew.

The flight duty period limits in § 117.15 may be extended by augmenting the flightcrew.

(a) For flight operations conducted with an acclimated augmented flightcrew, no certificate holder may assign and no flightcrew member may accept an assignment if the scheduled flight duty period will exceed the limits specified in Table C of this part.

(b) If the flightcrew member is not acclimated:

(1) The maximum flight duty period in Table C of this part is reduced by 30 minutes.

(2) The applicable flight duty period is based on the local time at the flightcrew member’s home base.

(c) No certificate holder may assign and no flightcrew member may accept an assignment under this section unless during the flight duty period:

(1) Two consecutive hours are available for in-flight rest for the flightcrew member manipulating the controls during landing;

(2) A ninety minute consecutive period is available for in-flight rest for each flightcrew member; and

(3) The last flight segment provides an opportunity for in-flight rest in accordance with paragraph (c)(1) of this section.

(d) No certificate holder may assign and no flightcrew member may accept an assignment involving more than three flight segments under this section unless the certificate holder has an approved fatigue risk management system under § 117.7.

(e) At all times during flight, at least one flightcrew member with a PIC type-rating must be alert and on the flight deck.

(f) In the event unforeseen circumstances arise:

(1) The pilot in command and certificate holder may extend a flight duty period up to 3 hours.

(2) An extension in the flight duty period exceeding 30 minutes may occur only once in any 168 consecutive hour period.

§ 117.21 Reserve status.

(a) Unless specifically designated otherwise by the certificate holder, all reserve is considered long-call reserve.

(b) For airport/standby reserve, all time spent in a reserve status is part of the flightcrew member’s flight duty period.

(c) For short call reserve,

(1) All time within the reserve availability period is duty.

(2) The reserve availability period may not exceed 14 hours.

(3) No certificate holder may schedule and no reserve flightcrew member on short call reserve may accept an assignment of a flight duty period that begins before the flightcrew member's next reserve availability period unless the flightcrew member is given at least 14 hours rest.

(4) The maximum reserve duty period for un-augmented operations is the lesser of –

(i) 16 hours, as measured from the beginning of the reserve availability period;

(ii) The assigned flight duty period, as measured from the start of the flight duty period; or

(iii) The flight duty period in Table B of this part plus 4 hours, as measured from the beginning of the reserve availability period.

(iv) If all or a portion of a reserve flightcrew member's reserve availability period falls between 0000 and 0600, the certificate holder may increase the maximum reserve duty period in paragraph (c)(4)(iii) of this section by one-half of the length of the time during the reserve availability period in which the certificate holder did not contact the flightcrew member, not to exceed 3 hours.

(5) The maximum reserve duty period for augmented operations is the lesser of –

(i) The assigned flight duty period, as measured from the start of the flight duty period; or

(ii) The flight duty period in Table C of this part plus 4 hours, as measured from the beginning of the reserve availability period.

(iii) If all or a portion of a reserve flightcrew member's reserve availability period falls between 0000 and 0600, the certificate holder may increase the maximum reserve duty period in paragraph (c)(5)(ii) of this section by one-half of the length of the time during the reserve availability period in which the certificate holder did not contact the flightcrew member, not to exceed 3 hours.

(d) For long call reserve,

(1) The period of time that the flightcrew member is in a reserve status does not count as duty.

(2) If a certificate holder contacts a flightcrew member to assign him or her to a flight duty period or a short call reserve, the flightcrew member must receive the required rest period specified in § 117.25 prior to reporting for the flight duty period or commencing the short call reserve duty.

(3) If a certificate holder contacts a flightcrew member to assign him or her to a flight duty period that will begin before and operate into the flightcrew member's window of circadian low, the flightcrew member must receive a 12 hour notice of report time from the air carrier.

(e) An air carrier may shift a reserve flightcrew member's reserve availability period under the following conditions:

(1) A shift to a later reserve availability period may not exceed 12 hours.

(2) A shift to an earlier reserve availability period may not exceed 5 hours, unless the shift is into the flightcrew member's window of circadian low, in which case the shift may not exceed 3 hours.

(3) A shift to an earlier reserve period may not occur on any consecutive calendar days.

(4) The total shifts in a reserve availability period in paragraphs (e)(1) through (e)(3) of this section may not exceed a total of 12 hours in any 168 consecutive hours.

§ 117.23 Cumulative duty limitations.

(a) The limitations of this section on flightcrew members apply to all commercial flying by the flightcrew member during the applicable periods.

(b) No certificate holder may schedule and no flightcrew member may accept an assignment if the flightcrew member's total flight time will exceed the following:

(1) 100 hours in any 28 consecutive calendar day period and

(2) 1,000 hours in any 365 consecutive calendar day period.

(c) No certificate holder may schedule and no flightcrew member may accept an assignment if the flightcrew member's total Flight Duty Period will exceed:

(1) 60 flight duty period hours in any 168 consecutive hours and

(2) 190 flight duty period hours in any 672 consecutive hours.

(d) Except as provided for in paragraph (d)(3) of this section, no certificate holder may schedule and no flightcrew member may accept an assignment if the flightcrew member's total duty period will exceed:

(1) 65 duty hours in any 168 consecutive hours and

(2) 200 duty hours in any 672 consecutive hours.

(3) If a flightcrew member is assigned to short-call reserve or a certificate holder transports a flightcrew member in deadhead transportation in, at a minimum, a seat in aircraft cabin that allows for a flat or near flat sleeping position, the total duty period may not exceed:

(i) 75 duty hours in any 168 consecutive hours and

(ii) 215 duty hours in any 672 consecutive hours.

(4) Extension of the duty period under paragraph (d)(3) of this section is limited to the amount of time spent on short-call reserve or in deadhead transportation.

§ 117.25 Rest period.

(a) No certificate holder may assign and no flightcrew member may accept assignment to any reserve or duty with the certificate holder during any required rest period.

(b) Before beginning any reserve or flight duty period, a flightcrew member must be given at least 30 consecutive hours free from all duty in any 168 consecutive hour period, except that:

(1) If a flightcrew member crosses more than four time zones during a series of flight duty periods that exceed 168 consecutive hours, the flightcrew member must be given a minimum of three physiological nights rest upon return to home base.

(2) A flightcrew member operating in a new theater must receive 36 hours of consecutive rest in any 168 consecutive hour period.

(c) No certificate holder may reduce a rest period more than once in any 168 consecutive hour period.

(d) No certificate holder may schedule and no flightcrew member may accept an assignment for reserve or a flight duty period unless the flightcrew member is given a rest period of at least 9 consecutive hours before beginning the reserve or flight duty period measured from the time the flightcrew member reaches the hotel or other suitable accommodation.

(e) In the event of unforeseen circumstances, the pilot in command and certificate holder may reduce the 9 consecutive hour rest period in paragraph (d) of this section to 8 consecutive hours.

§ 117.27 Consecutive nighttime operations.

No certificate holder may schedule and no flightcrew member may accept more than three consecutive nighttime flight duty periods unless the certificate holder provides an opportunity to rest during the flight duty period in accordance with § 117.17.

§ 117.29 Deadhead transportation.

(a) All time spent in deadhead transportation is considered part of a duty period.

(b) Time spent in deadhead transportation is considered part of a flight duty period if it occurs before a flight segment without an intervening required rest period.

(c) Time spent entirely in deadhead transportation during a duty period may not exceed the flight duty period in Table B of this part for the applicable time of start plus 2 hours unless the flightcrew member is given a rest period equal to the length of the deadhead transportation but not less than the required rest in § 117.25 upon completion of such transportation.

§117.31 Operations into unsafe areas.

(a) This section applies to operations that cannot otherwise be conducted under this part because of unique circumstances that could prevent flightcrew members from being relieved by another crew or safely provided with the rest required under § 117.25 at the end of the applicable flight duty period.

(b) A certificate holder may exceed the maximum applicable flight duty periods to the extent necessary to allow the flightcrew to fly to a destination where they can safely be relieved from duty by another flightcrew or can receive the requisite amount of rest prior to commencing their next flight duty period.

(c) The flightcrew shall be given a rest period immediately after reaching the destination described in paragraph (b) of this section equal to the length of the actual flight duty period or 24 hours, whichever is less.

(d) No extension of the cumulative fatigue limitations in § 117.3 is permitted.

(e) If the operation was conducted under contract with an agency or department of the United States Government, each affected air carrier must submit a report every 60 days detailing the –

(1) Number of times in the reporting period it relied on this section to conduct its operations.

(2) For each occurrence,

(i) The reasons for exceeding the applicable flight duty period;

(ii) The extent to which the applicable flight duty period was exceeded; and

(iii) The reason the operation could not be completed consistent with the requirements of this part.

(f) If the operation was not conducted under contract with an agency or Department of the United States Government, each affected air carrier must submit a report within 14 days of each occurrence detailing –

(1) The reasons for exceeding the applicable flight duty period;

(2) The extent to which the applicable flight duty period was exceeded; and

(3) The reason the operation could not be completed consistent with the requirements of this part.

(g) Should the Administrator determine that a certificate holder is relying on the provisions on this section, the Administrator may require the certificate holder to develop and implement a fatigue risk management system.

Table A to Part 117—Maximum Flight Time Limits for Un-augmented Operations

Time of Start (Home Base)	Maximum Flight Time (hours)
0000-0459	8
0500-0659	9
0700-1259	10
1300-1959	9
2000-2359	8

Table B to Part 117—Flight Duty Period: Un-augmented Operations

Time of Start (Home Base or Acclimated)	Maximum Flight Duty Period (hours) for Lineholders Based on Number of Flight Segments						
	1	2	3	4	5	6	7+
0000-0359	9	9	9	9.	9	9	9
0400-0459	10	10	9	9	9	9	9
0500-0559	11	11	11	11	10	9.5	9
0600-0659	12	12	12	12	11.5	11	10.5
0700-1259	13	13	13	13	12.5	12	11

Time of Start (Home Base or Acclimated)	Maximum Flight Duty Period (hours) for Lineholders Based on Number of Flight Segments						
	1	2	3	4	5	6	7+
1300-1659	12	12	12	12	11.5	11	10.5
1700-2159	11	11	10	10	9.5	9	9
2200-2259	10.5	10.5	9.5	9.5	9	9	9
2300-2359	9.5	9.5	9	9	9	9	9

Table C to Part 117—Flight Duty Period: Augmented Operations

Time of Start (Local Time)	Maximum Flight Duty Period (hours) Based on Rest Facility and Number of Pilots					
	Class 1 Rest Facility		Class 2 Rest Facility		Class 3 Rest Facility	
	3 Pilots	4 Pilots	3 Pilots	4 Pilots	3 Pilots	4 Pilots
0000-0559	14	16	13	14.5	12	12.5
0600-0659	15	17.5	14	15.5	13	13.5
0700-1259	16	18	15.5	17	14	14.5
1300-1659	15	17.5	14	15.5	13	13.5
1700-2359	14	16	13	14.5	12	12.5

PART 121 – OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

2. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 44101, 44701-44702, 44705, 44709-44711, 44713, 44716-44717, 44722, 46901, 44903-44904, 44912, 46105.

Subpart Q [Removed and Reserved]

3. Remove and reserve subpart Q, consisting of §§ 121.470 and 121.471.

Subpart R [Removed and Reserved]

4. Remove and reserve subpart R, consisting of §§ 121.480 through 121.493.

Subpart S [Removed and Reserved]

5. Remove and reserve subpart S, consisting of §§ 121.500 through 121.525.

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Raymond Towles

Acting Director, Flight Standards Service
Aviation Safety