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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 117, 119, and 121

[Docket No. FAA–2009–1093; Amdt. Nos. 117–1, 119–16, 121–357]

RIN 2120–AJ58

Flightcrew Member Duty and Rest Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This rule amends the FAA's existing flight, duty and rest regulations applicable to certificate holders and their flightcrew members operating under the domestic, flag, and supplemental operations rules. The rule recognizes the universality of factors that lead to fatigue in most individuals and regulates these factors to ensure that flightcrew members in passenger operations do not accumulate dangerous amounts of fatigue. Fatigue threatens aviation safety because it increases the risk of pilot error that could lead to an accident. This risk is heightened in passenger operations because of the additional number of potentially impacted individuals. The new requirements eliminate the current distinctions between domestic, flag and supplemental passenger operations. The rule 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: Effective January 14, 2014.

ADDRESSES: For information on where to obtain copies of rulemaking documents and other information related to this final rule, see ''How To Obtain Additional Information'' in the **SUPPLEMENTARY INFORMATION** section of this document.

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SUPPLEMENTARY INFORMATION:

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. This rulemaking is also promulgated under the authority described in 49 U.S.C. 44701(a)(4), which requires the Administrator to promulgate regulations in the interest of safety for the maximum hours or periods of service of airmen and other employees of air carriers.

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I. Overview of Final Rule

The FAA is issuing this final rule to address the risk that fatigue poses to passenger operations conducted under 14 CFR part 121. Part 121 applies to the majority of flights flown by the American public. As such, changes to the existing flight, duty and rest rules in part 121 will directly affect the flying public. This rule applies to all part 121 passenger operations, including traditional scheduled service and large charter operations. The FAA has removed the existing distinctions between domestic, supplemental and flag passenger operations because the factors leading to fatigue are universal and addressing the risk to the flying public should be consistent across the different types of operations.

This final rule addresses fatigue risk in several ways. The underlying philosophy of the rule is that no single element of the rule mitigates the risk of fatigue to an acceptable level; rather, the FAA has adopted a system approach, whereby both the carrier and the pilot accept responsibility for mitigating fatigue. The carrier provides an environment that permits sufficient sleep and recovery periods, and the crewmembers take advantage of that environment. Both parties must meet their respective responsibilities in order to adequately protect the flying public.

The final rule recognizes the natural circadian rhythms experienced by most people that causes them to be naturally more tired at night than during the day. Under the final rule, flightcrew members will be able to work longer hours during the day than during the night. Significant changes in time zones, a situation unique to aviation, are accounted for to reduce the risk to the flying public posed by ''jetlag''.

The FAA has decided against adopting various provisions proposed in the NPRM. The final rule does not apply to all-cargo operations, although those carriers have the ability to fly under the new rules if they so choose. The proposal that carriers meet certain schedule reliability requirements has been dropped, as has the proposed requirement that carriers evaluate flightcrew members for fatigue. The FAA has determined that these provisions were either overly costly or impractical to implement.

1. Fitness for Duty

This rule places a joint responsibility on the certificate holder and each flightcrew member. In order for the flightcrew member to report for an FDP properly rested, the certificate holder must provide the flightcrew member

with a meaningful rest opportunity that will allow the flightcrew member to get the proper amount of sleep. Likewise, the flightcrew member bears the responsibility of actually sleeping during the rest opportunity provided by the certificate holder instead of using that time to do other things. The consequence of a flightcrew member reporting for duty without being properly rested is that he or she is prohibited from beginning or continuing an FDP until he or she is properly rested.

2. Fatigue Education and Training

Part 121 air carriers are currently statutorily-required to annually provide, as part of their Fatigue Risk Management Plan, fatigue-related education and training to increase the trainees' awareness of: (1) Fatigue; (2) ''the effects of fatigue on pilots;'' and (3) ''fatigue countermeasures.'' Today's rule adopts the same standard of training as required by the statute. In addition, today's rule adopts a mandatory update of the carriers' education and training program every two years, as part of the update to their FRMP. Both of these regulatory provisions merely place the existing statutory requirements in the new flight and duty regulations for the ease and convenience of the regulated parties and the FAA.

3. Fatigue Risk Management System

The FAA proposed a Fatigue Risk Management System (FRMS) as an alternative regulatory approach to provide a means of monitoring and mitigating fatigue. Under an FRMS, a certificate holder develops processes that manage and mitigate fatigue and meet an equivalent level of safety. The FAA is adopting that proposal largely as proposed. The FAA has also decided to extend the voluntary FRMS program to all-cargo operations, which are not required to operate under part 117. Under the FRMS provisions that this rule adds to subparts Q, R, and S of part 121, an all-cargo operator that does not wish to operate under part 117 can nevertheless utilize an FRMS as long as it has the pertinent FAA approval.

4. Unaugmented Operations

One of the regulatory concepts that this rule introduces is the restriction on flightcrew members' maximum Flight Duty Period (FDP). In creating a maximum FDP limit, the FAA attempted to address three concerns. First, flightcrew members' circadian rhythms needed to be addressed because studies have shown that flightcrew members who fly during their window of circadian low (WOCL) can experience severe performance degradation. Second, the amount of time spent at work needed to be taken into consideration because longer shifts increase fatigue. Third, the number of flight segments in a duty period needed to be taken into account because flying more segments requires more takeoffs and landings, which are both the most task-intensive and the most safety-critical stages of flight. To address these concerns, the FAA is adopting as part of the regulatory text a table limiting maximum FDP based on the time of day and the number of segments flown during the FDP period. Under today's rule an FDP begins when a flightcrew member is required to report for duty that includes a flight and ends when the aircraft is parked after the last flight and there is no plan for further aircraft movement by the same flightcrew member. The maximum FDP limit is reduced during nighttime hours to account for being awake during the WOCL; when an FDP period consists of multiple flight segments in order to account for the additional time on task; and if a flightcrew member is unacclimated to account for the fact that the unacclimated flightcrew member's circadian rhythm is not in sync with the theater in which he or she is operating. Actual time at the controls (flight time) is limited to 8 or 9 hours, depending on the time of day that the FDP commences.

5. Augmented Operations

In order to accommodate common operational practices, the final rule allows longer duty periods in instances where the carrier provides additional crew and adequate on-board rest facilities. The extended FDPs are laid out in a table and provide maximum credit when an operator employs a 4-man crew and provides the highest quality on-board rest facility.

6. Extensions of Flight Duty Periods

This rule sets forth the limits on the number of FDPs that may be extended; implements reporting requirements for affected FDPs; and distinguishes extended FDPs due to unforeseen operational circumstances that occur prior to takeoff from those unforeseen operational circumstances that arise after takeoff. The FAA agrees that an extension must be based on exceeding the maximum FDP permitted in the regulatory tables rather than on the times that the air carrier had originally intended for an FDP, which may be considerably less than the tables allow. It is unreasonable to limit extensions on FDPs that are less than what the certificate holder can legally schedule. In addition, there is a 30-minute buffer attached to each FDP to provide certificate holders with the flexibility to deal with delays that are minimal.

7. Split Duty

Split duty rest breaks provide carriers with nighttime operations with additional flexibility. Typically split duty rest would benefit carriers who conduct late night and early morning operations where the flightcrew members would typically be afforded some opportunity to sleep, but would not receive a legal rest period. Under today's rule split duty rest must be at least 3 hours long and must be scheduled in advance. The actual split duty rest breaks may not be shorter than the scheduled split duty rest breaks. The rationale for this is that flightcrew members must, at the beginning of their FDP, evaluate their ability to safely complete their entire assigned FDP. In order to do so, they must not only know the length of the FDP, but any scheduled split duty rest breaks that they will receive during the FDP.

8. Consecutive Night Operations

In formulating this rule, the FAA was particularly concerned about cumulative fatigue caused by repeatedly flying at night. Modeling shows substantially deteriorating performance after the third consecutive nighttime FDP for flightcrew members who worked nightshifts during their WOCL and obtained sleep during the day. However, if a sleep opportunity is provided during each nighttime FDP, that sleep opportunity may sustain flightcrew member performance for five consecutive nights. Based on modeling results, the FAA has determined that a 2-hour nighttime sleep opportunity each night improves pilot performance sufficient to allow up to 5 nights of consecutive nighttime operations.

9. Reserve

The FAA has decided to rely on the expertise represented in the ARC to address the issue of reserve duty. The adopted regulatory provisions addressing reserve and unaugmented operations provide that the total number of hours a flightcrew member may spend in a flight duty period and reserve availability period may not exceed 16 hours or the maximum applicable flight duty period table plus four hours, whichever is less. This will allow most FDPs to be accommodated by a flightcrew member on short-call reserve. This rule adopts the proposal that limits the short-call reserve availability period, in which the

flightcrew member is not called to report to work, to 14 hours.

10. Cumulative Limits

The FAA is adopting cumulative limits for FDP and flight-time limits. The FAA has decided to retain both of these cumulative limits because (1) the FDP limits restrict the amount of cumulative fatigue that a flightcrew member accumulates before and during flights; and (2) the flight-time limits allow the FAA to provide air carriers with more scheduling flexibility by setting higher cumulative FDP limits in this rule. This additional scheduling flexibility justifies the added restrictions on cumulative flight time, which can easily be tracked by scheduling programs currently in use throughout the industry. The FAA has decided to eliminate the cumulative duty-period limits, which should greatly simplify compliance with this section.

11. Rest

Carriers will be required to provide their crew with a 10-hour rest opportunity prior to commencing a duty period that includes flying. While the 10-hour rest period may include the amount of time it takes to get to or from a flightcrew member's house or hotel room, the actual amount of time required for a sleep opportunity may not be reduced below 8 hours. In addition, the length of continuous time off during a 7-day period has been extended from 24 hours under the existing rules to 30 hours. Additional time off is required for individuals whose internal clock may be off because of flipping back and forth between different time zones.

12. Emergency and Government Sponsored Operations

This rulemaking also addresses operations that require flying into or out of hostile areas, and politically sensitive, remote areas that do not have rest facilities. These operations range from an emergency situation to moving armed troops for the U.S. military, conducting humanitarian relief, repatriation, Air Mobility Command (AMC), and State Department missions. The applicability provision of this section now specifically articulates the two categories of operations that are affected. This section applies to operations conducted pursuant to contracts with the U.S. Government department and agencies. This section also applies to operations conducted pursuant to a deviation issued by the Administrator under § 119.57 that authorizes an air carrier to deviate from the requirements of parts 121 and 135 to perform emergency operations. This authority is issued on a case-by-case basis during an emergency situation as determined by the Administrator. The FAA concludes that these two categories are the only types of operations that warrant separate consideration because of the unique operating circumstances that otherwise limit a certificate holder's flexibility to deal with unusual circumstances.

Costs and Benefits

We have analyzed the benefits and the costs associated with the requirements contained in this final rule. We provide a range of estimates for our quantitative benefits. Our base case estimate is $376 million ($247 million present value at 7% and $311 million at 3%) and our high case estimate is $716 million ($470 million present value at 7% and $593 million at 3%). The FAA believes there are also not-quantified benefits to the rule that, when added to the base case estimate, make the rule cost beneficial. The total estimated cost of the final rule is $390 million ($297 million present value at 7% and $338 million at 3%).

SUMMARY OVER A 10 YEAR PERIOD

Total quantified benefits			
Estimate	Nominal (millions)	PV at 7% (millions)	PV at 3% (millions)
Base	$376	$247	$311
High	716	470	593
Total quantified costs			
Component	Nominal (millions)	PV at 7% (millions)	PV at 3% (millions)
Flight Operations	$236	$157	$191
Rest Facilities	138	129	134
Training	16	11	13
Total	390	297	338

The FAA has made significant changes to the final rule since the NPRM. The training requirement has been substantially reduced because the FAA has determined that pilots are already receiving the requisite training as part of the statutorily required Fatigue Risk Management Plans. The FAA also has removed all-cargo operations from the applicability section of the new part 117 because their compliance costs significantly exceed the quantified societal benefits.[1] All-cargo carriers may choose to comply with the new part 117 but are not required to do so. Since the carrier would decide voluntarily to comply with the new requirements, those costs are not attributed to the costs of this rule. The costs associated with the rest facilities occur in the two years after the rule is published. The other costs of the rule and the benefits are then estimated over the next ten years.

[1] The projected cost for all-cargo operations is $306 million ($214 million present value at 7% and $252 million at 3%). The projected benefit of avoiding one fatal all-cargo accident ranges between $20.35 million and $32.55 million, depending on the number of crewmembers on board the aircraft.

II. Background

On September 14, 2010, the FAA published a Flightcrew Member Duty and Rest Requirements notice of proposed rulemaking (NPRM) setting out proposed flight, duty, and rest regulations intended to limit flightcrew member fatigue in part 121 operations. These proposed regulations applied to all operations conducted pursuant to part 121, and the regulations would

have imposed, among other things, the following limits/requirements: (1) A requirement that a flightcrew member must notify the certificate holder (air carrier) when he or she is not fit for duty and that a certificate holder must also independently evaluate its flightcrew members for fitness for duty; (2) a limit on daily flight duty period (FDP) and flight-time hours that varies depending on the time of day that the FDP begins; (3) cumulative limits on FDPs, flight times, and duty periods; (4) a schedule reliability requirement, which stated that a certificate holder's scheduled FDPs must be at least 95% consistent with actual FDPs; (5) a requirement that a flightcrew member be provided with at least 9 consecutive hours of rest between FDPs, as measured from the time the flightcrew member reaches a suitable accommodation; and (6) credit for employing fatigue-mitigating measures such as split-duty rest and augmentation.

The FAA received over 8,000 comments in response to the NPRM. In response to the comments, the FAA has made a number of changes to the regulatory provisions proposed in the NPRM. These changes include the following:

- The mandatory provisions of the NPRM do not apply to all-cargo operations. Instead, this rule permits all-cargo operations to voluntarily opt into the new flight, duty, and rest limitations imposed by this rule.
- Certificate holders are no longer required to independently verify whether flightcrew members are fit for duty.
- Most of the daily FDP limits have been increased to provide certificate holders with more scheduling flexibility. One of the daily flight-time limits has been decreased to address safety considerations.
- The cumulative duty-period limit has been removed from this rule.
- The schedule-reliability requirement has been largely removed from the final rule. The remaining parts of the schedule-reliability process have been changed to only apply to instances in which a flightcrew member exceeds the FDP and/or flight-time limits imposed by this rule.
- The flightcrew member must now be provided with 10 hours of rest between FDP periods, but that rest is measured from the time that the flightcrew member is released from duty. The rest must provide for an 8-hour sleep opportunity.
- The amount of credit provided for split-duty rest and augmentation has been increased, and changes to the final rule make these credits easier to obtain.

The changes listed above are just some of the amendments that were made to the NPRM in response to the comments. The Discussion of Public Comments and Final Rule section of this preamble contains a discussion of the changes that were made to the NPRM in response to issues raised by the commenters.

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 in flight, 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 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 for a long period of time 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 he or she would have received with 8 hours of sleep a night.
- *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.

Scientific research and experimentation have consistently demonstrated that adequate sleep sustains performance. For most people, 8 hours of sleep in each 24-hour period sustains performance indefinitely. Sleep opportunities during the WOCL are preferable because sleep that occurs during the WOCL provides the most recuperative value. 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. [2]

Several aviation-specific work schedule factors [3] 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

[2] 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.

[3] 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.

periods, and day-to-night or night-to-day transitions.

The FAA believes that its current regulations do not adequately address the risk of fatigue. The impact of this risk is greater in passenger operations due to the number of persons placed at risk. Presently, flightcrew members are effectively allowed to work up to 16 hours a day (regardless of the time of 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 National Transportation Safety Board repeatedly notes, the FAA's regulations do not account for the impact of circadian rhythms on alertness. The entire set of regulations is overly complicated, with a different set of regulations for domestic operations, flag operations, and supplemental operations. In addition, these regulations do not consider other factors that can lead to varying degrees of fatigue. Instead, each set of operational rules (*i.e.* those applicable to domestic, flag, or supplemental operations) sets forth a singular approach toward addressing fatigue, regardless of the operational circumstances that may be more or less fatiguing.[4]

B. National Transportation Safety Board (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.[5]

In February 2006 the NTSB issued safety recommendations after a BAE–J3201 operated under part 121 by Corporate Airlines 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 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 a Fatigue Risk Management System (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. Flight and Duty Time Limitations and Rest Requirements Aviation Rulemaking Committee

As part of this rulemaking action, the FAA chartered an aviation rulemaking committee (ARC) on June 24, 2009. The FAA brought together pilots, airlines, and scientific experts to collaborate and develop options for an FAA-proposed rulemaking to help mitigate pilot fatigue. The ARC provided a forum for the U.S. aviation community to discuss current approaches to mitigate fatigue found in international standards (*e.g.,* the International Civil Aviation Organization (ICAO) standard, the United Kingdom Civil Aviation Publication (CAP) 371, and the European Aviation Safety Agency

[4] While several of the commenters have claimed that the NPRM proposed a ''one-size-fits-all'' regulatory structure, the FAA believes this suggestion is misleading. In the NPRM, and in the final rule with regard to passenger-carrying operations, the FAA has eliminated distinctions between domestic, flag, and supplemental operations, but in all of these operations, the rule imposes differing requirements based on the operating environment.

[5] 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.

Notice of Proposed Amendment). The ARC provided its report, a copy of which is in this rulemaking docket, to the agency on September 9, 2009.

D. Congressional Mandate

On August 1, 2010, the President signed the Airline Safety and Federal Aviation Administration Extension Act of 2010 (Pub. L. 111–216). Section 212 of Public Law 111–216 required ''the FAA Administrator to issue regulations to limit the number of flight and duty time hours allowed for pilots to address pilot fatigue.'' This section, in subsection 212(a)(3), set a deadline of 180 days for the FAA to publish an NPRM and 1 year for the FAA to issue a final rule.

E. Notice of Proposed Rulemaking

On September 14, 2010, the FAA published in the **Federal Register** the Flightcrew Member Duty and Rest Requirements NPRM.[6] The NPRM proposed to amend the FAA's existing flight, duty, and rest regulations applicable to certificate holders and their flightcrew members. The proposal recognized the factors that lead to fatigue in most individuals, and it proposed to regulate these factors to ensure that flightcrew members do not accumulate dangerous amounts of fatigue. Because the proposed rule addressed fatigue factors that apply universally, the proposed requirements eliminated the existing distinctions between domestic, flag and supplemental operations. The proposal also provided 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.

The NPRM provided for a 60-day comment period, which ended on November 15, 2010. Following publication of the NPRM, the FAA received a number of requests to extend the comment period and to clarify various sections of the preamble, regulatory text, and the Regulatory Impact Analysis (RIA). In response, the agency published two actions in the **Federal Register**.

The first action was a ''Notice of procedures for submission of clarifying questions.''[7] Persons asking for clarifications were advised to file their questions to the rulemaking docket by October 15, 2010. The FAA said it would respond by October 22, 2010. On October 22, 2010, the agency filed two response documents to the rulemaking docket: ''Response to Clarifying Questions to the RIA'' and ''Response to Clarifying Questions to the NPRM.''

The second action was a ''Response to requests for a comment period extension.''[8] The FAA provided notice that the comment period would not be extended. The agency's rationale for this decision is outlined in the October 15, 2010 action.

The FAA received more than 8,000 comment submissions, containing multiple comments on various sections of the preamble and the rule. Many comment submissions also included specific recommendations for changes and clarifications.

III. Discussion of Public Comments and Final Rule

A. Applicability

In the NPRM, the FAA stated that fatigue factors are ''universal.''[9] The FAA noted that sleep science, while still evolving, was clear in several 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.

Id. In light of its determination concerning the universal applicability of factors underlying fatigue, the FAA proposed a single set of flight, duty, and rest regulations that would regulate these factors. The proposed regulations would have been applicable to all part 121 domestic, flag, and supplemental operations. The proposed regulations would also have applied to all part 91 flights conducted by part 121 certificate holders, including flights, such as ferry flights, that have historically been conducted under part 91. The NPRM also stated that ''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 its rulemaking initiative.'' *Id.* The comments received in response to the proposed applicability of this rule and the corresponding FAA responses are included below.

The National Air Carrier Association (NACA) and a number of air carriers operating non-scheduled flights objected to the proposed rule applying to supplemental operations. These industry commenters stated that non-scheduled operations require additional scheduling flexibility because they are fundamentally different from scheduled operations. The industry commenters stated that, unlike scheduled operations, non-scheduled operations provide on-demand operations on behalf of private and government consumers on a timetable that is determined by the consumer. According to the industry commenters, non-scheduled carriers do not have regularly-set schedules that they know months in advance, but are instead called to fly with little advance notice, making it more difficult to plan flightcrew member flight times and rest periods. The industry commenters emphasized that this difficulty is exacerbated by the fact that non-scheduled operations' flight times (especially departure times) are controlled largely by the consumer and not the air carrier.

The non-scheduled industry commenters also asserted that non-scheduled carriers serve remote, sometimes hostile locations, with no established crew bases. Thus, they do not have the same extensive infrastructure that scheduled operations have access to and must deadhead flightcrew members into remote locations in order to be able to swap out flightcrew members during an operation. These commenters emphasized that the certificate holders running non-scheduled operations are largely small businesses that will have difficulty adjusting to the burdens imposed by this rule.

Based on the differences between non-scheduled and scheduled operations, the industry commenters stated that a ''one-size-fits-all'' approach does not work for non-scheduled operations. The industry commenters stated that the existing regulations governing supplemental operations have existed for over 60 years, and that changing these regulations will adversely affect air security and national defense missions conducted through the use of non-scheduled operations. The commenters emphasized that the existing supplemental flight, duty, and rest regulations ensure aviation safety by containing additional rest requirements that are not a part of this rule. In conclusion, the industry commenters suggested that the FAA either: (1) Retain the existing flight, duty, and rest regulations governing supplemental operations, and/or (2) adopt the alternative proposal put forward by the industry commenters.

In addition to the concerns expressed by non-scheduled air carriers, the Cargo Airline Association (CAA) and a number of air carriers operating all-cargo flights have also objected to the

[6] 75 FR 55852; September 14, 2010.

[7] 75 FR 62486; October 12, 2010.

[8] 75 FR 63424; October 15, 2010.

[9] 75 FR 55852, 55857 (Sep. 14, 2010).

proposed rule applying to supplemental operations. These industry commenters asserted that, while a passenger-operation accident can result in numerous fatalities, an all-cargo accident would consist primarily of property damage.

The commenters also stated that the cargo industry is composed of both scheduled and on-demand operators, and that it specializes in express delivery services. To effectuate these express delivery services, some all-cargo carriers do not maintain U.S. domicile bases and regularly operate long-haul flights and point-to-point operations outside the United States, traveling across multiple time zones at all hours of the day and night. The industry commenters also stated that all-cargo carriers regularly operate around the world in all directions with extended overseas routings, not with quick overnight turns at foreign destinations. This results in a lower aircraft utilization rate than domestic passenger operations. According to the industry commenters, these types of nighttime and around-the-world operations are the norm for all-cargo carriers.

The all-cargo industry commenters added that, similar to non-scheduled operations, some all-cargo operations also fly to remote, undeveloped, and sometimes hostile locations. According to the industry commenters, these types of operations are driven by the same considerations as similar non-scheduled operations: (1) The schedule is determined primarily by the customer, and (2) there is a lack of infrastructure, which necessitates deadheading in flightcrew members. The industry commenters emphasized that many all-cargo carriers currently provide their flightcrew members with split duty rest while cargo is being sorted at sorting facilities, and that the carriers have invested millions of dollars in high-quality rest facilities. The industry commenters also stated that flightcrew members working in all-cargo operations fly fewer total hours than their passenger-transporting counterparts. The industry commenters concluded by asking the FAA to either: (1) Retain the existing flight, duty, and rest regulations that govern supplemental operations, or (2) adopt the alternative proposal that they have included in their comments.

Conversely, a number of labor groups submitted comments approving of a single flight, duty, and rest standard. These groups stated that they were ''pleased that the FAA has acknowledged the current science and recognizes that pilot fatigue does not differ whether the pilot is operating domestically, internationally or in supplemental operations.'' The NTSB also expressed support for a single flight, duty, and rest standard, commending the proposed rule for recognizing that ''human fatigue factors are the same across [domestic, flag, and supplemental] operations and science cannot support the notion of allowing longer duty hours for certain subgroups.'' Numerous individual commenters have also stated that the existing 16-hour duty periods utilized by supplemental operations result in an unsafe amount of fatigue.

In addition to the concerns expressed by the preceding comments, United Air Lines (United) objected to the applicability of this rule to flightcrew members who conduct only part 91 operations on behalf of part 121 certificate holders. United stated that the original reason for the applicability of this rule to part 91 operations on behalf of part 121 certificate holders was to ensure that flightcrew members operating under part 121 did not use part 91 to avoid their flight, duty, and rest requirements under part 121. Because flightcrew members who only conduct part 91 operations cannot conduct part 121 flights, United argued that these flightcrew members should not be subject to this rule.

The FAA also received a number of other questions and concerns about the applicability of this rule. The NetJets Association of Shared Aircraft Pilots (NJASAP) asked how this rule would apply to certificate holders who operate under several different parts of the regulation (*e.g.,* Part 121, Part 135, Subpart 91K). The Regional Airline Association (RAA) asked the FAA to amend this section in order to clarify that this rule applies to ''operations directed by the certificate holder under part 91 of this chapter.'' In addition, a number of part 135 certificate holders objected to having their operations included in the proposed flight, duty, and rest requirements. These commenters asserted that part 135 operations are fundamentally different from part 121 operations, and thus, these operations should not be subject to the same requirements.

In response to concerns expressed by part 135 certificate holders, the FAA emphasizes that this rule does not apply to part 135 operations. If, in the future, the FAA initiates a rulemaking to change the existing part 135 flight, duty, and rest regulations, the FAA will solicit comments from the affected stakeholders and respond to part-135-specific concerns at that time.

Turning to concerns expressed by United, this rule applies to some part 91 operations because many flightcrew members involved in part 121 operations have routinely used part 91 as a way of exceeding the limits imposed by the part 121 flight, duty, and rest requirements. However, the FAA agrees with United that there is no reason to require flightcrew members who do not fly any part 121 operations to comply with part 121 flight, duty, and rest requirements. Accordingly, the FAA has amended this rule so that it applies to flightcrew members operating under part 91 only if at least one their flight segments is operated under part 117. Flightcrew members operating under part 91 and who do not have any flight segments subject to part 117 (*e.g.* pilots flying only part 91 operations) are not subject to the provisions of this rule.

Turning to concerns expressed by air carriers conducting all-cargo operations, as discussed in the regulatory evaluation, the FAA has determined that this rule would create far smaller benefits for all-cargo operations than it does for passenger operations. Consequently, the FAA is unable to justify imposing the cost of this rule on all-cargo operations. The FAA notes that in the past it has excluded all-cargo operations from certain mandatory requirements due to the different cost-benefit comparison that applies to all-cargo operations. For example, in 2007, the FAA excluded all-cargo operations of airplanes with more than two engines from many of the requirements of the extended range operations (ETOPS) rule because the cost of these provisions for all-cargo operations relative to the potential societal benefit was simply too high.[10]

Based on the cost-benefit analysis of this rule and its past precedent, the FAA has amended this rule to make compliance with part 117 voluntary for all-cargo operations and to allow those operations to continue operating under the existing part 121 flight, duty, and rest regulations if they choose to do so. As such, this rule now allows all-cargo operations to voluntarily determine, as part of their collective bargaining and business decisions, whether they wish to operate under part 117.

In order to prevent manipulation of this voluntary provision, certificate holders who wish to operate their all-cargo operations under part 117 cannot pick and choose specific flights to operate under this rule. Instead, the certificate holders can only elect to operate under part 117: (1) All of their all-cargo operations conducted under contract to a U.S. government agency; and (2) all of their all-cargo operations

[10] 72 FR 1808, 1816 (2007).

not conducted under contract to a U.S. Government agency.

Turning to the objections expressed by non-scheduled passenger operations, the FAA notes that existing regulations set out different flight, duty, and rest standards for part 121 domestic, flag, and supplemental operations. Under these regulations, supplemental operations consist of non-scheduled, all-cargo, and public-charter flights. The existing regulations provide supplemental operations with significant scheduling flexibility because they allow air carriers conducting supplemental operations to schedule unaugmented flightcrew members for 16-hour FDPs [11] and augmented flightcrew members for 30-hour FDPs [12] regardless of the time of day.[13]

The FAA acknowledges that this rule will significantly impact supplemental passenger operations because it reduces the existing 16- and 30-hour across-the-board limits. This section discusses these reductions and why they are justified in light of the flexibility concerns of non-scheduled passenger operations. The other changes made by this rule that affect supplemental operations are discussed in the other parts of this preamble.

The FAA has decided to impose the same FDP limits on supplemental passenger operations as other part 121 operations because it has determined that the 16-hour unaugmented FDP and the 30-hour augmented FDP permitted by existing supplemental flight, duty, and rest regulations are almost always unsafe for passenger operations.[14] As discussed in other parts of this preamble, a series of studies analyzing the national accident rate as a function of the amount of hours worked have shown that after a person works for about eight or nine hours, the risk of an accident increases exponentially for each additional hour worked.[15] According to these studies, the risk of an accident in the 12th hour of a work shift is ''more than double'' the risk of an accident in the 8th hour of a work shift.[16] Based on this exponential increase in the accident rate, the FAA has determined that the risk of an accident in the 16th hour of an unaugmented FDP rises to unacceptable levels for passenger operations, especially for shifts that take place during the WOCL. The FAA has also determined, based on the above data, that a 30-hour FDP likewise poses an unacceptably high risk of an accident for passenger operations even with the fatigue-mitigation benefits provided by augmentation.

In determining that a 16-hour unaugmented and a 30-hour augmented FDP is unsafe for passenger operations, the FAA has also taken into account the fact that aviation-specific data shows that FDPs of this length significantly increase the risk of an accident. A study published in 2003 analyzed the accident rate of pilots as a function of the amount of time that the pilots spent on duty.[17] The study found that:

> [T]he proportion of accidents associated with pilots having longer duty periods is higher than the proportion of longer duty periods for all pilots. For 10–12 hours of duty time, the proportion of accident pilots with this length of duty period is 1.7 times as large as for all pilots. For pilots with 13 or more hours of duty, the proportion of accident pilot duty periods is over five and a half times as high.[18]

Because studies examining the national accident rate and aviation-specific accidents have both shown that working over 13 hours significantly increases the risk of an accident, the FAA has decided to disallow the 16-hour unaugmented and 30-hour augmented FDPs currently permitted in supplemental passenger operations by subjecting supplemental passenger operations to the same FDP limits as other part 121 passenger operations. The effect that other provisions of this rule will have on supplemental passenger operations and the reasons why the FAA has chosen to adopt these provisions are discussed in the corresponding portions of this preamble.

The FAA understands that including supplemental passenger operations in this rule will take away a portion of the scheduling flexibility currently enjoyed by non-scheduled passenger operations. However, this rule contains a number of provisions that ease the burden of current rules on non-scheduled operations in a way that does not decrease safety.

The most significant way in which this rule eases the burden of existing rules on supplemental passenger operations is the elimination of compensatory rest requirements. Under the existing rules, a pilot who flies an aircraft for over 8 hours in a supplemental operation must receive a compensatory rest period that is 16 hours or longer (depending on whether the flight was augmented) at the conclusion of his or her duty day. This compensatory rest requirement imposed a significant burden on supplemental passenger operations because pilots had to be provided with at least 16 hours of rest simply for flying for 9 hours. In addition, the FAA found that by focusing on flight time and not on FDP, the existing supplemental flight, duty, and rest regulations led to counterintuitive results in which long 16- and 30-hour FDPs were permitted with only a 9-hour required rest period, but a 9-hour flight time with a relatively-short FDP resulted in a 16- to 18-hour required rest period.

In order to address the concerns discussed in the preceding paragraph and because there was an absence of scientific data showing that rest periods providing for more than 8 hours of sleep were always necessary to combat transient fatigue, this rule eliminates the existing compensatory rest requirements for supplemental passenger operations. The removal of this additional rest requirement will allow certificate holders conducting non-scheduled passenger operations to fly augmented international operations, including those that are under contract with the United States Government, without having to provide flightcrew members with an additional 6 hours of rest at the end of the operation. In addition, to ensure that certificate holders

[11] 14 CFR 121.505(b). The existing regulations do not regulate FDPs, but instead, regulate the length of duty time. The FAA believes that duty time, as used in the existing regulations, is roughly equivalent to the concept of an FDP because flightcrew members typically begin and end their duty periods at about the same times as an FDP, as defined by this rule, would begin and end.

[12] 14 CFR 121.523(c).

[13] An unaugmented flight contains the minimum number of flightcrew members necessary to safely pilot an aircraft. An augmented flight contains additional flightcrew members and at least one onboard rest facility, which allows flightcrew members to work in shifts and sleep during the flight.

[14] The FAA notes that this rule technically allows an unaugmented flightcrew member to work on a 16-hour FDP if a 14-hour FDP is extended through the use of a 2-hour FDP extension. However, a 14-hour unaugmented FDP is only permitted during periods of peak circadian alertness, and the 2-hour FDP extension is subject to additional safeguards. A 30-hour FDP is never permitted, although a carrier could potentially develop an FRMS that allowed a 30-hour FDP in augmented operations.

[15] *See* Simon Folkard & Philip Tucker, *Shift work, safety and productivity,* Occupational Medicine, Feb. 1, 2003, at 98 (analyzing three studies that reported a trend in risk over successive hours on duty).

[16] *Id.* The FAA notes that the Federal Motor Carrier Safety Administration, another DOT agency, has examined studies comparing crash risk to hours worked in certain truck operations. Similar to the Folkard & Tucker study, these studies found a steady rise in crash risk with additional work hours; however, they did not show an increase as rapid as the results reported by Folkard and Tucker. (*See,* for example, Blanco, M., Hanowski, R., Olson, R., Morgan, J., Soccolich, S., Wu, S.C., and Guo, F., ''The Impact of Driving, Non-Driving Work, and Rest Breaks on Driving Performance in Commercial Motor vehicle Operations,'' FMCSA, April 2011).

[17] Jeffrey H. Goode, *Are pilots at risk of accidents due to fatigue?,* Journal of Safety Research 34 (2003) 309–13.

[18] *Id.* at 311.

conducting supplemental operations are able to provide critical services in support of government operations, this rule also contains an Emergency and Government Sponsored Operations section that allows operations performed in accordance with a government contract to exceed this rule's flight, duty, and rest limits in certain situations.

Another example of a provision in this rule that benefits supplemental passenger operations is the increase of the flight-time limits for augmented and unaugmented flights. This increase will allow certificate holders conducting supplemental operations to schedule unaugmented flightcrew members for 9 hours of flight time during peak circadian times after providing them with only 10 hours of rest. The existing regulations would require certificate holders conducting supplemental operations to provide their flightcrew members with 18 hours of rest after an operation involving 9 hours of unaugmented flight time.

In addition to including provisions that ease the burden of the maximum-FDP-limit reduction on supplemental operations, the FAA has also made adjustments to this rulemaking in response to concerns raised by air carriers (certificate holders) conducting non-scheduled passenger operations. Thus, the FAA has: (1) Increased the unaugmented and augmented FDP limits in Tables B and C, (2) increased the amount of the split-duty credit and made that credit easier to obtain, and (3) largely eliminated the scheduling reliability requirements that were proposed in the NPRM. All of these adjustments were made, at least in part, in response to the concerns raised by certificate holders conducting non-scheduled operations, and they should significantly ease the burden of this rule on these types of operations. In making these adjustments, the FAA has, where possible, incorporated into this rule portions of the alternative proposal put forward by the industry commenters who conduct non-scheduled passenger operations.

While air-carrier business models for passenger operations may differ, the factors that give rise to unsafe levels of fatigue are the same for each flightcrew member involved in these operations. A flightcrew member working a 16 or 30-hour FDP as part of a supplemental passenger operation will not be less tired simply because he or she is working in a supplemental type of operation instead of a domestic type operation. To account for this fact and ensure that fatigue is limited to safe levels, the FAA has decided to set a single flight, duty, and rest standard for all part 121 certificate holders conducting passenger operations. The FAA is sympathetic to the fact that supplemental passenger operations require additional flexibility that is not required by other business models and as a result, may bear a disproportionate cost of this rule. To ameliorate the cost of this rulemaking on supplemental operations, this rule contains supplemental-friendly provisions and adjustments that do not have an adverse effect on safety. However, the flexibility and cost-savings required by supplemental passenger operations can no longer be used to justify 16 and 30-hour FDPs for these operations because scientific studies have shown that FDPs of this length significantly increase the risk of an aviation accident that could injure passengers onboard an aircraft.

In response to NJASAP's question, the FAA notes that this rule applies to all part 121 certificate holder passenger operations and all part 121 and part 91 operations where an FDP includes at least one flight segment conducted under part 117. Thus, if a flightcrew member flies one or more segments of an FDP in passenger-carrying operations, but also flies a part 91 positioning flight as part of that FDP, the part 91 flight would have to be conducted under part 117. Parts 135 and 91K have their own set of flight, duty, and rest requirements that will continue to apply to those operations.

B. Definitions

The NPRM included definitions specific to this part. The definitions adopted in this rule are in addition to those in §§ 1.1 and 110.2. In the event that terms conflict, the definitions in part 117 control for purposes of the flight and duty regulations adopted in this rule. The section below provides a discussion of the specific definitions used in the final rule.

1. Acclimated

The FAA proposed to define ''acclimated'' as a condition in which a flightcrew member has been in a theater for 72 hours or has been given at least 36 consecutive hours free from duty.

The Airline Pilots Association (ALPA), the Allied Pilots Association (APA), the Coalition of Airline Pilots Associations (CAPA), and the Independent Pilots Association (IPA) stated that acclimated should mean a condition in which a flightcrew member has been in a new theater for the first 72 hours since arriving and has been given at least 36 consecutive hours free from duty during the 72 hour period. Also, the Flight Time Aviation Regulation Committee and Flightcrew Representatives (representing labor) (Flight Time ARC) supported the suggested, revised definition. These commenters noted that according to established science, three consecutive local nights' rest is required to become acclimated. They also noted that Cap 371 provides for three consecutive local nights rest to become acclimated.

NACA, North American Airlines (NAA), World Airways, and Atlas Air Worldwide Holdings, Inc. (Atlas) contended that the proposed definition should be revised to allow 30 consecutive hours free from duty instead of 36 hours.

NACA and NAA said that it is important in regulations controlling both schedules and operations that the extended rest periods be consistent across domestic and international operations. NACA, NAA, and World Airways said that the FAA's proposed acclimation time should be changed to reflect the agency's proposed 168-hour look-back rest period of 30 hours. (See § 117.25(b)). These commenters believed that 30 hours is appropriate because any further time to acclimate may preclude flightcrew members from returning to their home base as flightcrew members, which becomes important in commercial operations where flight hours are guaranteed.

World Airways said that its recommendation of 30 hours free from duty is within the range the ARC discussed as sufficient for acclimation to occur. Atlas said that there is no scientific justification for selecting 36 as the minimum number of consecutive hours. Atlas further commented that subsequent to publication of the NPRM, the FAA clarified its definition of acclimated, stating that the computation is based on actual, not scheduled, operations. Atlas believed that this clarification needs to be incorporated into the definition as follows: ''Time in theater begins upon block in at an airport more than four time zones from the previous acclimated location.''

In response to the above comments, the FAA is not persuaded by the argument that acclimation only can occur when the flightcrew member is in a new theater for 72 hours and has been given 36 consecutive hours free from duty during that period. The Flight Time ARC did receive information from the sleep specialists that an individual attempting to acclimate to a new time zone will adjust his or her clock approximately one hour per day for each hour of time zone difference. 75 FR 55852, 55861 (Sep. 14, 2010). The ARC, however, concluded that, based on its collective experience, acclimation can

occur more quickly if the flightcrew member manages the sleep opportunity appropriately. The ARC also concluded that a flightcrew member can become acclimated by either receiving three consecutive physiological nights' rest or a layover rest period of 30 to 36 consecutive hours. The ARC universally rejected the premise that, because the United Kingdom is 5 time zones away from the eastern coast of the United States, it would take between five and nine days to acclimate to a European time zone. The commenters did not present new information that was not considered during the ARC. There is no compelling information or argument that refutes the body of experience represented in the ARC and the FAA declines to amend this definition as suggested.

The FAA also declines to accept the suggestion that a 30 hour rest period is adequate to acclimate compared to the 36 hour period proposed in the NPRM. The ARC recommended a 30 to 36 hour layover rest period. The FAA decided to propose the 36-hour rest period because it provides for one physiological night's rest and then opportunity for a shorter rest period. The agency finds that the more conservative approach is appropriate to provide the more meaningful opportunity for rest.

United Parcel Service Co. (UPS) commented that administrative duties should be exempted or removed from the scope of flight duty when determining flightcrew member acclimation. UPS further commented that if flightcrew members revised company manuals or navigation charts during a duty free period (layover) or prior to report time, it is possible that the flightcrew members would not satisfy the definition of being acclimated or could drive different FDP limits based on when they claim their duties started.

In response to UPS' concern, to acclimate a flightcrew member under this rule, the certificate holder must provide the required rest and cannot assign any duties during the rest period. Similarly, it is the flightcrew member's responsibility to take advantage of the period and rest accordingly. If a flightcrew member independently decides to perform administrative type duties during this time period, as described by the commenter, the flightcrew member is considered acclimated regardless of whether he or she actually rested during this time period.

2. Acclimated Local Time

While the FAA did not propose this term, ALPA, CAPA, Flight Time ARC, and the Southwest Airlines Pilots Association (SWAPA) suggested including this term. They suggested that acclimated local time means the local time at the location where the pilot last had greater than 36 hours free from duty in the first 72 hours in theater. IPA recommended the same definition, except it replaced the term ''pilot'' with ''flightcrew member.'' In support of their recommendation, ALPA, CAPA, and Flight Time ARC said this new definition would provide an unambiguous time for applying the definition of ''nighttime duty period'' and for entering the FDP and flight time limit tables. They further said that the wording in the NPRM concerning acclimated or home base time left many questions of interpretation. For example, a USA-based pilot who acclimates in Europe and then subsequently flies to Japan would, under the current NPRM wording, enter the tables at home-base time instead of Europe time. The commenters also stated that the exact location of acclimation must be known to determine future loss of acclimation. Under their proposal, the commenters contended that both the tables and the definition of nighttime flight duty period would use the new term, ''acclimated local time.''

The FAA has accommodated these concerns by changing the heading of Tables A, B, and C to reflect acclimated time. In addition, the FAA clarifies that a flightcrew member is considered acclimated based on which rest he or she was given first. If the flightcrew member completes 36 consecutive hours of rest prior to being in theater for 72 hours, then the flightcrew member is acclimated at the time that the 36-hour period ends and he or she is acclimated at the location that the rest occurred.

3. Airport/Standby Reserve

According to the proposed definition, ''Airport/standby reserve'' means a defined duty period during which a flightcrew member is required by a certificate holder to be at, or in close proximity to, an airport for a possible assignment.

UPS said that the FAA's definition of airport/standby reserve is too vague and is open to interpretation. It recommended revising the definition to mean an assignment that requires a flightcrew member to be in a position to begin preflight activities following notification of an assignment without requiring additional travel time to arrive for the operation.

NACA and NAA did not believe that the definition is necessary because airport/standby reserve is an assignment within an FDP. If the term is adopted, NACA and NAA recommended that the term be defined as a duty period during which a flightcrew member is required by a certificate holder to be at, or in close proximity to, an airport for a possible assignment, and to show at the departure gate or aircraft within one hour.

Atlas contended that the FAA did not clarify the relationship of airport/standby reserve and short-call reserve in its clarification document published after the NPRM. This commenter noted that according to the FAA's clarification, airport/standby reserve and short-call reserve are mutually exclusive. Atlas said that the distinction was explained as whether or not the flightcrew member is ''at the airport or in close proximity to the airport.'' If at or in close proximity to the airport, a flightcrew member is deemed to be on airport/standby reserve, this suggests that a flightcrew member on short-call reserve in a hotel room near an airport could be deemed to be on airport/standby reserve. Atlas believed the distinction is important because it determines if the reserve is counted as part of the FDP. Atlas argued that airport/standby reserve means a defined duty period at an on-airport facility to which a flightcrew member has been required to report by a certificate holder immediately following assignment (usually within one hour) and at which no rest facilities are available or no rest is scheduled.

The FAA agrees that the proposed terminology could be confusing and has modified the term to mean a duty period during which a flightcrew member is required by a certificate holder to be at an airport for possible assignment.

4. Augmented Flightcrew

The NPRM defined ''augmented flightcrew'' as 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.

A number of industry commenters objected to the fact that the proposed augmented flightcrew definition did not allow a flight engineer to augment a pilot. These commenters stated that adding a flight engineer to a flightcrew has a number of safety benefits. The commenters added that their inability to augment with a flight engineer would result in three-seat aircraft being retired prematurely, which would raise the costs of this rule.

This rule does not allow augmentation with a flight engineer for

safety reasons. As discussed more fully in other parts of this preamble, an augmented flight provides fatigue-mitigation benefits because it contains more than the minimum number of pilots, and the additional pilots allow the flightcrew to obtain in-flight rest by working in shifts and replacing each other at the aircraft controls. However, a flight engineer is not qualified to manipulate the flight controls and pilot an aircraft and is generally prohibited from occupying a pilot duty station. Because a flight engineer who is not qualified as a pilot cannot occupy a pilot duty station, an engineer cannot replace a pilot at the aircraft controls. As such, this rule does not allow a pilot to be augmented with a flight engineer.

With regard to three-seat aircraft, even though this rule does not give augmentation credit for a flight engineer to augment a pilot, it does not prohibit flight engineers from working on three-seat aircraft. All this rule states is that, without additional pilots, a flightcrew that has a flight engineer would not be considered augmented. Because a flight engineer could still work on a three-seat aircraft under the terms of this rule, the FAA does not believe that the above limitation on augmentation would lead to the premature retirement of three-seat aircraft.

5. Calendar Day

The NPRM proposed that a ''calendar day'' means a 24-hour period from 0000 through 2359.

Alaska Airlines said that while the FAA contends in its clarifying document that the calendar day for the flightcrew member's home base should be sufficient, calendar day as defined in the NPRM does not provide this clarification. Alaska Airlines instead recommended that a calendar day means a 24-hour period from 0000 through 2359 local time at the flightcrew member's home base.

Boeing Commercial Airplanes (Boeing) suggested a similar definition to address frequent transitions between time zones. Boeing further stated that rules such as the ones proposed in the NPRM are implemented in computerized optimization systems for crew scheduling, and as a result, ambiguities in the rules can lead to different interpretations.

The FAA has amended this term to include reference to Coordinated Universal Time or local time. This is consistent with the definition of calendar day in section 121.467(a) (Flight attendant duty period limitations and rest requirements: Domestic, flag, and supplemental operations).

6. Consecutive Night Duty Period

The FAA did not propose a definition for this term; ALPA, CAPA, SWAPA, Flight Time ARC, and Federal Express Air Line Pilots Association, International (FedEx ALPA) said that the proposed § 117.27 limits consecutive nighttime flight duty periods to three periods. To avoid confusion in applying § 117.27, the commenters believed that the term ''consecutive night duty period'' should be defined. They recommended that consecutive night duty period mean two or more night flight duty periods that are not separated by at least a part § 117.25 rest between the duty periods that encompasses a physiological night's sleep (1 a.m. to 7 a.m. at home base or acclimated local time). IPA suggested the adoption of a similar definition.

The FAA declines defining the term consecutive night flight duty period and instead includes a provision in § 117.27 to address the commenters' concerns. Section 117.27 now specifies that the consecutive-night provisions apply to consecutive flight duty periods that infringe on the WOCL. The WOCL is defined later in this section.

7. Deadhead Transportation

As proposed, ''deadhead transportation'' means transportation of a flightcrew member as a passenger, by air or surface transportation, as required by a certificate holder, excluding transportation to or from a suitable accommodation.

Air Transport Association of America, Inc. (ATA) suggested removing the word ''passenger'' from the definition because the FAA should not assume that deadhead transportation should be limited to flightcrew members characterized as passengers when not all carriers carry passengers. Similarly, UPS commented that the proposed definition fails to address deadhead transportation on aircraft not configured for passenger operations (*i.e.*, all-cargo aircraft). UPS suggested that the FAA revise the definition as follows: ''Deadhead transportation means transportation of a flightcrew member as a passenger, non-assigned flight deck occupant, or other additional flightcrew member by air or surface transportation, as required by the certificate holder, excluding transportation to or from a suitable accommodation.''

The FAA agrees with the above commenters and has modified the term to apply to the transportation of a flightcrew member as a passenger or a non-operating flightcrew member. The FAA has also added two clarifying statements to the definition. The first is that all time spent in deadhead transportation is duty and is not rest. This provision was copied from proposed § 117.29 Deadhead transportation. Secondly, the FAA includes in this definition that deadhead transportation is not considered a segment for purposes of determining the maximum flight duty period in Table B.

8. Duty

The NPRM defines ''duty'' to mean any task, other than long-call reserve, that a flightcrew member 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.

Industry commenters largely rejected the proposition that short-call reserve be considered duty. They argued that this classification is inappropriate and unrelated to effective fatigue mitigation. They also stated that the only requirement or company task a pilot has on short call reserve is to be available to be contacted. Otherwise, the pilot is free to do what he or she wants and plans the day to take advantage of rest opportunities or any other activities as he or she desires, just as a lineholder would. Industry also largely objected to the classification of short-call reserve as duty. ALPA, CAPA, FedEx ALPA, SWAPA and APA all commented favorably on short call reserve being considered duty.

As stated in the NPRM, the FAA's rationale for this proposal was that while on short-call reserve, the flightcrew member can expect that he or she will not receive an opportunity to rest prior to commencing an FDP. Additionally, the flightcrew member is required to limit his or her action sufficiently so that he or she can report to the duty station within a fairly short timeframe. The FAA believed that this time should be accounted for under the cumulative limitations and therefore proposed that short-call reserve be considered duty.

However, the commenters argued that a flightcrew member on short-call reserve has the same predictable rest and sleep opportunities as a regularly-scheduled lineholder and that being on reserve cannot entail significant workload and thereby be fatiguing. The FAA accepts that while reserve cannot be categorized as ''rest'' it does not necessarily fit squarely with being considered duty either. As the commenters correctly pointed out, time

spent on short-call reserve is simply not as fatiguing as time spent on an FDP. Therefore, this rule no longer includes short-call reserve as duty.

ATA, NACA, UPS, United, Continental Airlines, Inc. (Continental), Alaska Airlines, NAA, Delta Air Lines (Delta), and World Airways stated that the proposed definition of duty is too broad, operationally unworkable, and not clear regarding accountability. They objected to the inclusion of the terms ''any task,'' ''on behalf of the certificate holder,'' and ''administrative work'' in the definition. ATA provided the example of a professional pilot who routinely performs tasks such as refreshing outdated publications, watching videos for recurrent training, and reading and responding to emails. Because a flightcrew member can perform these tasks at a time and place of his or her choosing, the commenters argued that a certificate holder has no way of knowing or controlling the pertinent flightcrew member conduct.

ATA asserted that the inclusion of administrative but not labor-related work in the definition does not make sense because no material distinction exists between administrative tasks performed on behalf of management and similar tasks performed on behalf of labor.

Alaska Airlines said that the FAA in its clarifying document noted that the term ''administrative work'' is readily understandable; however, the commenter noted that the term's role in fatigue and in the context of the regulation is vague. The commenter believed that the term needs further clarification and should only include work associated with flight operations.

Continental and United said that the definition of duty considers administrative work in the same way that it assesses flight duty. They contend that this is inappropriate when applied to the cumulative duty restrictions discussed in proposed § 117.23.

Alaska Airlines suggested that the FAA make clear in the final rule that duty only includes activities that the carrier can directly control. ATA recommended clarifying the definition by replacing the phrase ''on behalf of the certificate holder'' with ''directed by a certificate holder on company property.'' NACA, UPS, Delta, and World Airways suggested revising the definition of duty to mean ''any task, other than long-call and short-call reserve, that is directed by the certificate holder * * *'' NAA believed the term ''on behalf of the certificate holder'' should be replaced with ''is assigned by the certificate holder.''

UPS contended that the FAA must address the issue of management pilot duty and suggested that management pilot duty include all time spent during company business-related meetings and other business-related activity conducted on company property. UPS argued that if this is not addressed, management pilots will effectively become non-flying pilots.

NACA, World Airways, and NAA recommend deleting the term ''administrative work'' because it is too vague and inclusive of issues that have nothing to do with direction by the certificate holder or FDP fatigue mitigation. Continental and United recommended that the FAA remove administrative activity from the definition and add a provision to the regulation that applies administrative duty to specific FDPs. ATA and Delta request that if the term is kept in the definition, the FAA should clarify that the definition treats management and labor-related administrative work in the same way.

In response to the above comments, the definition of duty has been further modified by replacing ''on behalf'' of the certificate holder with ''as required'' by the certificate holder. This addresses the certificate holders' concern that the administrative work accomplished by the flightcrew member is work that he or she is required to do, and appropriately included as duty. Lastly, the FAA agrees that performance of administrative management work is not distinguishable from any other type of administrative work, and therefore administrative management work is included in the term ''administrative work'' under this definition.

9. Duty Period

As proposed, ''duty period'' means a period that begins when a certificate holder requires a flightcrew member to report for duty and ends when that crew member is free from all duties.

UPS said that defining the end of the duty period as ''* * * free from all duties'' is too ambiguous and uncertain since a certificate holder cannot control voluntary duties that a flightcrew member may decide to accomplish at the end of his or her FDP. UPS suggested that the definition be changed so that the end of the duty period occurs when the flightcrew member is ''* * * released from all company directed duties.'' In light of the changes that have been made to this rule, the FAA has determined that it is no longer necessary to define this term, and therefore the proposed definition is withdrawn.

10. Early Start Duty

The NPRM did not propose a definition for this term, however, APA recommended including the term, which would mean an FDP that commences in the period 0500 to 0659 home base time or where acclimated. The FAA does not agree that adopting this term is necessary or useful.

11. Fatigue

Fatigue as proposed means physiological state of reduced mental or physical performance capability resulting from lack of sleep or increased physical activity that can reduce a flightcrew member's alertness and ability to safely operate an aircraft or perform safety-related duties.

ATA commented that the proposed definition of fatigue is inconsistent with ICAO's proposed definition. ATA noted that ICAO proposes to define fatigue as ''a physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties.'' ATA recommended adopting the ICAO definition because it captures the fatigue-inducing effects of the interaction of sleep loss, circadian phase, and workload, and provides a scientific basis for fatigue risk management.

In response to ATA's comments, the FAA notes that ICAO has not finalized its definition of fatigue, and the proposed definition may be subject to change. At this point, it is not prudent for the FAA to include a term that ultimately may be changed or not even adopted. Therefore, the FAA is adopting the definition of fatigue that was proposed.

12. Fit for Duty

As proposed, the definition of ''fit for duty'' means physiologically and mentally prepared and capable of performing assigned duties in flight with the highest degree of safety.

UPS commented that including ''* * * duties in flight with the highest degree of safety'' in the definition of ''fit for duty'' is not practical and too subjective. UPS further stated that it is unrealistic for any human to be at their ''highest'' level of performance during every possible FDP and suggests replacing ''* * * highest degree of safety'' with ''* * * capable of performing duties that assure flight safety.''

The FAA does not agree with UPS because every flightcrew member on

every flight should be prepared and capable of performing the assigned duties at the highest degree of safety. Accordingly, the FAA has adopted the proposed definition in the final rule.

13. Flight Duty Period

The NPRM defines ''flight duty period'' to mean 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 would include 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.

ATA, UPS, World Airways, NAA, NACA, Delta, and Alaska Airlines objected to including all flight training in a flight simulator or training device in the definition of FDP. ATA, Delta, and Alaska Airlines commented that there is no scientific basis for such inclusion, and all seven commenters said there is no inherent safety basis for this decision. Alaska Airlines and Delta added that with simulator time included in the FDP, pursuant to section 117.27, flightcrew members would be unable to participate in simulator training on more than three consecutive nights. ATA further commented that there is no basis for including travel to a training site in the FDP unless the travel occurs before flight time.

ATA, Delta, and Alaska Airlines recommended that the FAA revise the proposed definition to state that only training and flight simulator time conducted before a flight without an intervening rest period is counted as part of the FDP. UPS said that it supports counting time spent in a simulator or flight training device as part of an FDP only if this time immediately precedes flight duty without an intervening rest period. UPS believed that there is an unintended consequence of treating simulator and flight training device training as part of an FDP, regardless of when the training occurs. That is, the practice of providing additional training to a flightcrew member who requests that training will be discontinued; thereby, affecting flight safety.

NACA, NAA and World Airways commented that an FDP ''must involve a flight, or at a minimum, movement of an aircraft where the public is at risk where an aircraft accident potential immediately exists.'' They suggested revising the proposed definition to add the following phrases: ''but not limited to'' and ''whenever these duties are performed in conjunction with duties involving flight without an intervening rest period.'' This would result in a definition that reads: ''* * * A flight duty period includes, but is not limited to, deadhead transportation * * * and airport/standby reserve whenever these duties are performed in conjunction with duties involving flight without an intervening rest period.''

The FAA clarifies that an FDP begins when the flightcrew member reports for duty and will include the duties performed by the flightcrew member on behalf of the certificate holder that occur before a flight segment or between flight segments without a required intervening rest period. The FDP ends when the aircraft is parked after the last flight and there is no intention for further aircraft movement by the same flightcrew member. Included in the FDP are any of the following actions if they occur before a flight segment or between flight segments without an intervening rest period: deadhead transportation, training conducted in an aircraft or flight simulator, and airport/standby reserve. Time spent in a flight training device that takes place after the aircraft has been parked after the last flight has been eliminated from this definition. For purposes of calculating the pertinent part 121 flight, duty, and rest limits, the FAA considers time spent on an FDP to be duty.

14. Flight Time

The NPRM did not propose a definition for this term; however, APA, ALPA, CAPA, FedEx ALPA, SWAPA, and Flight Time ARC recommended adding a definition for flight time to begin when the aircraft first moves with the intention of flight. These commenters argued that this term in § 1.1 is defined as the moment the aircraft first moves under its own power. However, the pilot in command (PIC) and required flight deck flightcrew members are always responsible and must perform their duties when the aircraft is moved by a tug or sits on a hardstand and that time should count, according to the commenters, as flight time if the movement is with the intention for flight. They also state that this definition would be consistent with Annex II, Subpart Q to the Commission of the European Communities Regulation No. 3922/91, as Amended (EU OPS subpart Q) which defines flight time as the time between an airplane first moving from its parking place for the purpose of taking off until it comes to rest on the designated parking position and all engines or propellers are stopped.

IPA suggested that the proposed definition be revised as follows: ''Flight time means when the aircraft first moves with the intention of flight until it comes to rest on the designated parking position.''

The FAA declines the commenters' recommendations. Numerous other regulations are based on the definition of flight time that is set out in § 1.1. Changing this term solely in the context of the flight and duty regulations would make this rule more complicated than necessary and create confusion between this rule and other regulations.

15. Late Finish Duty

The NPRM did not propose a definition for this term; however, APA said a definition of ''late finish duty'' is needed to provide for fatigue mitigation caused by consecutive early starts and late finishes. APA suggested that the term be defined as an FDP that ends during the period of 0000–0159, home base time or where acclimated. The FAA does not find that it is necessary or useful to adopt this term.

16. Night and Nighttime

The FAA did not propose definitions for either of these terms; however, NACA and NAA said that the FAA's intent for using the term ''night'' in the NPRM should be defined. If it is not defined, the commenters said that the FAA should always use the term ''physiological night'' in all text in the preamble and in the final rule. They recommended defining night to mean ''the period between 0100 and 0700 at the flightcrew member's designated home base or acclimated location.'' The commenters noted that this would make the term compatible with the definition of ''physiological night's rest.''

Atlas said that the final rule should contain a definition of the terms ''night'' and ''nighttime,'' so as to make the meanings comparable to references in proposed § 117.27, as well as to the definition of ''physiological night's rest.'' It noted that while ''physiological night's rest'' refers to the hours of 0100 and 0700, the term ''nighttime'' referenced in proposed § 117.27 is interpreted to refer to operations that commence between 2200 and 0500, according to page 22 of the FAA's clarification document. Both definitions, the commenter said, differ from the definition of ''night'' in 14 CFR. § 1.1, which is the time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time.

The FAA declines to adopt these terms. The FAA uses the word ''physiological night's rest'' when it is appropriate. In addition, please refer to the FAA's response to the term ''Consecutive Night Duty Period.''

17. Nighttime Flight Duty Period

The FAA did not propose a definition for this term; however, APA, ALPA, CAPA, FedEx ALPA, SWAPA, and Flight Time ARC said that to avoid confusion when conducting consecutive nighttime operations under § 117.27, the FAA should define ''nighttime flight duty.'' They suggested that this term be defined to mean a duty period during which any part of the duty period falls within the home base or acclimated local time period of 0200 to 0459.

IPA suggested a definition of ''nighttime flight duty'' as follows: ''a duty period during which any part of the duty period falls within the home base or acclimated local time period of 0200 to 0459.''

Please see response to ''6. Consecutive Night Duty Period.'' The FAA does not find it necessary to define the term as suggested.

18. Nighttime Operations

ATA said that the FAA should add a new definition of nighttime operations for purposes of part 117 to be consistent with the agency's document that responds to clarifying questions to the NPRM. The commenter believed that the definition should include operations that commence between 10 p.m. and 5 a.m. The FAA has clarified the pertinent provisions of section 117.27, and as such, it finds that a separate definition for nighttime operations is unnecessary.

19. Report Time

The NPRM defined ''report time'' as the time that the certificate holder requires a flightcrew member to report for a duty period. The FAA did not receive any comments with regard to this definition, and as such, this rule adopts the proposed definition.

20. Reserve Availability Period

The NPRM defined ''reserve availability period'' to mean a duty period during which a certificate holder requires a reserve flightcrew member on short call reserve to be available to receive an assignment for a flight duty period.

NACA objected to the premise that short call reserve is duty. It noted that ARC discussions were clear that short call reserve, which is a period of time when the only responsibility the crew member has is to answer the phone, is not a fatiguing event, and thus, it should not constitute duty for cumulative-duty purposes. NACA suggested revising the proposed definition so that it reads ''reserve availability period means a period of time during which a certificate holder requires a reserve flightcrew member on short call reserve to be available to receive an assignment for a flight duty period.''

As discussed in other portions of this preamble, cumulative-duty-period limits have been removed from this rule. This removal addresses the concern expressed in NACA's comment as short-call reserve is no longer subject to the cumulative-duty-period limits.

21. Reserve Duty Period

The NPRM defined ''reserve duty period'' as the time, applicable only to short call reserve, from the beginning of the reserve availability period to the end of an assigned flight duty period. In light of the changes that were made to the reserve status section, this definition is no longer necessary, and it has been removed from the final rule.

22. Reserve Flightcrew Member

The NPRM defined ''reserve flightcrew member'' as a flightcrew member who a certificate holder requires to be available to receive an assignment for duty. The FAA did not receive any comments with regard to this definition, and as such, this rule adopts the proposed definition.

23. Rest Facility

The NPRM defines ''rest facility'' as a bunk, seat, room or other accommodation that provides a flightcrew member with a sleep opportunity. In determining what constitutes each specific type of rest facility, the FAA took note of a comprehensive evaluation of available onboard rest facilities, which was conducted by the Dutch government in 2007. Simons M, Spencer M., *Extension of Flying Duty Period By In-Flight Relief*. Report TNO–DV2007C362. TNO, Soesterberg, Netherlands, 2007 (TNO Report). The TNO Report was created in order 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.

As defined in the NPRM, ''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 flightcrew member to control light, and provides isolation from noise and disturbance. ''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 flightcrew members. ''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.

ATA stated that the proposed rule was overly restrictive with respect to the facilities it deemed sufficient for conferring credit for in-flight rest on augmented flights. ATA, NACA, and UPS criticized the proposal for over-relying on the TNO Report. ATA and UPS emphasized that the TNO Report is only a single study that has not been adopted by any regulatory body. NACA asserted that ''the TNO report is more than 10 years old and was proposed by a limited number of scientists and based upon limited studies.'' NACA added that ''[i]n the ARC discussions, Dr. Hursh stated that his [SAFTE/FAST] models value sleep on a bunk at approximately 66 to 80 percent of normal sleep.'' APA stated that the TNO Report has not been validated in the aviation context.

ATA stated that the proposed rule's adoption of the TNO report would have substantial adverse impacts on U.S. carriers because it would deviate from the less-restrictive criteria for rest facilities that the FAA set out in Advisory Circular (AC) 121–31. This is because, ATA asserted, many air carriers have invested a substantial amount of money developing rest facilities that comply with the guidelines set out in AC 121–31, and these facilities would not satisfy the more stringent criteria for rest facilities set out in the TNO Report. ATA noted that although it supports the concept of credit for in-flight rest, it does not support rest facility criteria derived from the TNO Report. It further noted that ''the FAA should continue to accept AC 121–31 standards for all aircraft built prior to the imposition of the new rule, the use of current business class seats as Class 2 facilities and for credit being afforded to all-cargo aircraft that provide a 'horizontal sleep opportunity' to flightcrew members. Rest facilities in use today built to AC 121–31 standards are operationally validated as a means of fatigue mitigation that FAA has accepted and there is no evidence that such facilities should not be used in the future.'' To minimize costs, ATA recommended that ''[a]t a minimum, the guidance in AC 121–31 should remain in effect for all aircraft built prior to the implementation date of the NPRM and

a significant period allowed for newer aircraft to conform to any new standards.''

UPS added that most air-cargo carriers would be unable to install rest facilities needed for the augmentation credit because air-cargo aircraft do not have passenger cabins. UPS asserted that it would be unable to install the rest facilities required by this rule in approximately 18% of its total fleet.

The existing advisory circular that provides guidance for onboard rest facilities (AC 121–31) was written in 1994 based on the science that existed at that time. The TNO Report, on the other hand, was written in 2007, and it provides the most comprehensive evaluation available to date of onboard rest facilities. This report may not yet have been adopted by other regulatory bodies because it is only four years old, and significant regulatory changes usually take place over a longer period of time. When drafting this rule, the FAA found the TNO Report to be more persuasive than AC 121–31 because the TNO Report performed a comprehensive evaluation of rest facilities, and because it was based on more recent scientific data than AC 121–31.

The FAA understands that the TNO Report provides more conservative conclusions than the pertinent SAFTE/FAST data concerning onboard rest facilities. However, in response to comments discussed above, the FAA has increased the augmented FDP limits in Table C. This increase should more accurately reflect the results of the SAFTE/FAST modeling for augmented operations.

The FAA has considered the fact that basing the definition of rest facilities on the TNO Report may pose hardships for air carriers who currently rely on AC 121–31 for guidance about onboard rest facilities. To mitigate this hardship, as well as for a number of other considerations, the FAA has decided to make the effective date of this rule two years from publication. This two-year window will provide air carriers with time to phase out their current onboard rest facilities and install/upgrade onboard rest facilities that comply with the provisions of this rule.

APA, FedEx ALPA, SWAPA, CAPA, and Flight Time ARC said that the definition of ''rest facility'' should include the following clarification: ''A rest facility on an aircraft shall only be used for in-flight rest opportunities.'' The commenters said this statement will eliminate any temptation to have crews obtaining their part § 117.25 or part § 117.17 rest on the aircraft when it is on the ramp. Several of these commenters noted that a bunk or seat on an aircraft is not a suitable rest facility on the ground. APA further recommended that the FAA separate the definitions of an ''in-flight, onboard rest facility'' and a ''ground-based rest facility'' and clearly differentiate between a ground-based rest facility and a suitable accommodation.

The FAA agrees with the above commenters that rest in a rest facility should take place while an aircraft is in-flight. That is why the augmented FDP section, section 117.17, to which the rest-facilities definition applies, mandates that the required minimum augmentation rest take place in-flight. Because section 117.17 already requires that the minimum augmentation rest take place in-flight, there is no need to further amend the pertinent regulatory text.

Turning to APA's request for clarification concerning the distinction between onboard and ground-based rest facilities, the FAA notes that a rest facility is a facility that is installed in an aircraft. A suitable accommodation, on the other hand, is a ground-based facility. The FAA has amended the pertinent definitions to clarify this distinction between a suitable accommodation and a rest facility.

APA also stated that detailed minimum standards should be spelled out in regulatory requirements. At a minimum, the language in the Class 1 facility definition should be improved to indicate that other surfaces that allow for a flat sleeping position should be suitably padded and reasonably comfortable and suitable for sleeping. APA noted that the ARC's discussions described ground-based facilities primarily as bunkrooms and the like used by cargo carriers to provide rest during a package sort operation. APA urged the FAA to adopt the detailed recommendations regarding onboard rest facility requirements set out in the appendix included in its comment submission. APA added that it remains concerned that if such specifications are left to Advisory Circulars, and if important details are not followed, in-flight rest could be seriously compromised. Additionally, it noted that several studies have commented on sleep problems caused by low humidity or an improper temperature, but the FAA did not mention these factors nor list any requirement for them. APA suggested that a Class 1 rest facility should account for low humidity and improper temperatures.

Delta expressed concern with the following description of a Class 2 facility that, it said, is contained both in the preface and in Advisory Circular 121–31A: A Class 2 rest facility is ''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).'' Delta said that many U.S. carriers currently providing on board rest facilities on routes for which Class 2 seats would be used are using a passenger business class type seat, some of which have been slightly modified or enhanced. The commenter further noted that these types of facilities have been in use for many years mostly on flights governed by 14 CFR 121.483. According to Delta, the ARC discussed this issue and acknowledged that these existing seats have worked very well. Delta asserted that most of these seats do not recline to the 80 degree range nor is it known yet if it is feasible to modify them for this capability. Delta believed that business class type seats currently being used are more than adequate to allow for in-flight rest.

UPS and NACA said that the definition of a Class 2 rest facility fails to address rest facilities on aircraft configured without a passenger cabin (*i.e.,* all-cargo aircraft). UPS suggested that the definition should read: ''In an aircraft configured with a passenger cabin, Class 2 rest facility means a seat that allows for a flat or near flat sleeping position and 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 in-flight flightcrew members. In an aircraft not configured with a passenger cabin, Class 2 rest facility means a seat that allows for a flat or near flat sleeping position.''

In response to these comments, the FAA notes that, as discussed above, the specific requirements for rest facilities were derived from the TNO Report, which analyzed how much rest would be obtained from each rest facility that complied with those requirements. Because various air carriers currently utilize different types of rest facilities, the FAA has determined that adding to the TNO Report's minimum rest-facility requirements would require more air carriers to replace their existing rest facilities without a demonstrated safety benefit to justify this cost. Accordingly, the FAA declines to add additional requirements to the rest-facility requirements set out in the NPRM.

The FAA has also decided not to expand the definition of a Class 2 rest facility beyond the recommendations of the TNO Report. The FAA is open to the possibility of expanding the definition of a Class 2 rest facility if additional data is provided as part of an FRMS, and if expanding this definition would not adversely affect safety. In response

to UPS and NACA's concerns, the FAA has changed the phrase ''passenger cabin'' to ''aircraft cabin'' in the rest-facility definition in order to include rest facilities on aircraft without a passenger cabin.

A number of industry groups and air carriers also objected to the fact that the NPRM did not consider economy-class seats to be a rest facility. These commenters stated that, in their operational experience, economy-class seats provided flightcrew members with significant amounts of restful sleep. The commenters cited a number of studies that, they claimed, indicate that an economy-class seat can provide restful sleep.

The decision to not consider an economy-class seat to be a rest facility was based on the TNO Report, which determined that ''the probability of obtaining recuperative sleep in such a seat would be minimal.'' [19] The TNO Report's determination was based on the following considerations: (1) An economy-class seat does not recline more than 40 degrees ''and has no opportunities for adequate foot and leg rest, which diminishes the probability of recuperative sleep;'' (2) ''space around the seat is not sufficient to create an adequate separation from the passengers (jostle in economy class), or guarantee any privacy;'' and (3) ''a majority of passengers are unable to sleep at all in an economy seat. With the help of sleeping aids or alcohol, some passengers succeed in obtaining some sleep, but they often feel a general malaise after sleeping in a cramped position.'' [20] The FAA agrees with the TNO Report's analysis of economy-class seats, and based on this analysis, which states that economy-class seats provide minimal amounts of recuperative sleep, the FAA has determined that economy-class seats should not be considered a rest facility in this rule.

Delta stated that it is unclear why the FAA is concerned with keeping crew rest facilities out of the coach or economy section of the aircraft. Delta believes that if the seat meets the NPRM definition requirements and the specifications provided in AC 121–3A (now AC 117–1), the geographical location of the rest facility on the aircraft should be immaterial. Delta further noted that it attempted to locate a scientific or an operational basis for the exclusionary requirement and has been unable to find any; therefore, Delta believes this is an unjustified constraint and should be removed.

As discussed in the preceding response, one of the reasons why an economy-class seat does not provide restful sleep is that space around the seat is not sufficient to create an adequate separation from the passengers (economy jostling). Because there are substantially more passengers in the economy section of an aircraft, that section is generally noisier and has more densely-packed people than the other sections of the aircraft. In addition, the FAA notes that economy cabins are generally located behind the aircraft engines, and thus, have to deal with louder engine noise. Due to all of these considerations, locating a rest facility in the economy section would reduce the restfulness of the sleep obtained by a flightcrew member.

Boeing stated it has concerns about the use of the phrase ''sleep opportunity'' in the definition. It noted that it considers a ''sleep opportunity'' to be a period of time during which sleep or rest can feasibly occur. Boeing suggested that the definition be revised to read: ''Rest facility means a bunk, seat, room, or other accommodation that provides a flightcrew member with comfort and quiet so as to maximize sleep and rest within a sleep opportunity period.''

Boeing's suggested definition of rest facilities has already been largely incorporated into the definitions for the Class 1 and 2 rest facilities. The FAA declines to incorporate the suggested definition for a Class 3 rest facility because there is no recommendation in the TNO Report that a Class 3 facility provide sound mitigation.

Boeing also said that it finds the new crew rest definitions to be overly prescriptive, and may drive design and configuration decisions that would run counter to the intent of the proposed rule. For example, all three classes of rest facility are defined by their location: Class 1 must be located ''separate from both the flight deck and passenger cabin;'' Class 2 must be in the passenger cabin; and Class 3 must be in the cabin or flight deck. Boeing notes that while these definitions may encompass most or many of the current airplane configurations, they preclude new and novel designs that might better match the intent of the rule. The commenter recommended that the FAA consider including a provision in the rule that would allow new or alternative designs to be qualified as ''equivalent'' to Class 1, 2, or 3, based on scientific data, such as: ''Rest facilities may be qualified to a higher Class if the quantity of sleep achieved in the facility can be demonstrated to be equal to or greater than the level achieved by that Class.''

Boeing's recommendation for recognizing new rest facilities that provide a sleep opportunity that is equivalent to the rest facilities defined by this rule is addressed by the FRMS and exemption processes. If an air carrier can show that its rest facility provides the same benefits as a Class 1, 2, or 3 rest facility, the FAA may approve an FRMS or an exemption recognizing the rest facility in question as providing the same fatigue mitigation as the rest facilities regulated by this rule.

Atlas said that the proposed rule's definition of rest facility is unworkably vague and leaves a number of uncertainties, which the FAA declined to clarify in response to questions. In particular, NACA and Atlas stated that the definition of Class 1 rest facility needs to be revised, as it is impossible to provide complete ''isolation from noise and disturbance'' on an aircraft. Atlas said that it supports changing the definition of a Class 3 rest facility to include a common coach class seat or non-crew seat on the flight deck of an all-cargo aircraft.

The definition for a Class 1 rest facility does not require that the isolation from noise and disturbance be complete. The FAA will accept a Class 1 rest facility that minimizes noise and disturbance without eliminating it completely, as complete elimination of noise and disturbance onboard an aircraft is virtually impossible. As discussed above, the FAA has declined to accept an economy-class seat as a rest facility because the TNO Report has determined that these types of seat provide a minimal amount of restful sleep.

24. Rest Period

The NPRM defined ''rest period'' as a continuous period determined prospectively during which the flightcrew member is free from all restraint by the certificate holder, including freedom from present responsibility for work should the occasion arise. None of the comments raised any significant issues with regard to this definition, and as such, this rule adopts the proposed definition.

25. Scheduled

The NPRM stated that ''scheduled'' means times assigned by a certificate holder when a flightcrew member is required to report for duty.

UPS commented that the definition does not address reschedules that occur during an FDP but only schedules assigned when the flightcrew member

[19] TNO Report at 17.

[20] *Id.* at 18.

reported for duty. UPS suggested revising the definition as follows: ''Scheduled means times assigned by a certificate holder when a flightcrew member is required to report for duty or has been given a re-schedule during the FDP that fully complies with the requirements of this part.''

The FAA agrees with UPS that the proposed definition was ambiguous. The pertinent definition has been amended for clarification purposes.

26. Schedule Reliability

The NPRM defines ''schedule reliability'' to mean the accuracy of the length of a scheduled flight duty period as compared to the actual flight duty period.

FedEx ALPA, ALPA, CAPA, SWAPA, IPA, and Flight Time ARC proposed the following revised definition for schedule reliability: ''Schedule reliability means the accuracy of the length of both a scheduled flight duty period and a scheduled flight segment as compared to the actual flight duty period and segment.'' SWAPA offered the following rationale for the revised definition: ''To achieve schedule reliability, the individual flight segments must be considered. If a given segment within a pairing causes the pairing to exceed the limits, the certificate holder can merely leave the offending segment and change the pairing mix to bring it within limits. The segment would never be corrected. We believe that a scheduling metric must be included in § 117.9. Certificate holders now provide on-time reports to the DOT on an individual flight segment so this should not be a burdensome requirement.''

UPS said that defining schedule reliability as a comparison of an actual FDP to a scheduled FDP has no fatigue or safety implications. It recommended revising the definition as follows to match the preamble description: ''Schedule reliability means the accuracy of the length of a scheduled flight duty period as compared to the maximum FDP listed in either Tables B or C (as applicable).''

As discussed in other parts of this preamble, the FAA has largely removed the proposed schedule-reliability requirements from the final rule. As such, there is no longer a need to define schedule reliability, and that definition has been removed from this rule.

27. Short-Call Reserve

The NPRM stated that ''short-call reserve'' means a period of time in which a flightcrew member does not receive a required rest period following notification by the certificate holder to report for a flight duty period.

NACA said that the only task assigned during short-call reserve is answering the phone. Otherwise, flightcrew members are free to conduct their lives as if they were in a rest period. NACA recommended clarifying the definition by specifying that short-call reserve is not duty.

NACA, Atlas, and NAA asked the FAA to more clearly distinguish short-call reserve from airport/standby reserve. Atlas recommended revising the definition of short-call reserve to mean ''a short, designated period of time (usually three hours or less), either at home or in a hotel, during which a flightcrew member is on reserve call-up for an assignment. Because the flightcrew member has not reported for assignment and rest is available, the time on short-call reserve is not to be considered part of FDP or duty.'' NAA recommended the following revision to the definition to address its concerns: ''Short-call reserve means a period of duty time in which a flightcrew member does not receive a required rest period following notification by the certificate holder to report for a flight duty period, but is provided more than one hour notice of the required reporting time.''

In response to the above comments, the FAA notes that the distinctive feature of short-call reserve is that the flightcrew member on short-call reserve is assigned a reserve availability period. Accordingly, the definition of short-call reserve has been amended to clarify that this definition only applies to a flightcrew member who is assigned to a reserve availability period. As discussed in the pertinent portions of this preamble, the FAA has removed the cumulative-duty-period limits from this rule, in part, in response to concerns raised by commenters about the way that this cumulative limit impacted short-call reserve.

28. Split Duty

The NPRM defines ''split duty'' as a flight duty period that has a scheduled break in duty that is less than a required rest period.

NACA said that the definition of split duty should make clear that the term ''scheduled'' is used only where it is clearly applicable to the situation intended. For non-scheduled operations, NACA believed that a schedule begins when the flightcrew member shows up for an FDP. As such, NACA argued that split-duty credit should be provided for a break in nonscheduled operations that was not foreseen. Additionally, according to NACA, a scheduled split duty break should not be strictly enforced because it may be intended in a nonscheduled FDP at the time the flightcrew member shows up for the FDP but not used for real-time operational reasons.

NACA further said that the fatigue-mitigating rest must be provided in the FDP in which the split-duty credit is actually used. According to NACA, the split-duty rest can only be used if the split duty rest opportunity is actually provided. NACA recommended that the definition be revised as follows, to include the phrase ''an actual'' to address its concerns: ''split duty means a flight duty period that has an actual scheduled break in duty that is less than a required rest period.'' Atlas added that, for clarity and to strengthen split duty as a fatigue mitigation vehicle, the phrase ''a scheduled break'' in the split duty definition should be changed to ''an actual break.''

RAA said that the definition should be revised as follows: ''split duty means a flight duty period that has a scheduled break in duty in a suitable accommodation that is less than a required rest period.''

The FAA agrees with the above commenters that split duty should be based on actual and not just scheduled rest. In light of the commenters' concerns, the split duty section has been amended to clarify that actual split-duty rest may not be less than the amount of split-duty rest that was scheduled. With regard to NACA's concerns about the term ''scheduled,'' as discussed in the split-duty section of this preamble, air carriers are required to schedule split-duty before the beginning of a split-duty FDP so that flightcrew members can accurately self-assess their ability to safely complete the FDP before the FDP begins.

29. Suitable Accommodation

The NPRM defines ''suitable accommodation'' to mean a temperature-controlled facility with sound mitigation that provides a flightcrew member with the ability to sleep in a bed and to control light.

APA, ALPA, CAPA, SWAPA, FedEx ALPA, and Flight Time ARC said that operational experience has demonstrated that a single-occupancy room is required. Otherwise, disruptions such as the other person's reading, watching television, snoring, *etc.,* will disrupt the roommate's rest. To address these concerns, the commenters recommend revising the definition as follows so that it only applies to single occupancy: ''Suitable accommodation means single occupancy facility with sound mitigation that provides a flightcrew member with the ability to

sleep in a bed and to control light.'' APA recommended the following revised definition: ''suitable accommodation means a single-occupancy hotel room or equivalent with a bed, sound mitigation and light and temperature controls that is reasonably free from disturbances.''

In response to the above commenters, the FAA notes that it is unaware of any scientific data showing that single-occupancy rooms are essential for split-duty rest. Until there is more data showing the safety benefits of single-occupancy rooms, the FAA will not impose the cost of obtaining these types of rooms on air carriers. In addition, upon reevaluation of the definition of suitable accommodation, the FAA has determined that a chair that allows for a flat or near flat sleeping position would also provide significant recuperative split-duty rest. Therefore, the definition of suitable accommodation has been amended accordingly.

In addition, as discussed further in the definition of ''rest facilities,'' a suitable accommodation only applies to ground facilities and does not apply to rest facilities onboard aircraft because the use of onboard rest facilities as a suitable accommodation raises concerns regarding flightcrew member safety. The use of onboard rest facilities requires that the aircraft's environmental systems be turned on and that someone monitor the continuing operation of these systems. However, if an onboard rest facility is used as a suitable accommodation while the aircraft is on the ground, there would be no one awake to monitor the continuing safe operation of these environmental systems. Consequently, the use of onboard rest facilities for ground-based sleep poses a safety risk, which is also discussed in the aircraft flight manual, and as such, this rule does not consider onboard rest facilities to be a suitable accommodation.

30. Theater

The NPRM states that ''theater'' means a geographical area where local time at the flightcrew member's flight duty period departure point and arrival point differ by no more than 4 hours.

Flight Time ARC, ALPA, CAPA, IPA, and FedEx ALPA said that the definition should provide for instances where countries such as China have just one time zone. These commenters recommended amending the definition as follows to address such instances: ''Theater means a geographical area where local time at the flightcrew member's flight duty period departure point and arrival point differ by no more than 4 time zones or 60 degrees of longitude.'' APA and SWAPA commented similarly, except they recommended referencing three time zones instead of four so that the definition reads: ''Theater means a geographical area where local time at the flightcrew member's flight duty period departure point and arrival point differ by no more than three time zones or sixty (60) degrees of longitude whichever is most restrictive.''

In support of its recommendation, APA and SWAPA said that they believe the intent of the NPRM is to define a theater as an area four time zones in width. Thus, this would be a difference of three time zones from the flightcrew member's point of origin. APA further commented that it recommended three time zones because while the United States is four time zones wide, the difference between the east and west coast is three hours or three time zones. APA believed that specifying more than this amount would be contrary to most scientific recommendations about theater and acclimation. APA also believed that its revised definition addresses the irregularities of daylight savings time.

Theater is now defined as ''a geographical area where the flightcrew member's flight duty period departure point and arrival point differ by more than 60 degrees longitude.'' The FAA has chosen to eliminate the reference to time zones in this definition because, as the commenters correctly pointed out, time zones do not provide a uniform method of measurement, as they tend to vary in different geographic regions.

31. Unacclimated

The FAA did not propose a definition for this term; however, several commenters recommended that such a definition be included in the final rule.

Flight Time ARC, ALPA, CAPA, SWAPA, IPA, APA and FedEx ALPA said that the FAA should define this term because it is used throughout the NPRM. Each of these commenters (except APA and SWAPA) defined the term as follows: ''A pilot becomes unacclimated if he has traveled to a location more than 4 time zones or more than 60 degrees of longitude from the location at which he was last acclimated.'' APA suggested the same definition except it referenced three time zones instead of four. SWAPA defined the term as follows: ''A pilot becomes unacclimated if he has a legal rest period less than 36 consecutive hours within a 72 hour period at a location more than 60 degrees of longitude from the location at which he last acclimated and has not spent 72 consecutive hours in that theater.''

The commenters believed that defining acclimated in terms of time zones is subject to the whim of government policy. For example, China has one time zone but spans five normal time zones in width. Also, 60 degrees of longitude is equivalent to four normal time zones and should be included as a supplement to the time zone metric. APA added that a location more than three time zones away is in fact in the fourth time zone or further.

In response to the above comments, the FAA notes that this rule defines ''acclimated,'' and under that definition, it lists the conditions that are necessary for a flightcrew member to be considered acclimated. If a flightcrew member does not meet those conditions, it logically follows that the flightcrew member is unacclimated. Accordingly, it is unnecessary to provide a separate definition for ''unacclimated.''

32. Unforeseen Operational Circumstance

The NPRM defines ''unforeseen operational circumstance'' as an unplanned event beyond the control of a certificate holder of insufficient duration to allow for adjustments to schedules, including unforeseen weather, equipment malfunction, or air traffic delay.

Alaska Airlines commented that it disagrees with the following explanation from the FAA's Response to Clarifying Questions document:

> To the extent the NPRM uses the term ''unforeseen circumstances,'' the agency intended the term to have the same meaning as ''unforeseen operational circumstances.'' This term does not differ significantly from the current application of ''beyond the control of the certificate holder'' in § 121.471(g) except that in the NPRM the FAA is clear that even if a situation is beyond the certificate holder's control, it may not extend beyond the general limits if the circumstances were reasonably foreseeable.

The commenter said that it disagrees with the FAA's clarification because there is a major difference between the proposed definition and the current authorization in section 121.471(g). Alaska Airlines stated that the proposed definition was extremely vague because it did not definitively state whether situations such as bad weather would always constitute unforeseen circumstances.

UPS expressed concern that the definition is not used consistently. It notes that in proposed §§ 117.15 and 117.19, the term ''unforeseen circumstance'' is used, but the related wording does not match what is used in

the defined term. To address its concern, UPS suggested maintaining the current definition of ''beyond the control of the certificate holder.''

The FAA agrees with the above commenters that the proposed definition of ''unforeseen operational circumstances'' is unclear. To make the definition more definitive, ''beyond the control of the certificate holder'' was removed from the definition. As such, under the provisions of the final rule, an event constitutes an unforeseen operational circumstance as long as it was unplanned and long enough in duration that the issues associated with that event could not be resolved through minor schedule adjustments. The ''beyond the control of the certificate holder'' safeguard was moved into the reporting requirement for various FDP extensions where it is easier to understand, and it is discussed in more detail in the pertinent portions of this preamble.

Atlas, World Airways, NAA, and NACA said that while the FAA's definition works well for scheduled service, it does not work for nonscheduled service. These commenters noted that nonscheduled service includes significant unforeseen circumstances where customers determine departure airports, arrival airports, and departure times. They also included instances where ground service providers typically give low priority to low frequency ad hoc or non-scheduled operations even though service contracts are assured before aircraft arrival. NAA and NACA added that the proposed definition also does not include other operational irregularities like Minimum Equipment List issues.

To address their concerns, Atlas, World Airways, NAA, and NACA recommended the following revised definition: ''Unforeseen operational circumstance means an unplanned event beyond the control of a certificate holder of insufficient duration to allow for adjustments to schedules, including, but not limited to, un-forecast weather, equipment malfunction, or air traffic delay, charter customers' failure to present passengers and/or cargo at the scheduled time and place; and ground service providers that fail to provide services at the scheduled time.''

In response to the concerns expressed above, the FAA emphasizes that the examples provided in the definition of ''unforeseen operational circumstances'' are not intended to be exclusive. As discussed in the preceding response, an event constitutes an unforeseen operational circumstance as long as it was unplanned and long enough that the issues associated with that event could not be resolved through minor schedule adjustments. This definition includes unplanned events that are specific to supplemental operations.

Alaska Airlines stated that the impact of all weather is unforeseeable, and the duration is always unknown and beyond the control of the certificate holder. It also stated that while many weather events are foreseeable, all are beyond the carriers' control. The commenter suggested eliminating the phrase ''insufficient duration to allow for adjustments to schedules,'' and revising the definition as follows: ''Unforeseen operational circumstance means an event beyond the control of a certificate holder, including unforecast weather, equipment malfunction, or air traffic delay.''

In response to Alaska Airlines, the FAA notes that the phrase ''insufficient duration to allow for adjustments to schedules'' is intended to exclude unplanned events of relatively short duration. For example, the FAA would not consider a five-minute air traffic delay as an unforeseen operational circumstance that justifies the need for a two-hour FDP extension. Because relatively short unplanned events should not be used as a basis for extending an FDP, the FAA has decided to retain ''insufficient duration to allow for adjustments to schedules'' in the definition of unforeseen operational circumstances.

33. Window of Circadian Low

The NPRM defined window of circadian low as a period of maximum sleepiness that occurs between 0200 and 0559 during a physiological night. The FAA did not receive any comments with regard to this definition, and as such, this rule adopts the proposed definition.

C. Fitness for Duty

The goal of proposed section 117.5 was to address situations in which a flightcrew member complies with the other provisions of this proposal, but still shows up for an FDP too fatigued to safely perform his or her assigned flight duties. The proposed section 117.5 would have made fatigue mitigation the ''joint responsibility of the certificate holder and the flightcrew member.'' 75 FR 5587. This section sought to discourage certificate holders from pushing the envelope with fatigue-inducing practices such as ''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.'' *Id.* The proposed section 117.5 also sought to discourage flightcrew-member practices such as ''pick[ing] up extra hours, moonlight[ing], report[ing] to work when sick, commut[ing] irresponsibly, or simply not tak[ing] advantage of the required rest periods.'' *Id.*

To discourage the above practices, the proposed section 117.5 contained a number of restrictions. First, this section would have prohibited flightcrew members from accepting an assignment that would consist of an FDP if they were too tired to fly safely. Second, this section would have prohibited flightcrew members from continuing subsequent flight segments if they were too fatigued to fly safely. Third, the proposed section would have required the certificate holder to assess a flightcrew member's state when he or she reported for work, and, if the flightcrew member was showing signs of fatigue, this section prohibited the certificate holder from allowing that flightcrew member to fly. Fourth, this section would have required flightcrew members to report to management about other flightcrew members who they believed were too tired to fly, and in those instances, it required management to perform an evaluation to determine whether the flightcrew member in question was indeed too tired to fly safely. Fifth, this section would have required certificate holders to develop and implement an internal evaluation and audit program to monitor whether flightcrew members were reporting to work fatigued.

The FAA received numerous comments regarding the proposed section 117.5. For the sake of clarity, the FAA will analyze the substantive issues raised by the comments as those issues pertain to each of the proposed provisions of 117.5.

Proposed § 117.5(a)

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

Two commenters stressed the importance of pilots being fit for duty. IPA, ALPA, Flight Time ARC, and one other commenter supported the proposed provision, and emphasized that this provision does not create a policing environment in which certificate holders track or monitor flightcrew members' off-duty activities. Fifteen pilots requested the removal of the above provision, arguing that this provision unfairly places the burden of showing up fit for duty solely on the flightcrew member. Multiple commenters also emphasized that

tracking fitness for duty must be the joint responsibility of the certificate holder and the flightcrew member.

Several commenters included suggestions and requests for clarification. NJASAP sought clarification regarding the repercussions of a flightcrew member reporting for duty without being properly rested. NAA and UPS recommended including the statement that flightcrew members need to be prepared to work ''up to the prescribed FDP limits in Tables B or C'' when they begin an FDP.

Section 117.5(a) does not place the burden of showing up fit for duty solely on the flightcrew member. Section 117.5(a), in conjunction with the other provisions of this rule, places a joint responsibility on the certificate holder and each flightcrew member. In order for the flightcrew member to report for an FDP properly rested as required by this section, the certificate holder must provide the flightcrew member with a meaningful rest opportunity that will allow the flightcrew member to get the proper amount of sleep. Likewise, the flightcrew member bears the responsibility of actually sleeping during the rest opportunity provided by the certificate holder instead of using that time to do other things. The consequences of a flightcrew member reporting for duty without being properly rested are addressed by subsections (b) and/or (c) of this section, which prohibit the flightcrew member from beginning or continuing an FDP until he or she is properly rested.

Turning to NAA and UPS' suggestion, the FAA has declined to add the proposed language to subsection 117.5(a). The adopted language of subsection 117.5(a) requires each flightcrew member to report for an FDP ''rested and prepared to perform his or her assigned duties.'' These assigned duties will not always extend to the outer limits prescribed in tables B and C of this rule. Indeed, a certificate holder will find it difficult to comply with the cumulative limits specified in section 117.23 if it always assigns duties at the outer limits of tables B and C. Therefore, the text of this subsection reflects the fact that a flightcrew member needs to be rested and prepared to safely perform the duties that are actually assigned to him or her.

Proposed § 117.5(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.

Peninsula Airways, Pinnacle Airlines, and Southern Air stated that the flightcrew is the best source of determining fatigue, and as such, an air carrier should not be responsible for monitoring fatigue symptoms and assessing fatigue. ATA, CAA, NACA, and a number of other commenters stated that the proposed subsection would be impossible to implement because it places the burden of determining flightcrew member fatigue on air carriers without providing the air carriers with an objective scientific standard for measuring fatigue. ATA and Delta added that when a flightcrew member reports for duty at the beginning of an FDP, it is impossible for an airline to determine whether that flightcrew member will be fatigued toward the end of the FDP.

The NTSB supported enabling flightcrew members to self-report fatigue. NJASAP and Boeing stated that flightcrew members cannot subjectively self-assess whether they are too fatigued to safely carry out their assigned FDPs. NJASAP based its assertion on NASA fatigue research showing that when a person is fatigued, he or she suffers from impaired judgment, and may lack the ability to self-assess his or her level of alertness. Boeing asked the FAA to include non-subjective factors in the fatigue determination requirement, such as time of day and the amount of sleep received in a 24-hour period. Alaska Airlines asked that the phrase ''too fatigued'' be defined more clearly. Boeing was also concerned about flightcrew members who self-assess at the beginning of an FDP improperly assessing their competency to actually complete the FDP.

CAPA, SWAPA, and APA recommended that the FAA add a non-retaliation provision to the proposed subsection in order to prevent disciplinary action against flightcrew members who self-report fatigue. One commenter stated that fatigue reporting should be voluntary. Two commenters argued that the entire crew should be assessed to determine fitness for duty.

The FAA agrees with the commenters who stated that at this time sleep science cannot support a general regulatory standard under which air carriers would be required to monitor the exact level of flightcrew member fatigue. As these commenters correctly pointed out, there does not currently exist an objective standard for determining fatigue levels. As such, requiring air carriers to suspend flightcrew members who they ''believe'' are too fatigued would create a vague and difficult-to-apply regulatory standard. To address this concern, the FAA has eliminated the following provision from the proposed subsection: ''or if the certificate holder believes that the flightcrew member is too fatigued to safely perform his or her assigned duties.'' The remaining language in this subsection places a limited burden on the certificate holder—it prohibits the certificate holder from assigning an FDP to a flightcrew member who has informed the certificate holder that he or she is too fatigued to safely perform his or her assigned duties.

The discussion in the preceding paragraph should not be construed to imply that air carriers cannot identify flightcrew member fatigue. As the proposed AC 120–FIT (finalized as AC 117–3) pointed out, there are objective signs that could be used to identify flightcrew member fatigue. The FAA has simply chosen not to impose a mandatory regulatory requirement because the signs used to identify fatigue cannot be synthesized into a general objective standard. However, the FAA encourages air carriers to voluntarily evaluate flightcrew members who are showing signs of fatigue.

NJASAP and Boeing's concerns about the subjective nature of flightcrew member self-assessment and self-reporting are mitigated by the fact that, pursuant to statutorily-mandated Fatigue Risk Management Plans (FRMP), flightcrew members will undergo fatigue education and training. The information that the flightcrew members learn during this training will increase each flightcrew member's ability to self-assess his or her fatigue levels.

In response to the comment that fatigue reporting should be made voluntary, the FAA has decided to make fatigue reporting mandatory because allowing a flightcrew member to accept an assignment to an FDP when that flightcrew member knows that he or she is too tired to fly safely poses an unacceptable safety risk. However, the FAA cannot, at this time, impose an objective requirement on self-reporting fatigue because, as the other commenters pointed out, there is no objective science-based standard that could be used to measure fatigue levels. The FAA also cannot further define the phrase ''too fatigued'' because defining this phrase requires the creation of an objective fatigue-measurement standard, which does not exist at this time. Instead of creating a single objective fatigue-measurement standard, the above subsection requires each flightcrew member to utilize the information provided during his or her statutorily-mandated fatigue training to self-assess whether he or she feels well-rested enough to safely complete his or

her assigned FDP. The FAA also emphasizes that flightcrew members who feel alert at the beginning of an FDP can immediately terminate the FDP, under subsection (c) of section 117.5, if they feel themselves becoming too fatigued to safely continue their assigned duties.

The FAA also considered the possibility of adding a non-retaliation provision to the above text, but ultimately decided against adding such a provision. As the NPRM pointed out, ''[c]arriers are entitled to investigate the causes for an employee's fatigue.'' 75 FR 55858. ''If a carrier determines that the flightcrew member was responsible for becoming fatigued, it has every right to take steps to address that behavior.'' *Id.* However, if the flightcrew member's fatigue is a result of the carrier not following the regulatory requirements of this rule, the FAA may initiate enforcement action against the carrier.

Turning to concerns about fatigue affecting other air carrier employees, as discussed in the NPRM, the FAA ''has decided to take incremental steps in addressing fatigue.'' 75 FR 55857. In accordance with this decision, the NPRM proposed a flight, duty, and rest rule that was only applicable to flightcrew members. Because the proposed rule was not applicable to other flight crewmembers, such as flight attendants, expanding the rule to those flight crewmembers at this point in time would exceed the scope of this rulemaking. However, the FAA emphasizes that its incremental approach contemplates ''future rulemaking initiatives [that] may address fatigue concerns related to flight attendants, maintenance personnel, and dispatchers.'' *Id.*

Proposed § 117.5(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.

The FAA did not receive any comments that were specific to this subsection. To the extent any of the comments discussed in the preceding subsection are applicable to this subsection, the FAA's response to those comments can be found above.

Proposed § 117.5(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.

ATA, NACA, Delta, Alaska Airlines, and UPS stated that requiring persons to report other people who they believe to be fatigued could result in persons with no training or with ill will making erroneous reports. Multiple commenters emphasized that there is no objective scientific standard to guide personnel about when they need to make a report about another flightcrew member's fatigue. ATA stated that the proposed subsection will shift liability to airlines and impose significant costs in the form of training and retraining tens of thousands of employees.

The FAA agrees with the commenters who stated that, because there is no objective scientific standard to guide personnel about when they need to report other flightcrew members' fatigue, having a mandatory reporting requirement could lead to a multitude of erroneous reports. To address this concern, the FAA has eliminated the above subsection from the final rule. However, even though the FAA has decided not to impose a mandatory reporting requirement, each flightcrew member and covered employee is encouraged to voluntarily inform their employer when they observe a fatigued flightcrew member.

Proposed § 117.5(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.

Numerous commenters stated that there is no objective scientific standard under which a certificate holder could evaluate a flightcrew member's fitness for duty. The commenters also emphasized that the proposed subsection would create difficulties at remote airports where the certificate holder lacks personnel qualified to conduct a fitness-for-duty evaluation.

The FAA agrees with the commenters that there is no objective scientific standard that an air carrier could use to evaluate a flightcrew member's continued fitness for duty. Accordingly, the FAA has eliminated the above subsection from the final rule.

Proposed § 117.5(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.

RAA stated that there was no benefit to requiring each flightcrew member to sign a document stating that he or she is fit for duty. Instead, RAA suggested that the PIC sign the fitness for duty affirmation on behalf of the entire crew. NJASAP asked (1) how the flightcrew members would affirm fitness for duty via the flight release, and (2) whether this requirement would apply to each flight segment.

As the FAA and other commenters pointed out elsewhere, there is no objective scientific test that the PIC could use to measure the fatigue levels of other flightcrew members. Because the PIC has no way to objectively measure other flightcrew members' fatigue, the FAA has determined that each flightcrew member should be required to monitor his or her own fatigue level. As such, each flightcrew member must either make a written affirmation that he/she is fit for duty or terminate the assigned FDP pursuant to subsection 117.5(c).

The requirement that flightcrew members make a written affirmation about their continued fitness for duty applies to each flight segment of the assigned FDP. This is because a flightcrew member who is alert at the beginning of an FDP may become dangerously fatigued once the FDP is underway. Requiring a written fitness for duty affirmation before each flight segment will help ensure that flightcrew members continuously monitor their fatigue levels during the course of an FDP. If, during the course of this monitoring, flightcrew members determine that they cannot safely continue their assigned duties, section 117.5(c) would require them to terminate their assigned FDP prior to the beginning of the next flight segment.

The affirmation on the dispatch or flight release simply needs to state that the undersigned flightcrew members affirm that they are fit for duty. The dispatch or flight release containing the affirmation must be signed by each flightcrew member. This requirement applies to each flight segment and each air carrier should inform its flightcrew members about the significance of signing a fitness-for-duty affirmation.

Proposed § 117.5(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.

Alaska Airlines stated that the audit requirement is duplicative of the current FRMP process. Delta added that the audit requirement is unclear about how a carrier is supposed to monitor which flightcrew members are showing up fit for duty. ATA asserted that the evaluation and audit requirement is unworkable and impossible to implement because there are no objective scientific standards that a certificate holder could apply to ''monitor'' which flightcrew members

are reporting for an FDP fit for duty. ATA added that the proposed subsection is unclear about what constitutes a ''deficiency'' and how a certificate holder is supposed to correct a ''deficiency.''

The FAA agrees with Delta and ATA that the proposed subsection does not provide a workable standard for the internal evaluation and audit program. Therefore, the FAA has removed the above subsection from the final rule.

D. Fatigue Education and Training

As part of the NPRM, the FAA proposed a fatigue education and training program. Studies have shown that fatigue degrades all aspects of human performance and impedes the exercise of sound judgment.[21] Studies have also shown that, depending on the operating environment, it can be difficult for an individual to recognize that he or she is fatigued and that his or her judgment may be compromised.[22] Given the impact that fatigue has on the performance of flight-related duties, the FAA was concerned that the existing regulatory structure did not properly educate air carrier personnel about fatigue and its impact flight safety.[23]

In order to raise awareness of fatigue-related issues and provide training on fatigue mitigation strategies, the FAA proposed that certain air carrier personnel be required to undergo a fatigue education and training program. First, the proposed fatigue education and training provisions would have required fatigue education and training for each person involved with scheduling aircraft and crews, as well as all flightcrew members and individuals who conduct management oversight over covered personnel. Second, the proposed section would have required an initial 5-hour-long training session for all newly-hired covered employees and a 2-hour-long annual recurrent training session for all other covered employees. Third, this section set out a training curriculum that would have informed covered personnel about fatigue and fatigue countermeasures. Fourth, the proposed fatigue education and training section would have required certificate holders to make changes to their fatigue education and training programs after being notified of the need to do so by the Administrator.

Alaska Airlines suggested that the FAA eliminate the proposed fatigue education and training section and instead rely on the FRMP to provide the necessary fatigue-related information to airline personnel. The FAA agrees with Alaska Airlines that the fatigue education and training program proposed in the NPRM was unnecessarily cumulative.

Part 121 air carriers are currently statutorily-required to annually provide, as part of their FRMP, fatigue-related education and training to increase the trainees' awareness of: (1) Fatigue; (2) ''the effects of fatigue on pilots;'' and (3) ''fatigue countermeasures.'' *See* Public Law 111–216 sec. 212(b)(2)(B). Today's rule adopts the same standard of training as required by the statute. In addition, today's rule adopts a mandatory update of the carriers' education and training program every two years, as part of the update to their FRMP. See Public Law 111–216 sec. 212(b)(4)(A) and (B). Both of these regulatory provisions merely place the existing statutory requirements in the new flight and duty regulations for the ease and convenience of the regulated parties and the FAA.

The statute does not limit the required training to flightcrew members; however, the FRMPs developed by carriers and accepted by the FAA have generally been so limited. Today's rule would require an expansion of the training portion of the FRMPs to all employees responsible for administering the provisions of the new rule, including flightcrew members, dispatchers, individuals directly involved in the scheduling of flightcrew members, individuals directly involved in operational control, and any employee providing direct management oversight of those areas.[24] As discussed below, the FAA continues to believe that personnel responsible for crew scheduling and who play a role in assuring the carrier has operational control need to understand the causes of fatigue as well as the risk that pilot fatigue poses to safe operations.

In response to comments from ATA, Atlas Air and NAA, among others, the FAA has amended the regulatory text to clarify that the fatigue education and training requirement only applies to individuals who are directly involved in flightcrew scheduling and/or operational control and their direct supervisors. The reason for designating such a broad category of covered personnel is to ensure that each individual who has the power to alter a flightcrew member's schedule and/or change the manner in which operational control is exercised is fully aware of how his or her actions will affect flightcrew fatigue and flight safety. Direct management personnel were ultimately included in this category because a manager could order his or her immediate subordinate(s) to change flightcrew member schedules and/or change the manner in which operational control is exercised.

The FAA has decided not to limit the scope of covered personnel to specific enumerated positions because air carriers may employ individuals who exercise significant control over flightcrew scheduling and/or operational control while not occupying one of the positions commonly associated with this type of authority. To ensure that these individuals receive the appropriate fatigue-related education and training, the FAA has retained the requirement that all individuals directly involved in flightcrew scheduling and/or operational control, as well as their direct supervisors, receive the training required under this section.

In response to a question by ATA and Alaska Airlines about whether an air carrier's CEO would be required to undergo fatigue education and training, that CEO would have to undergo fatigue education and training only if he or she is either (1) directly involved in scheduling flightcrew members/exercising operational control, or (2) directly manages someone who is directly involved in scheduling flightcrew members/exercising operational control. Business decisions made by the CEO that only indirectly affect flightcrew scheduling/operational control would not trigger the fatigue education and training requirements of this section.

Alaska Airlines and Delta asserted that they already have fatigue education and training programs. Alaska Airlines asked whether the proposed education and training requirements are

[21] *See, e.g.,* NASA, *Crew Factors in Flight Operations X: Alertness Management in Flight Operations,* at 16 (Apr. 1999), http://human-factors.arc.nasa.gov/zteam/PDF_pubs/ETM.TM8_99rev.pdf (''Sleepiness can degrade essentially every aspect of human performance'').

[22] The NASA fatigue report stated that:

The level of underlying physiological sleepiness can be concealed by an environment in which an individual is physically active, has consumed caffeine, or is engaged in a lively conversation. Whereas these factors may affect the self-reported rating of sleepiness (usually individuals will report greater alertness than is warranted), they do not affect the underlying sleep need expressed by the level of physiological sleepiness.

Id. at 17.

[23] The National Institute for Occupational Safety and Health (NIOSH) provides one example of the unacceptable effects that the current lack of fatigue education has on flight safety. In its comment, NIOSH points out that ''[i]n a survey of pilots working for large operators in Alaska, 22% responded that they made a decision to fly fatigued either weekly or monthly.'' NIOSH Comments to DOT at 2.

[24] Because the statute requires FRMPs to be updated every two years, the FAA anticipates that carriers will simply expand the group of employees subject to training in their next update, scheduled for the summer of 2013.

cumulative with regard to the existing Advanced Qualification Program (AQP).[25] UPS suggested that the FAA rely on the AQP and FRMS to provide fatigue-related information to airline personnel.

Delta requested that it be permitted to include material from its existing training program in the program now required by this section and that it be given credit for the training that its employees have already received. ATA and Alaska Airlines asked whether, in the case of an employee that changes employers, training received from a prior employer would count towards the requirements of this section. These commenters asserted that because the proposed training subject areas are generic and untethered to a specific airline's operations, fatigue training from a prior employer should count toward fulfilling the requirements of this section.

The FAA has determined that the problem with simply relying on AQP and FRMS to carry out the goals of the proposed fatigue education and training section is that both AQP and FRMS are programs that have been designed as alternatives to general requirements imposed on part 121 certificate holders. An air carrier can opt into an AQP program as an alternative to general training requirements that it would otherwise be subject to. *See* 14 CFR 121.901(a). Likewise, under section 117.7(a) of this rule, an air carrier can opt into an FRMS program as an alternative to some of the restrictions imposed by this rule. If the FAA was to rely on AQP and FRMS to take the place of the proposed fatigue education and training section, it would have to change AQP and FRMS to make them mandatory non-alternative programs in order to ensure that air carriers who currently choose not to participate in these programs have properly-trained personnel. This would destroy the alternative nature that is at the core of these programs, and as such, the FAA has decided against this approach.

It should be emphasized, however, that air carriers that had fatigue education and training programs prior to development of their FRMP did not necessarily need to design a new separate program to accommodate the statutory requirement for training and may not need to do so in order to provide education and training to all personnel covered by today's rule. Instead, these carriers may have simply supplemented their existing programs to meet the additional requirements imposed by the statute. For example, an existing fatigue education and training program that was offered as part of an air carrier's AQP could have been amended so that it also met the requirements for an FRMP. That program would then satisfy the statute and the requirement adopted today, as well as the air carrier's AQP-related fatigue education and training obligations.

The FAA agrees with ATA and Alaska Airlines that, when changing employers, covered personnel do not need to repeat non-operation-specific fatigue training that they received from their previous employer if that training meets the requirements of this section.

RAA objected to the proposed method of Administrator-required revisions to the fatigue education and training program. RAA argued that the proposed language ''would open the door for changes directed at an airline's fatigue training program from any number of individuals in [FAA] field offices, without standardization and coordination among those directives and at the risk of creating confusion in the important fatigue risk mitigation programs, messages and strategies that are sought though this regulation.'' RAA suggested that the FAA update fatigue education and training programs by either: (1) Initiating a new rulemaking each time that the programs need to be updated, or (2) using its OpSpec authority under 14 CFR 119.51 to require changes to the fatigue education and training programs.

Since the regulatory requirements adopted today will be administered through the carrier's FRMP, the FAA has adopted the same language as the statute, to wit, the education and training programs must be updated every two years and the FAA will either approve or reject the updates within 12 months of submission. If an update is rejected, the FAA will provide suggested modifications for resubmission of the update.

RAA asked that this section be renamed ''Fatigue Training Program'' because the word ''education'' does not have a well-understood regulatory meaning. NJASAP asked whether distance learning would be permitted to satisfy the fatigue education and training requirements or whether the training must be conducted in person. With regard to NJASAP's question about distance learning, this section does not prohibit distance learning.

The FAA has also decided to retain the word ''education'' in the name of this program. The Merriam-Webster Dictionary defines ''educate'' as: (1) To train by formal instruction and supervised practice, or (2) to provide with information. Because covered personnel will receive formal instruction and be provided with information, the term ''education'' aptly describes the program that is required by this section. To further clarify the goals of this program, the FAA has amended the program's name to the ''Fatigue Education and Awareness Training Program.''

E. Fatigue Risk Management System

The FAA proposed a Fatigue Risk Management System (FRMS) as an alternative regulatory approach to provide a means of monitoring and mitigating fatigue. Under an FRMS, a certificate holder develops processes that manage and mitigate fatigue and meet an equivalent level of safety.

Under proposed § 117.7, an FAA-approved FRMS would 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; and (6) a performance evaluation. In addition, if the Administrator determines that revisions were necessary to a carrier's FRMS, the certificate holder must make the requested changes upon notification.

Most commenters generally supported the concept of an FRMS as a way to manage fatigue and incorporate risk mitigation. Commenters questioned the scope and implementation of FRMS, and whether FRMS is a mature process that can be used effectively. There were few commenters, including Southern Air, who flatly disagreed that the FRMS would be effective.

Commenters were split between two approaches: those who endorsed the concept of FRMS as an alternative approach to the regulatory provisions adopted in this rule; and those who argued that FRMS should not permit certificate holders to deviate from the prescriptive measures, but rather supplement the regulatory requirements.

ATA contended that the FAA should wait for ICAO and international standards because the ambiguities presented in the proposal, as well as possible certificate holder reliance on future FAA determinations, could

[25] AQP is a systematic methodology for developing the content of training programs for air carrier flightcrew members and dispatchers. It replaces programmed hours with proficiency-based training and evaluation derived from a detailed job task analysis that includes crew resource management. The AQP provides an alternate method of qualifying and certifying, if required, pilots, flight engineers, flight attendants, aircraft dispatchers, instructors, evaluators, and other operations personnel subject to the training and evaluation requirements of 14 CFR parts 121 and 135.

competitively disadvantage U.S. carriers. Furthermore, ATA commented that the timing and approval of an FRMS is critical as operators that want to use an FRMS should be able to do so immediately once these rules are in place. UPS argued that the FRMS approval process must be available for least 12 months prior to the implementation of any final rule so that carriers can transition to an FRMS on the day that the requirements are effective. Lynden Air Cargo (Lynden) believed that the FRMP and FRMS processes are redundant and sought further explanation on the necessity of the two processes.

ALPA, IPA, FedEx ALPA, APA, SWAPA and the Flight Time ARC specifically stated that the FRMS needs to be an equal partnership that includes the FAA, the certificate holder, and the pilot body. APA further commented that successful safety programs such as Aviation Safety Action Program (ASAP) [26] and the Flight Operational Quality Assurance (FOQA) [27] are based on a three-way partnership and that FRMS should be treated the same way. ATA, however, argued for a collaborative approach, similar to that of an AQP as a relationship between the carrier and FAA with no other parties involved. The Flight Time ARC argued that pilot representatives must have the right to suspend or terminate participation in the FRMS if they determine that the program's safety purpose is not being met. Multiple entities commented that the FRMS should provide for an open reporting system and non-punitive environment.

A number of commenters questioned the process by which an FRMS is to be amended and which FAA office would provide this oversight. ATA commented that the process of the FRMS should be centrally located at the headquarters level, to provide a uniform approval scheme. RAA, however, interpreted the proposed language as enabling FAA field offices to require certificate holders to makes changes to their FRMS, which creates standardization and coordination problems and possibly confusion. NACA commented that industry must have a clear understanding of the parameters and implementation of FRMS so that competitive advantages cannot be gamed through differing interpretations and implementation of FRMS.

Some commenters, including RAA, believed that the approval of FRMS programs can best be accomplished via the same Operations Specifications authority that was established for each airline's recently filed FRMP under § 119.51. Additionally, RAA stated that generally the process for incorporating new science or advances regarding a program such as FRMS is through Advisory Circular process, where it can be presented as a new best practice. RAA further stated that if the FAA finds that future FRMS changes cannot be accommodated through the Advisory Circular process, then the agency should undertake appropriate rulemaking action and not simply skip the rulemaking process. ATA commented that the proposed regulatory text and draft AC120–103 do not provide the criteria used to approve a submitted FRMS.

APA and ALPA argued that FRMS should be limited to specific certificate holders' data and scheduled city pairs or substantially similar city pairs in terms of FDP length, start time and block, which must be scientifically and operationally validated by all stakeholders. ATA commented that in the NPRM, the FAA appears to suggest that FRMS will disfavor a system-wide approach.

Some commenters sought stronger regulatory text describing the FRMS as active, data-driven and scientifically based.

In response to the above comments, the FAA notes that, as stated in the NPRM, the option of an FRMS provides flexibility for certificate holders to conduct operations using a process that has been approved by the FAA based upon an equivalent level of safety for monitoring and mitigating fatigue for certain identified operations. A certificate holder may decide to use FRMS as a supplement to the requirements adopted in the rule, or it may use the FRMS to meet certain elements of this rule for which the adopted regulatory standard is not optimal.

The FAA has decided to adopt subsections (a) and (b) of the regulatory text as proposed. Subsection (a) provides for a certificate holder to use an approved FRMS as an alternative means of compliance with the flight duty regulations provided that the FRMS provides at least an equivalent level of protection against fatigue-related accidents or incidents. Subsection (b) specifies the components of an FMRS.

The FAA has also decided to extend the voluntary FRMS program to all-cargo operations, which are not required to operate under part 117. Under the FRMS provisions that this rule adds to subparts Q, R, and S of part 121, an all-cargo operator that does not wish to operate under part 117 can nevertheless utilize an FRMS as long as it has the pertinent FAA approval.

The implementing guidance in AC 120–103 details each component, the minimum necessary tools for a complete and effective FRMS, the steps in the FRMS process and the roles and responsibilities of all the participants. An FRMS is a data-driven and scientifically based process that allows for continuous monitoring and management of safety risks associated with fatigue-related error. See AC 120–103 at p.3. Furthermore, an FRMS is an effective mitigation strategy when the organization bases it on valid scientific principles. *Id.*

ICAO requires member states to implement some alternative means of compliance with existing rules and has recently issued Standards and Recommended Practices (SARPs) (effective December 15, 2011) that authorize the use of FRMS. In addition, ICAO, IATA and the International Federation of Air Line Pilots' Association (IFALPA) jointly issued the *Implementation Guide for Operators, 1st Edition,* in July, 2011 to provide carriers with information on implementing an FRMS that is consistent with the ICAO SARPs. The FAA concludes that incorporating an FRMS element is critical to implementing a comprehensive regulatory schedule addressing fatigue. Therefore, this rule incorporates the ability of a certificate holder to use an FRMS. The provisions adopted in this rule are consistent with the ICAO standards and AC 120–103 provides a means by which the operator may comply with these provisions.

The FAA agrees that certificate holders should be able to use an approved FRMS on the effective date of these regulations. The FAA understands that this rule may impact collective bargaining agreements and that time is needed for those changes to be adopted and for certificate holders to submit and receive approval for an FRMS.

[26] The objective of the ASAP is to encourage air carriers and repair station employees to voluntarily report safety information that may be critical to identifying potential precursors to accidents. Under an ASAP, safety issues are resolved though corrective action rather than through punishment or discipline. The ASAP provides for the collection, analysis, and retention of the safety data that is obtained. An ASAP is based on a safety partnership that will include the FAA and the certificate holder, and may include a third party, such as the employee's labor organization.

[27] FOQA is a voluntary safety program that is designed to make commercial aviation safer by allowing commercial airlines and pilots to share de-identified aggregate information with the FAA so that the FAA can monitor national trends in aircraft operations and target its resources to address operational risk issues. The fundamental objective of this new FAA/pilot/carrier partnership is to allow all three parties to identify and reduce or eliminate safety risks, as well as minimize deviations from the regulations.

Therefore, the effective date of this rule is two years after publication date. This should allow adequate time for certificate holders to take the necessary steps prior to the effective date.

The FAA indicated in the NPRM that it anticipates that all the FRMS proposals would be evaluated and approved at headquarters by individuals within Air Transportation Division, Flight Standards Service (AFS–200), who are dedicated to ensuring the continued quality of FRMS. The FAA has determined that the above course of action remains the best process to ensure consistency in the approval process.

The process of evaluating FRMS proposals will generally proceed as follows. The certificate holder will request a meeting with AFS–200 to express its interest in pursuing an FRMS authorization. During this meeting, the certificate holder will outline its plans for an FRMS. AFS–200 will then review the certificate holder's plans for an FRMS. Based upon the requirements for data collection identified by the certificate holder, the certificate holder, working in concert with AFS–200, will identify the applicable limitations from which the certificate holder may need a limited exemption for the sole purpose of data collection.

Once the certificate holder has petitioned for this exemption, AFS–200 will review the petition providing an analysis and developing applicable limitations and conditions for the exemption based upon the certificate holder's data collection plan. If AFS–200 grants the requested exemption, the resulting exemption will be limited in duration and scope for the purpose of the necessary data collection. Once the data has been collected, the data will be submitted to AFS–200 for data validation and evaluation of FRMS policies and procedures and FRMS training requirements. The FAA will publish guidance for review and approval of an FRMS authorization.

A successful FRMS will require a shared responsibility among management and the flightcrew members. In particular, developing mitigation strategies and schedule adjustments is going to be the result of a collaborative management process that includes all the stakeholders. In FAA Advisory Circular No. 120–103 Fatigue Risk Management Systems for Aviation Safety, the FAA identified four basic tools for a complete, workable, effective, and accountable FRMS: (1) Fatigue-related data; (2) fatigue analysis methods; (3) identification and management of fatigue drivers; and (4) application of fatigue mitigation procedures. As flightcrew member input is critical to implementing these tools, the FAA finds that the FRMS philosophy is consistent with the approach of the identified voluntary programs, such as ASAP and FOQA and requires participation by more than just the FAA and the certificate holder.

The FAA does not agree with the Flight Time ARC on imposing a requirement that the FRMS must be terminated or suspended if pilot representatives disagree with the program's purpose. This issue is beyond the scope of the NPRM and pilot representatives independently may raise their issues with the certificate holder.

In managing fatigue risk, the FAA has identified two types of operational evidence that are available to operators. (See AC No. 120–103, para (6)(1) and (2).) The first is monitoring flightcrew member duty schedules, which provides indirect evidence of potential fatigue resulting from inadequate or poorly timed opportunities to sleep. The second type of operational evidence is a non-punitive reporting system. Flightcrew members and other employees will be more encouraged to report subjective fatigue and to request relief from duties as necessary because of chronic fatigue. This reported information can be critical, in conjunction with other information about the conditions that contributed to fatigue, such as the work schedule for the week prior to the report.

The FAA agrees with the commenters and has deleted the proposed paragraph in § 117.7 that would have required a certificate holder to make necessary changes to its FRMS upon notification by the Administrator. Once approved by the FAA, an FRMS will be incorporated into the certificate holder's operations specifications and as contemplated in the NPRM, the FAA will use the process outlined in § 119.51 to amend operations specifications, if changes are necessary to a certificate holder's FRMS.

The FAA agrees with RAA that the use of advisory circulars is appropriate to incorporate new science or advances regarding fatigue as it relates to aviation operations. The regulations adopted in this rulemaking provide the baseline requirements for mitigating fatigue and instituting rest requirements. In the future, if the FAA concludes that the baseline regulations for flight and duty need to be revised, a rulemaking will be initiated. An approved FRMS can take advantage of the gains in science and experience, and if approved by the FAA, can permit certificate holders to exceed the baseline requirements.

The regulatory text provides the mechanism for a certificate holder to use an FRMS and the elements that must be addressed in the FRMS. The implementing guidance addresses how the certificate holder may proceed with documentation and scientific analyses to support its request to deviate from the standards adopted in this rule. The analyses and supporting documentation needed for approval are driven by how the certificate holder intends to use the FRMS and the elements of the flight and duty regulations that the FRMS is intended to supplement.

The FAA clarifies that a certificate holder may use an FRMS for any of the elements of the flight and duty requirements provided under this rule. While the FAA did state in its response to clarifying questions that ''validating an FRMS will be costly and likely to be used only on a 'route specific' basis,'' the agency was not attempting to discourage the use of an FRMS. The FAA encourages the use of an FRMS for certificate holders that can optimize their operations by doing so.

The FAA has updated its guidance in AC No. 120–103, Fatigue Risk Management Systems for Aviation Safety,[28] as a result of this rule. This AC is available at *www.faa.gov.* The FAA fully expects that as the program matures, certain carriers may apply the system to more than specific operations.

In accordance with Public Law 111–216, each part 121 air carrier had to submit to the FAA an FRMP. An FRMP is statutorily required for each part 121 air carrier; whereas, an FRMS is an optional approach to fatigue mitigation. The FRMP outlines the certificate holder's policies and procedures for managing and mitigating day-to-day fatigue from within a regulatory structure. This plan addresses the carrier's flightcrew members. The FRMP consists of three elements with respect to managing pilot fatigue: (1) Current flight time and duty period limitations; (2) a rest scheme that enables the management of fatigue and includes annual training to increase awareness of fatigue and fatigue countermeasures; and (3) the development and use of a methodology that continually assesses the effectiveness of the program.

While this plan is required under the statute, the simple adherence to this plan would not permit for any allowances by the certificate holder outside the adopted flight and duty regulations. An FRMS requires a process to apply to other individuals responsible for flightcrew fatigue other than pilots. As stated previously, there is a variety of positions held by individuals who are responsible for

[28] AC No. 120–103 was issued on August 3, 2010.

addressing fatigue other than pilots. The FRMS requires the process to include all applicable individuals. Furthermore, the FRMS is a means to permit a carrier to meet the requirements of this rule through an alternative measure. The FRMP does not contain adequate elements to allow the FAA to authorize operations or specific operations to be conducted outside the regulatory baseline requirements. Therefore, it is necessary to retain both the FRMS section and the FRMP requirement. These two processes, while sharing similar information, pose two distinct purposes.

F. Flight Duty Period—Unaugmented

One of the regulatory concepts that this rule introduces is the restriction on flightcrew members' maximum FDP. In creating a maximum FDP limit, the FAA attempted to address three concerns: (1) Flightcrew members' circadian rhythms, (2) the amount of time spent at work, and (3) the number of flight segments that a flightcrew member is scheduled to fly during his or her FDP.

First, flightcrew members' circadian rhythms needed to be addressed because studies have shown that flightcrew members who fly during their window of circadian low experience severe performance degradation.[29] Second, the amount of time spent at work needed to be taken into consideration because longer shifts increase fatigue.[30] Third, the number of flight segments in a duty period needed to be taken into account because flying more segments requires more takeoffs and landings, which are both the most task-intensive and the most safety-critical stages of flight. These takeoffs and landings require more time on task, and as pilots generally appear to agree, ''flying several legs during a single duty period could be more fatiguing.'' 75 FR 5858.

To address the concerns listed above, the FAA proposed a table limiting maximum FDP based on the time of day and the number of segments flown during the FDP period. This table was based on the conservative proposal articulated by the Flight Time ARC members representing labor, which in turn was based on the approach used by foreign flight, duty, and rest regulations such as United Kingdom Civil Aviation Authority Publication 371 (CAP–371) and European Aviation Safety Agency (EASA) Notice of Proposed Amendment No. 2009–02A. Under the FAA's proposal an FDP would begin when a flightcrew member is required to report for duty that includes a flight and would end when the aircraft is parked after the last flight and there is no plan for further aircraft movement by the same flightcrew member. Under the proposal, the maximum FDP limit would be reduced: (1) During nighttime hours to account for being awake during the WOCL; (2) when an FDP period consists of multiple flight segments in order to account for the additional time on task; and (3) if a flightcrew member is unacclimated to account for the fact that the unacclimated flightcrew member's circadian rhythm is not in sync with the theater in which he or she is operating.

In filed comments, Drs. Belenky and Graeber stated that ''there is no scientific basis'' for the different FDP limits assigned during different departure times. NACA and Atlas Air also stated that the different FDP limits are too complex and not based on science. Conversely, the National Institute of Occupational Safety and Health (NIOSH), Delta, APA, NJASAP, and three individual commenters endorsed the FAA's approach of varying FDP limits based on the time of day. In support, NIOSH pointed out that studies have shown that long night shifts significantly increase the risk of an accident, as compared to day shifts. Delta stated that its pilot working agreement has used a time-of-day-based approach ''to mitigate fatigue for many years.''

ATA, UPS, and Southwest Airlines also asserted that the reduction of the daily FDP limit to account for additional segments flown during the FDP is not supported by science or any other evidence. ATA argued that anecdotal evidence was not sufficient to support reducing the FDP limit in response to multiple flight segments assigned during the FDP. The SkyWest Airlines Pilot Association also stated that reducing FDP based on the number of flight segments disproportionately affected regional air carriers. Southwest stated that an FDP reduction based on the number of flight segments would also significantly raise the operational costs of its point-to-point business model.

Conversely, RAA stated that ''[i]t is also intuitive that there is likely correlation between the number of flight segments flown during an FDP and the level of fatigue that a flightcrew member will experience, although the exact science for that relationship remains under research.'' FedEx ALPA agreed, stating that ''[w]e also know that additional flight segments significantly increase fatigue and workload.'' APA's comment pointed to a number of scientific studies indicating that flying multiple segments is more fatiguing than flying a single segment. APA argued that Table B should reduce FDPs after the first segment instead of after the first 2–4 segments. The Families of Continental Connection Flight 3407,[31] as well as three individual commenters, also stated that flying additional flight segments, with the corresponding additional takeoffs and landings, adds to fatigue.

ATA, CAA, Capital Cargo, and UPS also argued that some of the limits set out in Table B are unreasonable and overly restrictive. These commenters asserted that the 9-hour limit is unscientific, and significantly lower than the 11-hour nighttime limit established by CAP–371 and EU Rules Subpart Q. UPS emphasized that the 9-hour FDP limit constitutes a 44% reduction from the current regulations. CAA also argued that the Campbell-Hill report indicates that regulation of FDPs under 15 hours is unnecessary because the FAA's regulatory impact analysis indicates that the rate of accidents begins to increase only after 15 hours on duty.

CAA submitted an alternative proposal in which nighttime FDPs are limited to 11 hours. Capital Cargo emphasized that, if this rule built in additional rest requirements, the longer FDPs in the CAA proposal could be implemented without decreasing safety. ATA added that the 9-hour limit for night operations is unreasonable because air carriers that regularly operate nighttime operations provide mitigation to their crews that would allow those crews to exceed the 9-hour limit. Grand Canyon Airlines argued that the 9-hour nighttime limit is unreasonable because flightcrew members who repeatedly fly at night will acclimate to working during their WOCL. SkyWest Airlines asked that the FAA increase the nighttime FDP limit to 14 hours to accommodate overnight continuous duty operations. SkyWest asserted that these types of operations are safe because ''most all [continuous duty operation] pairings provide at least 5 hours of sleep between the periods of 11:30 p.m.–4:30 a.m., spanning a 12–13-hour duty period.''

NIOSH, on the other hand, suggested that the FDP limit for night shifts be decreased to 8 hours. In support of its suggestion, NIOSH pointed out that, in general, studies have shown that ''[r]isk for worker errors and injuries are 15% higher for evening shifts and 28%

[29] *See, e.g.,* NASA, *supra* note 22, at 19–34.

[30] Folkard, *supra* note 15, at 98 (analyzing three studies that reported a trend in risk over successive hours on duty).

[31] Continental Connection Flight 3407 was operated by Colgan Air.

higher for night shifts, as compared to day shift[s].'' NIOSH also stated that ''[w]hen compared with 8-hour shifts, 10-hour shifts increased the risk by 13% and 12-hour shifts increased risk by 28%.'' NIOSH thus concluded that permitting night shifts consisting of long hours could result in risk ranging from 41% to 55%, as compared to 40-hour-week day shifts. NJASAP stated that ''it is prudent to keep the FDP at 9 hours or less when the FDP touches the [window of circadian low].''

A number of individual commenters wrote in suggesting maximum FDP limits ranging from 10 to 16 hours. Washington State University (WSU), at the behest of RAA, examined the parts of the FAA-proposed FDP limits that were different from the FDP limits proposed by the Flight Time ARC members representing industry. As part of its examination, WSU ran the different limits through its own unvalidated model, as well as the SAFTE model. Both the WSU and SAFTE models showed that, in the 0400–1759 timeframe, the FAA-proposed FDP limits were more restrictive than necessary as compared to the industry ARC members' proposed FDP limits. As a result of WSU's findings, RAA suggested: (1) That the Table B limits in the 0400 through 1059 timeframe be adjusted upward to reflect the industry ARC members' proposal, and (2) that the Table B limits for a 5-flight-segment FDP in the 1700 through 2159 timeframe be adjusted downward to reflect the industry ARC members' proposal. Continental also urged the FAA to adopt the industry ARC members' FDP-limit proposal.

In addition, ATA argued that the limits for the 0500–0559 and 0600–0659 blocks are unreasonable. ATA stated that these block times would involve flying mostly during daytime hours, and that they would involve flightcrew members who received most of their sleep during the window of circadian low. ATA emphasized that the costs associated with these limits cannot be justified in light of the fact that there is no scientific basis for the specific daily FDP limits proposed by the FAA.

Conversely, APA argued that the FDP limits for early morning and late evening duty periods should be reduced because flightcrew members on those FDPs will either (1) receive truncated window-of-circadian-low sleep, or (2) have been awake for an extended period of time. NJASAP added that the FDP limits proposed by labor ARC members promote a higher level of safety than the FDP limits proposed by industry ARC members.

In response to the above comments, the FAA finds that, as NIOSH correctly pointed out, studies have shown that human performance varies significantly depending on the time of day. Thus, for example, a NASA report on fatigue in flight operations found that ''75% of night workers experience sleepiness on every shift, and 20% report falling asleep.'' [32] To account for these time-of-day-based variations of human performance, Table B sets FDP limits that are higher for FDPs taking place during peak circadian times and lower for FDPs taking place during the WOCL.

Studies have also shown that after a person works for approximately eight or nine hours, the risk of an accident increases exponentially for each additional hour worked.[33] According to a series of studies that examined the national rate of accidents as a function of the amount of hours worked, the risk of an accident in the 12th hour of a work shift is ''more than double'' the risk of an accident in the 8th hour of a work shift.[34] To account for this data, the flight time limits in Table A restrict a flightcrew member's time on task to either 8 or 9 hours. Because Table A does not allow a flightcrew member's time on task to exceed 9 hours, the maximum FDP limits in Table B permit an FDP that is up to 14 hours, depending on the time of day.

Turning to the complex nature of the FDP limits, the reason for Table B's complexity is to avoid regulating to the lowest common denominator. As an alternative to the different FDP limits listed in Table B, the FAA could have set an across-the-board FDP limit of 9 hours. This limit would have been simple to understand, and it would have provided the necessary protection for multi-segment FDPs that take place during the WOCL. However, this limit also would have effectively reduced flight times, since with a 9-hour FDP, a flightcrew member would never reach a full 9-hour flight time. Such an approach would also fail to recognize the flexibility required for multi-segment operations, which incorporate some ''down-time'' into intermittent time-on-task. Thus, in order to provide air carriers with additional scheduling flexibility and avoid unnecessarily restricting all FDPs to the lowest common denominator, the FAA ultimately decided to utilize the somewhat more complex FDP limits listed in Table B.

Turning to the comments concerning flight segments, each flight segment that is flown by a flightcrew member includes a takeoff and a landing, which are the most task and safety-intensive parts of the flight. A flightcrew member whose FDP consists of a single flight segment only has to perform one takeoff and landing, while a flightcrew member whose FDP consists of six flight segments will have to perform six sets of takeoffs and landings. Because takeoffs and landings are extremely task-intensive, it logically follows that a flightcrew member who has performed six sets of takeoffs and landings will be more fatigued than the flightcrew member who has performed only one takeoff and landing.

While there are no studies measuring the objective performance of pilots who have flown multiple flight segments, there are studies that are based on subjective pilot reporting of fatigue that support a link between fatigue and the number of flight segments. For instance, a 2008 study of fatigue in two-pilot operations found that ''the most important influences on pilot fatigue were the number of sectors and the length of the duty period.'' [35] A 2007 study of pilot fatigue in short-haul operations found that ''[d]uty length and the number of sectors increased fatigue in a linear fashion.'' [36] A 2003 study of perceived fatigue for long and short-haul flights found that ''time pressure, number of legs per day, and consecutive days on duty contributed to increased fatigue.'' [37] Based on these studies, its operational experience, and the logical connection between fatigue and additional flight segments, the FAA has decided to retain, in Table B, the FDP-decreases caused by FDPs with multiple flight segments.

However, while there is a link between FDP and multiple flight segments, it is unclear exactly how much fatigue is caused by each flight segment. As such, Table B does not utilize the method employed by other civil aviation authorities of a linear FDP-limit decrease after the first flight segment. Instead, Table B generally does not decrease FDP limits until a flightcrew member is assigned an FDP that has five or more flight segments.

[32] *See* NASA, *supra* note 22, at 28.

[33] *See, e.g.,* Folkard, *supra* note 15, at 98.

[34] *Id.*

[35] David Powell, *et al., Fatigue in Two-Pilot Operations: Implications for Flight and Duty Time Limitations,* Aviation, Space, and Environmental Medicine, Vol. 79, No. 11, Nov. 2008, at 1047.

[36] David Powell, *et al., Pilot Fatigue in Short-Haul Operations: Effects of Number of Sectors, Duty Length, and Time of Day,* Aviation, Space, and Environmental Medicine, Vol. 78, No. 7, Jul. 2007, at 701.

[37] Samira Bourgeois-Bougrine, *et al., Perceived Fatigue for Short- and Long-Haul Flights: A Survey of 739 Airline Pilots,* Aviation, Space, and Environmental Medicine, Vol. 74, No. 3, Oct. 2003, at 1076.

For several FDP limits that are unusually high and/or that take place during critical circadian times, Table B decreases FDP limits after the first two flight segments to account for the additional fatigue caused by those FDPs.

The FAA understands that an FDP-limit decrease linked to multiple flight segments will disproportionately affect regional air carriers and point-to-point operations, such as the one employed by Southwest. That is why, given the lack of information on the specific amount of fatigue caused by each flight segment, Table B does not follow the approach taken by CAP–371 and the EU OPS subpart Q of reducing FDP after the first flight segment. However, as discussed above, there appears to be a link between fatigue and the number of flight segments, and the flightcrew members working for Southwest and regional carriers are as susceptible to multiple-flight-segment-caused fatigue as other flightcrew members. Because a flight duty and rest rule must take into account the increased fatigue caused by performing multiple takeoffs and landings in a single FDP, Southwest and regional air carriers cannot be exempted from this portion of Table B.

The FAA also agrees with NIOSH that long duty periods that take place during the WOCL substantially increase the risk of an accident. As discussed above, studies have found that human beings who work during the WOCL experience substantial degradation in their ability to safely perform their assigned duties.[38] Studies have also found that each additional hour worked after approximately 8 or 9 hours exponentially increases the risk of an accident.[39] Given this data, the FAA has restricted nighttime FDPs to 9 hours. Because a 9-hour FDP is relatively safe, the FAA has decided not to reduce the nighttime FDP limit any further. However, given the significantly increased risk of an accident posed by long nighttime FDPs, the FAA has also decided not to raise the nighttime FDP limit above 9 hours, even though this means that in many instances the flightcrew member would not reach the allowable flight limit.

In addition, the FAA has determined that there is little evidence that a flightcrew member who repeatedly works on nightshifts will experience substantial safety-relevant changes to his or her circadian rhythm through acclimation. Acclimation consists of changes to a person's circadian rhythm that are made in response to external environmental factors, such as receiving sunlight at a time when one's body is used to experiencing nighttime darkness. While people who continuously work at night may experience some acclimation, that acclimation is neither complete nor long-lasting. The nightshift acclimation also generally disappears after only a few days off.

Similarly, it does not appear likely at this time that a longer rest period would necessarily decrease the substantial risk associated with longer nighttime FDPs. This is because daytime sleep is less restful than nighttime sleep, and the additional rest provided to a nightshift flightcrew member would be taken during the day. However, the FAA is open to the possibility of allowing air carriers to exceed the 9-hour nighttime FDP limit if they can establish through an FRMS that additional daytime sleep would allow their flightcrew members to safely work on longer nighttime FDPs.

The FAA has also considered CAA's argument concerning the Campbell-Hill report's analysis, which states that the accident rate only statistically increases in the 15th hour of duty and beyond. The FAA finds the peer-reviewed studies analyzing the national accident rate to be more persuasive.[40] This is because the national-accident-rate analyses are based on the overall national accident rate, which provides a far larger sample than the number of aviation incidents on which the Campbell-Hill analysis is based. As discussed above, according to the peer-reviewed national-accident-rate studies, the risk of an accident increases exponentially for each hour worked after 8 hours.[41] Even CAA, which submitted the Campbell-Hill report, appears to have implicitly recognized that report's limitations because the alternative proposal that CAA submitted to the FAA did not use the 15-hour FDP limit suggested by Campbell-Hill. Instead, CAA's proposal limited nighttime FDPs to 11 hours and daytime FDPs to 13 hours.[42]

The FAA has also recognized that CAP–371 and EU OPS subpart Q permit higher nighttime FDP limits in some situations. However, these foreign regulators are able to safely allow higher nighttime FDP limits because their operating environment allows them to mitigate the risk associated with nighttime FDPs in other ways. For example, CAP–371 sets general nighttime FDP limits to 11 hours for one-segment nighttime FDPs. However, if a flightcrew member is scheduled for nighttime duty on five consecutive nights, CAP–371 reduces that flightcrew member's nighttime FDP limit to eight hours and imposes substantial additional rest requirements.[43] CAP–371 also imposes a mandatory split duty rest period for flightcrew members who have a nighttime FDP for at least two consecutive nights.[44] This rule, on the other hand, only requires a mid-duty rest period if a flightcrew member has a nighttime FDP for at least four consecutive nights.

Similarly, EU OPS subpart Q also appears to set slightly higher FDP limits for nighttime operations.[45] However, in exchange for these higher limits, Subpart Q limits FDP extensions to 1 hour and requires a minimum of 12 hours' rest between FDP periods.[46] This rule, on the other hand, permits FDP extensions of 2 hours and only requires 10 hours' rest between FDP periods. As these examples illustrate, some of the key provisions of this rule are fundamentally different from the provisions of its international counterparts. These differences are a result of the different operating environments in which these rules regulate, and, by themselves, these differences are insufficient to justify increasing the nighttime limits of Table B.

With regard to comments about nightshift carriers providing mitigation to their crews and continuous duty operations that employ mitigation measures, this rule takes nighttime mitigation into account through the split duty and augmentation credits. If an air carrier employs mitigation measures not addressed by this rule, that air carrier may submit its mitigation measures for FAA evaluation as part of an FRMS program.

The FAA agrees with RAA that SAFTE modeling shows that the proposed FDP limits in the 0400 through 1059 timeframe were excessive and did not increase the degree of safety as compared to the industry-ARC-members' proposal. As such, these limits have been adjusted upward to reflect the industry-ARC-members' suggested FDP limits for these timeframes. The FAA also agrees with ATA that the proposed limits for the 0500–0659 timeframe were set unreasonably low. This is because

[38] *See, e.g.,* NASA, *supra* note 22, at 19–34.

[39] *See* Folkard, *supra* note 15, at 98.

[40] *See id.*

[41] *Id.*

[42] *See* Comments of the Cargo Airline Association, Attachment C at 5 (Nov. 15, 2010).

[43] CAP–371 section 7.3.1.

[44] *Id.* section 7.3.

[45] EU Rules, Subpart Q, OPS 1.1105, sections 1.3 and 1.5.

[46] *Id.* OPS 1.1105, section 2.1; OPS 1.1110, section 1.1.

flightcrew members who fly during those times obtain most of their sleep at night and sleep through most of their WOCL. The upward adjustment that the FAA made in response to RAA's SAFTE modeling increases the FDP limits in this timeframe to a reasonable level, and should address ATA's concerns in this area.

The FAA declines to make a downward adjustment to the five-segment FDP limit in the 1700–2159 timeframe.[47] This is because the flight time limits contained in Table A substantially restrict a flightcrew member's time on task. The time-on-task restriction allows the FAA to safely impose a higher FDP limit for a five-segment FDP in this timeframe. As such, the FAA has not made downward adjustments to this limit.

In addition, the FAA declines APA's suggestion of decreasing FDP limits for early morning and late evening FDPs. The primary time-of-day safety concern on which Table B is based is that flightcrew members who fly during the WOCL suffer a severe degradation of performance. FDPs that begin in the early morning or end late in the evening do not infringe on the WOCL, and thus, do not trigger this concern. Also, as ATA correctly pointed out, flightcrew members assigned to these FDPs are able to obtain most of their sleep at night, and nighttime sleep is the most restful type of sleep. Moreover, as discussed above, RAA's SAFTE modeling showed that a slight upward adjustment to early morning FDPs would not decrease safety. For all these reasons, the FAA has decided not to decrease the FDP limits for FDPs that begin early in the morning or end late in the evening.

UPS stated that because the FDP limits are determined by actual pilot reporting time and not the pilot's scheduled reporting time, air carriers are put in an untenable position of having to track the fluctuating and unpredictable FDPs of individual pilots. The Aerospace Medical Association (AMA) asserted that the different FDP limits were inefficient and would crowd departure times at busy airports. AMA suggested that, instead of changing FDP limits based on reporting time, duty time that takes place during the window of circadian low be counted as time-and-a-half or double time. APA suggested that FDP limits not be associated with specific reporting times, but that they instead be determined through a linear function, which could then be utilized by modern scheduling software. This approach, APA argued, would be better than the FAA-suggested approach in which a 1-minute reporting difference can result in a 1-hour FDP limit difference.

The FAA has determined that an approach to daily FDP limits that requires a linear function or mathematical computations in order to determine the applicable limit would be unduly complex. Under the FAA's approach to Table B, a flightcrew member can determine his or her FDP limit simply by finding the cell in Table B that applies to his or her scheduled FDP. Given that some commenters find even this approach to be unduly complex, the FAA has decided not to add any more complexity to this section.

In response to UPS' concern, the FAA clarifies that FDP limits are determined by scheduled reporting time and not by actual reporting time. Thus, an air carrier can determine a flightcrew member's maximum FDP limit simply by looking at that flightcrew member's schedule. The labels for Tables B and C are amended to clarify that the applicable limits are based on scheduled start time.

The FAA also emphasizes that FDP is defined as beginning at the time that a flightcrew member is ''required'' to report for duty. Thus, if a flightcrew member is late for an FDP, the FDP begins to run at the time that the flightcrew member was scheduled to report for an FDP, not the time that he or she actually reported for the FDP.

Aloha Air Cargo (AAC) recommended upward modifications to the proposed maximum FDPs. At AAC, flightcrews report for night flight duty between 1935 and 2142 local time and end at 0700 each morning. To support flightcrew rest periods occurring at the same time each day, AAC schedules its crews to assure that flightcrews complete their duty by 0700 each morning. This system naturally reduces the FDP for later report times without artificially constricting earlier report times. AAC has evaluated this fatigue mitigation process for over nine months through daily reviews of FRMP crew data, and through selective crew debriefs when FRMP data results flagged elevated fatigue risk. AAC asserted that this method has proven to be more reliable in mitigating fatigue risk within AAC's flight operation than the FAA's current proposal. Therefore, AAC recommended that the FAA consider the table below as an alternative to the proposed table, and that the FAA include ''Time of Completion'' (the end of the FDP) as an additional criterion to support adequate rest in consideration of the flightcrew's circadian rhythms.

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	*12	*12	*11	*11	*10.5	*10	*10
2200–2259	*11.5	*11.5	*10.5	*10.5	*10	*10	*9.5
2300–2359	*10.5	*10.5	*10	*10	*9.5	*9.5	*9

* Proposed changes.

The FAA has declined to adopt AAC's suggestion of requiring FDPs to terminate at a certain time. This rule applies to many different air carriers with differing business models, and the approach taken by AAC may not work for an air carrier conducting supplemental operations whose schedule is subject to the demands of its clients. In order to take into account the diverse business models subject to this rule, the FAA has chosen not to include a ''Time of Completion'' as part of its FDP restrictions. The FAA notes that, because Table B sets higher FDP limits for FDPs that begin earlier in the evening, AAC will be able to retain its existing business model if it opts to operate its all-cargo operations under part 117 so long as each scheduled FDP

[47] The FAA has actually increased the FDP limit in question to account for concerns expressed by supplemental carriers. The increases based on supplemental-carrier comments are discussed more fully below.

complies with the limits set out in Table B.

Turning to the specific FDP limits proposed by AAC, the FAA has chosen not to make further upward adjustments to FDPs in the 1700 to 2359 timeframe. FDPs that begin during this timeframe will infringe on the WOCL, and, as discussed above, this infringement raises significant safety concerns.

NACA and a number of other commenters stated that the limits in the proposed Table B unduly focus on domestic scheduled service and do not recognize the needs of non-scheduled operations currently flown under Subpart S. These commenters suggested the following alternative to the FAA-proposed Table B:

Time of start	Acclimated segments			
	1–4	5	6	7+
0000–0559	12	11	10	9
0600–1159	14	13	12	11
1200–1259	13	12	11	10
1300–2359	12	11	10	9

The SkyWest Airlines Pilot Association similarly asked the FAA to increase the FDP limits to avoid disproportionately impacting regional air carrier pilots. SkyWest Airlines stated that the proposed FDP limits would significantly increase its operating expenses, as well as the amount of time that its flightcrew members spend resting away from home. SkyWest, NAA, and Northern Air Cargo suggested that the FAA permit air carriers to schedule FDPs that are either 12 or 14 hours, depending on whether they infringe on the window of circadian low. Allegiant also supported permitting a 14-hour FDP for FDPs that included two or less flight segments.

Conversely, American Airlines and American Eagle Airlines supported the FDP limits set out in Table B. The Families of Continental Connection Flight 3407 also endorsed the maximum 13-hour FDP limit, asserting that it effectively limits the fatigue exposure of regional airline pilots. APA supported the 13-hour maximum FDP limit, citing studies showing a higher likelihood of an accident for each additional hour worked, a conclusion supported by the crash of American Airlines Flight 1420, in which fatigue was a causal factor, and which occurred at the 13:06 point in the flightcrew members' FDP. APA added that duty days that exceed 13 hours could result in flightcrew members being awake for 16 to 17 hours before the beginning of their FDP. APA cited a study showing that a person who has been awake for 17 hours exhibits the same level of performance as a person who is legally drunk. NJASAP expressed concern over increasing the maximum FDP limits, citing a NASA study in which a poll of corporate pilots revealed fatigue concerns for duty time over 8 and 10 hours.

Due to the WOCL considerations discussed above, the FAA has declined the suggestion by air carriers conducting supplemental operations to increase nighttime FDP limits to 12 hours. However, the FAA notes that these concerns do not apply to daytime FDPs that begin in the morning, especially since flightcrew members' time on task is restricted by the flight time limits of Table A. As such, and in response to the comments made by regional carriers, and those conducting only supplemental passenger operations, the FAA has made upward adjustments to some of the FDP limits in Table B.

First, the FAA has increased the one- and two-segment FDP limits in the 0600 to 0659 timeframe from 12 to 13. However, the FAA did not further increase the FDP limits for FDPs with four or less segments in this timeframe to 14 hours (as the supplemental carriers suggested) because an early morning FDP that starts between 0600 and 0659 does not start during peak circadian alertness. As such, without additional FRMS-provided data, the FAA cannot justify permitting longer multi-segment early morning FDPs.

Second, the FAA has increased most of the FDP limits in the 0700 to 1659 timeframe to reflect the limits suggested by NACA's proposal. The reason for this increase is that the FDPs in this timeframe mostly take place during the day and do not infringe on the WOCL. Given the 8 and 9-hour flight time restrictions contained in Table A, the FAA has determined that an increase to the FDP limits in the 0700 to 1659 timeframe would not have a detrimental effect on safety.

It should also be noted that, in the 0700 to 1159 timeframe, the FAA has only allowed one- and two-segment FDPs to go to 14 hours. The reason that the FAA did not follow NACA's suggestion of allowing three- and four-segment FDPs to be 14 hours long is because, as discussed above, additional flight segments increase fatigue. Since a 14-hour FDP is a very long FDP, the FAA has chosen to disallow 14-hour-long multi-segment FDPs without additional data showing that a multi-segment FDP greater than 2 segments of this duration does not decrease safety. The FAA has also chosen not to increase the FDP limit to 14 hours for FDPs that begin after 1159 because this type of increase would result in more FDPs infringing on the WOCL.

Third, the FAA has reevaluated the FDP limits in the 1700 to 2359 timeframe and has made slight upward adjustments to those limits to reflect the safety mitigation provided by the time on task restrictions of Table A. These adjustments are not as high as the supplemental air carriers recommended because FDPs that begin during these times infringe on the WOCL.

The FAA has considered the concern raised by APA, NJASAP, and the Families of Continental Connection Flight 3407 about raising the maximum FDP limit above 13 hours. However, there are a number of reasons why the FAA considers a 14-hour FDP limit for FDPs that begin in the morning to be safe. First, most of the 14-hour FDP would take place during the day after a flightcrew member has had a full night's sleep and thus, this type of FDP does not raise any circadian-rhythm concerns.

Second, the flight time restrictions in Table A have been adjusted downward to 9 hours in order to restrict the amount of time on task that a flightcrew member can be subjected to in a 14-hour FDP. Thus, a flightcrew member in a 14-hour FDP can only be asked to fly an aircraft for 9 of those hours, and the remaining 5 hours must be spent on non-flight activities. The FAA notes that the studies cited by APA in support of a 13-hour-maximum FDP limit did not impose any time-on-task (flight-time) restrictions. The FAA agrees with APA that a 14-hour unaugmented FDP in which a flightcrew member spends the entire 14 hours flying an aircraft would be unsafe, which is why, as discussed more fully

elsewhere, the FAA has decided to retain the flight-time limits set out in Table A.

Finally, the cumulative limits in this rule limit the frequency at which an air carrier can assign long FDPs to its flightcrew members. For example, under the 60-hour weekly FDP limit set out in section 117.23(c)(1), if an air carrier insists on repeatedly assigning a 14-hour FDP to its flightcrew members, those flightcrew members will reach their weekly FDP limit after slightly more than four days of work, and will be unable to accept an FDP for the remainder of the week. Under the 190-hour monthly FDP limit set out in section 117.23(c)(2), if an air carrier regularly assigns 14-hour FDPs, its flightcrew members will reach their monthly limits after slightly over 13 days, and will be unable to accept an FDP for the remainder of the month. Thus, the cumulative FDP limits contained in section 117.23(c) severely limit the frequency at which air carriers can assign the longer FDPs permitted by Table B. Given these numerous safeguards, a 14-hour FDP that consists of only one or two flight segments and takes place during peak circadian times does not raise significant safety concerns.

UPS objected to basing the FDP limits for an unacclimated flightcrew member on the time at that flightcrew member's home base. UPS stated that, under this approach, an unacclimated flightcrew member could be assigned a long FDP during a local night. UPS added that the FAA's acclimation approach does not take into account flightcrew members who change their acclimation status mid-pairing. UPS provided an example of an international flight arriving early and, as a result, the flightcrew on that flight having enough time in a new theater to unexpectedly become acclimated. Because this unexpected acclimation could lead to a reduced FDP limit for the return trip, UPS argued that this type of scenario was ''patently absurd'' because in this scenario a flightcrew that unexpectedly received additional rest would be subjected to a lower FDP limit.

In response, the FAA notes that this section does not determine unacclimated flightcrew members' FDP limits based on local time. This is because the circadian rhythm of flightcrew members who are unacclimated is not synchronized to the theater in which they are operating. Consequently, in order to accurately take into account each flightcrew member's WOCL and general circadian rhythm, this section determines FDP limits based on the local time at the theater with which a flightcrew member's circadian rhythm is synchronized.

With regard to mid-pairing acclimation, the FAA has amended the language in section 117.13(b)(2) to state that an unacclimated flightcrew member's FDP limit is determined by the local time at the theater in which that flightcrew member was last acclimated. The reason for this change is that a flightcrew member may be away from his or her home base for a significant amount of time. If that happens, the flightcrew member's circadian clock will not be synchronized with his or her home base, but rather, with the theater in which he or she was last acclimated.

Turning to UPS' scenario, it is indeed possible that a flightcrew member who arrives in a new theater unexpectedly early will experience unanticipated acclimation. Depending on the local hours, this acclimation may reduce that flightcrew member's FDP limit for the return trip. The reason for this reduction is that the longer amount of time that this flightcrew member will spend in-theater will result in his or her body becoming synchronized with the local time in that theater. Once this synchronization takes place, the flightcrew member will experience the circadian penalties associated with working during non-peak local times. As such, this rule prevents acclimated flightcrew members from accepting longer FDPs during non-peak local times. This result is not ''patently absurd'' because the shorter FDPs that may stem from unexpected acclimation are not a result of longer rest, but rather, a result of more time that a flightcrew member spends in-theater.

NACA and NAA also stated, without elaboration, that when a pilot is unacclimated, the FDP in Table B should be decreased by one hour instead of half an hour. The 30-minute FDP-limit reduction for unacclimated flightcrew members was imposed to account for the additional fatigue experienced by these flightcrew members. However, at this time, the FAA is unaware of any reasons for increasing this reduction to one hour.

NJASAP sought clarification of how acclimation is determined when a flightcrew is made up of flightcrew members who are based in different time zones. In response, the FAA emphasizes that acclimation and FDP limits are specific to each flightcrew member. As such, the unacclimated flightcrew members on a flightcrew are subject to subsection (b) of this section. However, the acclimated flightcrew members on that flightcrew are only subject to subsection (a) of this section.

Drs. Belenky and Graeber criticized the maximum FDP limits for not taking into account onboard rest facilities, which, they argued, allowed a flightcrew to obtain rest onboard the aircraft prior to descent. Boeing also endorsed the concept of controlled napping. AMA stated that controlled in-cockpit naps should be ''vigorously encouraged,'' but should not be allowed to increase the maximum FDP. In response, the FAA notes that there is currently insufficient data about whether a controlled nap could safely be taken by a flightcrew member during an actual unaugmented flight. As such, the FAA is not prepared to regulate for controlled napping as a mitigation measure at this time. Once more data becomes available, the FAA may conduct a rulemaking to add controlled napping to the flight, duty, and rest regulations.

NACA and NAA stated that the time-of-day windows in Tables A and B are not synchronized. However, the reason that Tables A and B are not synchronized is that Table B uses many different FDP limits ranging from 9 to 14 hours, and multiple rows were necessary to clearly distinguish each different set of FDP limits. Table A, on the other hand, only uses 8 and 9 hours as flight time limits, and as such, fewer rows were necessary to clearly convey the flight time limits for each phase of the day.

G. Flight Time Limitations

As discussed above, studies indicate that if a person works for longer than 8 or 9 hours, the risk of an accident increases exponentially for each additional hour worked.[48] Given this data, the FAA was hesitant to eliminate current flight time regulations, which generally limit flightcrew members to 8 hours of flight time regardless of the time of day. Thus, instead of relying solely on FDP limits to regulate acute fatigue, the FAA proposed flight time limits ranging from 8 to 10 hours (depending on the time of day) for unaugmented flights. The FAA also proposed a 16-hour flight time limitation for augmented flights.

ATA, NACA, CAA, RAA, and multiple air carriers objected to including daily flight time limits in this rule. ATA, RAA, International Air Transport Association (IATA), and a number of other commenters argued that the daily flight time limits were arbitrary, not scientifically justified, inconsistent with leading international

[48] *See* Folkard, *supra* note 15, at 98.

standards, operationally unwieldy, unduly burdensome to carriers, and against the public interest.

The above commenters stated that the daily flight time limits were unnecessarily redundant. The commenters emphasized that this rule creates a large number of regulatory limitations, and an additional limitation on flight time limits only unnecessarily adds complexity to this rule. These commenters stated that flight time is considered to be part of an FDP, and thus, flight time is subject to the FDP limits. The commenters emphasized that being awake is what causes fatigue, and this fatigue factor is addressed through FDP limits better than through flight time limits.

ATA stated that this rule also indirectly regulates flight times through mandatory rest periods because a flightcrew member cannot fly an aircraft during a rest period. UPS stated that industry ARC members' acceptance of FDP limits was predicated on the abolition of flight-time limits.

In filed comments Drs. Belenky and Graeber stated that there was no justification for flight time limits in addition to FDP limits apart from regulating for ''differences in workload.'' Drs. Belenky and Graeber stated that the differences in workload are taken into account in the FDP limits through the different limitations on circadian timing and the number of flight segments. As such, Drs. Belenky and Graeber concluded that there was no remaining justification for retaining flight time limits in this rule. ATA, CAA, and a number of air carriers supported Drs. Belenky and Graeber's analysis.

ATA, IATA, CAA, and a number of air carriers noted that other regulatory regimes, such as CAP–371 and EU OPS subpart Q, have largely eliminated the concept of daily flight-time limits. These commenters argued that this demonstrates that a flight-time limit is unnecessary, and that imposing this limit on U.S. carriers will make them less competitive with carriers operating under other regulatory regimes. The commenters asked the FAA to eliminate the daily flight-time limit to make this rule more consistent with the other regulatory regimes.

Conversely, NJASAP, AAC, and a number of labor groups supported the flight time limits. NJASAP emphasized that ''[m]ultiple stressors are present in flight operations such as weather and [air traffic control] that take a cumulative toll on fatigue levels.''

In response, the FAA notes that existing regulations generally limit flight time to 8 hours. Studies have shown that fatigue accumulated by working longer than 8 or 9 hours significantly increases the risk of an accident.[49] Given this data, the FAA needs to ensure that flightcrew members are not permitted to fly an aircraft for longer than 8 or 9 hours. This rule accomplishes this goal by setting flight-time limits at 9 hours for peak circadian times, and 8 hours for all other times.

As the industry commenters correctly pointed out, the FDP limits in this rule also limit flight time. However, abolishing flight-time limits and relying solely on FDP limits to regulate flight time poses a significant problem. This problem arises from the fact that the FDP limits do not differentiate between flight time and non-flight activities. For example, if a flightcrew member spends 5 total hours flying an aircraft and 4 hours sitting in an airport on a layover, that flightcrew member's FDP is 9 hours. However, if another flightcrew member spends 8 total hours flying an aircraft and 1 hour sitting in an airport on a layover, that flightcrew member's FDP is also 9 hours. Thus, the FDP limits would treat the above two flightcrew members identically, even though one of them spent an additional 3 hours engaged in the more fatiguing activity of flying an aircraft.

To resolve the above problem and differentiate between flight time and less-fatiguing non-flight activity conducted on behalf of the certificate holder, the FAA has decided to impose flight-time limits in addition to FDP limits. Setting flight-time limits at 8 or 9 hours ensures that flightcrew members do not fly an aircraft for longer periods of time. This also allows the FAA to provide air carriers with more scheduling flexibility by setting higher FDP limits because with flight-time limits in place, longer FDPs will simply include more non-flight activities instead of longer flight times.

An alternative approach that the FAA considered was eliminating flight-time limits, and setting lower FDP limits to ensure that flightcrew members do not fly an aircraft for longer than 8 or 9 hours. However, the FAA ultimately rejected this approach because it would have resulted in peak-circadian-time FDP limits of approximately 10 or 11 hours, which would have greatly hampered the scheduling flexibility of air carriers. This approach also would have unnecessarily limited non-flight activities, which are generally not as fatiguing as flying an aircraft.

The FAA also considered ATA's comment that rest requirements indirectly limit flight time. However, the problem with relying solely on rest requirements to regulate flight time is the same as the problem with relying solely on FDP limits—neither provision differentiates between non-flight and flight activities. In addition, the proposed rest requirements do not even closely approximate levels that would effectively limit flight time to acceptable levels. As such, the FAA has chosen not to use the rest requirements in this rule as a replacement for flight-time limits.

Turning to UPS' comment that industry ARC members' acceptance of FDP limits was predicated on the abolition of flight-time limits, the FAA notes that the ARC's recommendations are advisory.[50] Thus, for example, in response to industry concerns that were raised in the comments, the FAA has increased some of the FDP limits in Table B beyond the levels suggested by the ARC members. Similarly, to address scientific data showing that the risk of an accident greatly increases after a person has worked for 8 or 9 hours,[51] the FAA has decided to set firm flight-time limits to ensure that flightcrew members do not fly an aircraft for longer than 8 or 9 hours.

As Drs. Belenky and Graeber correctly pointed out, the number of flight segments flown by a flightcrew member is taken into account by the FDP limits. However, while takeoffs and landings associated with multiple flight segments are the most task-intensive portions of a flight, they are not the only task-intensive portion of the flight. When flying an aircraft after takeoff, a flightcrew member must, among other things, keep track of weather patterns, communicate with air traffic control, and respond to unforeseen developments that may arise during the flight. All of these tasks (as well as the constant alertness needed to perform these tasks) increase fatigue, and they are not fully taken into account by the FDP limits, which do not distinguish between a flightcrew member flying an aircraft and a flightcrew member sitting at an airport during a layover. To account for these fatigue-inducing tasks, the FAA has decided to retain flight-time limits in this rule.

Turning to the foreign aviation standards cited by some of the commenters, the FAA notes that the

[49] *See id.;* John A. Caldwell, *Fatigue in aviation,* Travel Medicine and Infectious Disease, 3, at 88–90 (2005).

[50] The FAA also notes that the near-total lack of consensus among ARC members as to the appropriate levels to adopt indicates that the ARC members understood that the FAA could not assume either industry or labor support of all aspects of its proposal.

[51] *See supra* note 50.

Administrative Procedure Act requires the FAA to consider the specific operating environment that it is regulating instead of simply following the foreign standards. The FAA notes that while other regulatory regimes have eliminated daily flight-time limits, the elimination of these limits has resulted in more stringent requirements elsewhere. For example, EU OPS subpart Q sets the maximum FDP limit at 13 hours and requires 12 hours of rest between FDP periods.[52] This rule, on the other hand, sets a maximum FDP limit at 14 hours (for peak circadian times) and requires a rest period of only 10 hours between FDP periods. One of the reasons why some provisions of this rule are less stringent than their EU OPS counterparts is because this rule contains a daily flight-time limit that regulates how long flightcrew members can fly an aircraft.

The FAA also notes that the other regulatory regimes did not completely eliminate flight-time limits. While other regulations do not contain daily flight-time limits, many of them still retain cumulative flight-time limits.[53] These cumulative flight-time limits are significantly lower than the cumulative flight-time limits imposed by this rule.[54]

Over 1,300 individual commenters objected to the proposed 10-hour flight-time limit for the 0700–1259 timeframe. These commenters emphasized that the 10-hour limit constitutes a 25% flight time increase over existing limitations, and as such, will increase fatigue. A number of commenters stated that flight time limitations should not be greater than 8 hours. NJASAP emphasized that existing regulations limit flight time to 8 hours, and, given studies that show the risk of an accident increasing exponentially for each additional hour worked, there is no reason to increase the existing flight-time limits. The Families of Continental Connection Flight 3407, Captain Sullenberger, International Brotherhood of Teamsters (IBT) Local 1224, and multiple labor groups stated that there are no scientific findings supporting an increase in flight time to 10 hours, and that this type of increase should be permitted only if it is supported by FRMS-provided data. NTSB cautioned the FAA about increasing flight-time limits to 10 hours without first studying adverse consequences that could result from this increase. Many of the above commenters recommended reducing the 10-hour flight-time limit to 9 hours, emphasizing that this would still be a 12.5% increase over existing flight-time restrictions. A number of labor groups recommended that the early morning and late evening flight-time limits be reduced to 7 hours ''to reflect the unanimous view of the ARC.''

Conversely, RAA stated that there is no scientific evidence that a small increase in the current flight time limits would adversely affect safety. SkyWest objected to decreasing the flight time limits, arguing that it would impose additional hardships upon air carriers. Delta stated that increasing flight time limits beyond 8 hours is safe because the maximum FDP limits reduce the amount of time that flightcrew members spend at work.

The FAA agrees with the overwhelming number of commenters who stated that a 10-hour flight-time limit is not justified by current scientific data. A series of studies examining the national accident rate has shown that 10 hours spent at work pose a much greater risk of an accident than 8 or 9 hours spent at work.[55] A study examining the number of aviation accidents determined that ''[f]or 10–12 hours of duty time, the proportion of accident pilots with this length of duty period is 1.7 times as large as for all pilots.''[56] Another study found that ''20% of all U.S. commercial aviation mishaps appear to occur at the 10th hour [of pilot duty] and beyond.''[57] Because scientific data shows that the risk of an accident substantially increases when a person's time on task is 10 hours, the FAA has decided to limit flight-time that begins during 0700–1259 to 9 hours.

The FAA has also decided not to reduce any of the proposed 9-hour flight-time limits to 8 hours. The existing regulations impose an across-the-board 8-hour flight-time limit. However, that limit regulates to the lowest common denominator because it does not take into account the fact that people are capable of safely working longer hours during periods of peak circadian alertness. Accordingly, this rule retains the 8-hour flight-time limit for shifts encompassing non-peak circadian times, but increases the flight-time limit to 9 hours for shifts encompassing periods of peak circadian alertness.

Turning to comments about the ARC recommendations, the FAA notes that the ARC's recommendations are advisory and there was no consensus on the hourly limitations with industry generally supporting more generous limits and labor generally supporting more restrictive limits. The existing regulations impose an 8-hour flight-time limit, and the FAA has been administering this limit for over 50 years. Based on its operational experience, the FAA does not believe that an 8-hour flight-time limit for non-peak circadian times is unsafe, especially if that limit is based on actual and not scheduled flight time. As such, the FAA has decided not to decrease any of the flight-time limits below 8 hours.

ATA, IATA, UPS, United, and a number of other air carriers also objected to the lack of an extension for daily flight-time limits. These commenters stated that an inflexible daily flight time limit would severely restrict scheduling because air carriers would have to build in large scheduling buffers to account for unforeseen circumstances occurring after takeoff. IATA emphasized that the prohibition on continuing an FDP that exceeds the flight-time limits may result in flightcrew members unsafely rushing to complete preflight activities to avoid violating the flight time limits. UPS stated that, without a flight time extension, unforeseen delays could leave crews stranded in international destinations. United asserted that an inflexible flight-time limit may, as a result of unforeseen delays, result in cancellations of multi-leg itineraries after some of the legs have been completed. Southwest stated that large numbers of flights would be disrupted by an inflexible flight-time limit because small delays would eventually build up during the day, and these would require air carriers to cancel flights in order to comply with the rigid flight-time limits. The above commenters suggested that flight time limits be based on scheduled and not actual flight time.

Conversely, ALPA, FedEx ALPA, IBT Local 1224, and a number of other labor groups supported the lack of a flight-time extension, arguing that air carriers currently do not build sufficient buffers into their schedules. These commenters stated that air carriers currently schedule flights up to the last permissible limit of flight time, even when the air carriers know that a high possibility of a delay makes their schedules unrealistically optimistic. These commenters emphasized that an inflexible flight-time limit was particularly important in this case because this rule does not have a compensatory rest provision.

[52] EU Rules, Subpart Q, OPS 1.1100, section 1.3 and OPS 1.1110, section 1.1.

[53] *See, e.g.,* EU Rules, Subpart Q, OPS 1.1100, section 1.2.

[54] *See id.;* CAP–371, section 21.1.

[55] *See* Folkard, *supra* note 15, at 98.

[56] Jeffrey H. Goode, *Are pilots at risk of accidents due to fatigue?,* Journal of Safety Research, 34, at 311 (2003).

[57] Caldwell, *supra* note 50, at 90.

The flight-time limits apply to actual and not scheduled flight time because actual flight time is what impacts safety. Flight-time calculations are based on the en route times contained in the flight plan. Once a flightcrew member flies an aircraft for a certain amount of time, that flightcrew member's risk of being involved in an accident increases exponentially for each additional hour worked.[58] This exponential increase in risk is based on actual hours worked and not the hours that someone was scheduled to work. Thus, a flightcrew member who flies an aircraft for 11 hours does not have a lower risk of an accident simply because he or she was scheduled to fly the aircraft for only 9 hours. In order to account for the factors that control accident risk, the flight-time limits in this rule are based on actual and not scheduled flight time.

Turning to the concerns expressed by industry commenters, the FAA notes that air carriers currently utilize schedules that are unrealistically optimistic and do not include sufficient buffers for unforeseen circumstances. It has been the FAA's experience that an air carrier subject to an 8-hour scheduled flight-time limit will sometimes schedule a flight that, on paper, lasts 7 hours and 59 minutes when the air carrier knows that the actual flight will likely take well over 8 hours to complete. Because many current air carrier schedules are unreasonably optimistic, air carriers can prevent many of the pre-takeoff situations listed in their comments simply by incorporating reasonable buffers for unforeseen circumstances into their scheduling practices.

However, in evaluating the above comments, the FAA noted that different considerations apply after an aircraft has taken off. If unexpected circumstances significantly increase the length of the flight while an aircraft is in the air, the only way for a flightcrew member to comply with the flight-time limits imposed by this rule would be to conduct an emergency landing instead of piloting the aircraft to its intended destination. Because this is not the preferred method of complying with flight-time limits, the FAA has amended this section to provide a post-takeoff flight-time extension to the extent necessary to safely land the aircraft at its intended destination airport[59] if unexpected circumstances occur after takeoff. To monitor the use of this post-takeoff extension, the FAA is requiring certificate holders to report their flightcrew members who exceed the flight-time limits and describe the circumstances surrounding the exceeded flight time.[60]

The FAA emphasizes that this extension only applies to unexpected circumstances that arise after takeoff. If a flightcrew member becomes aware, before takeoff, that he or she will exceed the applicable flight-time limit, that flightcrew member may not take off, and must return to the gate.

One hundred sixty-seven individual commenters opposed increasing the augmented flight-time limit to 16 hours. AMA supported the 16-hour flight-time limit for augmented operations, stating that peer review studies and SAFTE/FAST modeling show that after 16 hours on duty crew performance falls off dramatically.[61] NJASAP stated that flight-time limitations are necessary for augmented operations, and that use of an FRMS to extend maximum flight times should be subject to high levels of scrutiny and oversight. Conversely, Continental asked that augmented FDPs be allowed to exceed the 16-hour flight-time limit. Atlas Air stated that, for some augmented FDPs, the 16-hour FDP flight time would exceed the applicable FDP limit.

Continental submitted supplemental comments objecting to the 16-hour flight time limit for augmented flights. Continental objected to this limitation on ultra long range (ULR) flights, and it submitted new studies, which it claimed showed that ULR flights do not pose additional fatigue risk. ALPA submitted a response to Continental's supplemental submission, pointing out that ''[f]lights over 16 hours block conducted by U.S. carriers are rare so there is only limited actual experience with the fatigue factors of such flights.'' ALPA also asserted that the studies submitted by Continental were actually a single study (based on the composition of the subjects), and that the study suffered from a number of biases, including an age, gender, and volunteer participation. ALPA also stated that the sample size that the study examined was too small to provide meaningful data for a system-wide standard.

A 16-hour flight-time limit was proposed for augmented operations because, for a four-pilot crew working in shifts of two, a 16-hour flight time supposes that each pilot will be at the duty station for about 8 hours. In response to industry comments, the FAA has concluded that a slight increase of the limit for four-pilot augmented FDPs would not impact safety. As such, the augmented flight-time limit for a four-pilot crew has been increased to 17 hours. Seventeen hours was selected as the limit because each member of a four-pilot crew that works on a 17-hour flight in shifts of two would only be at the duty station for 8.5 hours. Eight and a half hours of manning the duty station falls within the 8-to-9-hour flight-time range that, as discussed above, the FAA considers to be safe.

Upon reevaluation of the augmented flight-time limit, the FAA has also concluded that a separate flight-time limit is necessary for a three-pilot flightcrew. This is because if a three-pilot crew works in shifts of two on a 17-hour flight, each flightcrew member will be at the duty station for approximately 11 hours. Because this falls outside the 8-to-9-hour flight-time range that the FAA considers to be safe, the flight-time limit for three-pilot augmented flightcrews has been reduced to 13 hours. A 13-hour flight-time limit ensures that each member of a 3-pilot crew only needs to be at the duty station for approximately 8.5 hours.

Turning to Continental's supplemental comment, as ALPA correctly pointed out, there are currently very few flights that exceed 16 hours of flight time, and as such, there is little data concerning the safety issues presented by these very long flights. The studies put forward by Continental are not particularly helpful in this regard because they analyzed a small sample of flights. Due to the small size of this sample, the data provided by these studies is not sufficient to justify further increasing the augmented flight-time limits. However, the FAA may relax the limits for ULR flights (through either an FRMS or a future rulemaking) if more data is provided showing that longer flight times do not adversely affect safety.

H. Flight Duty Period—Augmented

In formulating this rule, the FAA considered the fact that augmentation is currently used by air carriers to mitigate fatigue. An augmented flight is staffed by more than the minimally-required number of flightcrew members, and the extra staffing allows the flightcrew members to work in shifts and rest during the flight. Existing regulations allow higher flight times for augmented flights, and this allows air carriers to conduct longer flights.

[58] *See* Folkard, *supra* note 15, at 98.

[59] If the destination is unavailable, the aircraft would land at the designated alternate airport.

[60] The ''FDP Extensions'' section contains a more detailed discussion of the reporting requirements that apply to flightcrew members who exceed the applicable FDP and/or flight-time limits.

[61] Citing Colquhoun, P., *Psychological and Psychophysiological Aspects of Work and Fatigue,* Activitas Nervosa Superior, 1976, 18:257–263.

Augmentation has three significant impacts on flight safety. First, flightcrew members on augmented flights work in shifts, and therefore, do not spend as much time engaged in the fatiguing task of piloting an aircraft. For example, on a 17-hour flight staffed by 4 flightcrew members working in shifts of 2, each flightcrew member will only be on the flight deck for approximately 8.5 hours. This is in contrast to unaugmented flights, in which each flightcrew member must be on the flight deck for the full length of the flight.

Second, when they are not on the flight deck, flightcrew members on an augmented flight have access to an onboard rest facility, which will allow them to sleep during the flight. This in-flight rest will, depending on the quality of the rest facility, help mitigate against some of the fatigue accumulated during the FDP. Third, the redundancy created by augmentation allows fatigued flightcrew members to ask for assistance from other flightcrew members. Thus, if a flightcrew member discovers, mid-flight, that he or she is unduly fatigued, that flightcrew member can ask one of the extra flightcrew members to take over his or her duties and safely land the aircraft at its intended destination.

Because augmentation significantly mitigates fatigue, the FAA has found that longer FDPs can safely be permitted for augmented flights. In determining the specific FDP limits, the FAA took note of the recommendations set out in the TNO Report. The TNO Report was created 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. The TNO Report recommended that: (1) An aircraft with a Class I rest facility provide an FDP extension equal to 75% of the duration of the rest period; (2) an aircraft with a Class II rest facility provide an FDP extension equal to 56% of the duration of the rest period; and (3) an aircraft with a Class III rest facility provide an FDP extension equal to 25% of the duration of the rest period.[62]

Based on the TNO Report, the FAA proposed Table C, which set out separate FDP limits for augmented flights. These limits were generally based on the unaugmented FDP limits, and then were increased in accordance with the available rest facility by the TNO–Report-recommended extension. If a flightcrew member was unacclimated, the augmented FDP limits were reduced by 30 minutes, and the applicable FDP limits were determined based on the local time at the flightcrew member's home base. Because augmented FDPs were generally intended to be used for longer flights, the proposal limited augmented FDPs to three flight segments. In addition, to ensure sufficient in-flight rest for augmented flightcrew members, the proposal would have required: (1) Two consecutive hours of in-flight rest during the last flight segment for flightcrew members who would be manipulating the controls during landing, and (2) ninety consecutive minutes of in-flight rest for all other flightcrew members. The proposal also would have required that at all times during flight, at least one flightcrew member with a PIC type-rating must be alert and on the flight deck.

Drs. Belenky and Graeber stated that ''there is no scientific basis for the different hours assigned as limits for different departure times.'' They asserted that ''[u]npublished alertness modeling data provided to the ATA (and presumably the ARC) demonstrated that a rest provided during the second half of a long-haul flight equal to (flight time minus two hours) divided by two produced roughly equivalent alertness regardless of time of departure.'' Drs. Belenky and Graeber concluded that, based on the modeling data, there is no need to differentiate between the different departure times so long as in-flight rest was provided during the second half of the flight. ATA added that augmented flights departing later in the day would provide in-flight sleep during the WOCL for flightcrew members who would be manipulating the controls during landing, and thus, that in-flight sleep would be more restful.

NACA and a number of air carriers who conduct supplemental operations submitted the following FDP limits as an alternative to the proposed Table C.

NACA PROPOSED TABLE C TO PART 117—FLIGHT DUTY PERIOD: AUGMENTED OPERATIONS

Acclimated	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
0000–2359	18	20	17	19	16	18

The above proposal for augmented operations extends the flight duty period limits for augmented operations by four to six hours, depending on the number of pilots used and the type of rest facilities available onboard the aircraft. Because in-flight rest is provided through onboard rest facilities, the proposal made by the air carriers who conduct supplemental operations does not decrease a flightcrew member's flight duty period limits when the pilot flies during the WOCL.

UPS suggested that ''four person augmented operations with a class one rest facility should provide a 16-hour FDP regardless of report time.'' UPS asserted that this type of augmented FDP limit ''would allow U.S.-based certificate holders to compete globally without an FRMS.''

Atlas Air asserted that most of its augmented flights have FDPs lasting between 18 and 20 hours, many of which are single-stop and nonstop flights in support of AMC missions. Atlas Air stated that it would not be able to keep operating those flights under the limits set out in Table C. As such, Atlas Air suggested that the FAA increase the FDP limits in Table C.

Conversely, ALPA, IPA, CAPA, Flight Time ARC, and other labor groups submitted the following alternative to the proposed Table C, arguing that, in applying the TNO Report, Table C utilized a rounding process ''that doesn't adequately represent the actual calculations used in the ARC process.''

[62] TNO Report at 19.

REVISED TABLE C—FLIGHT DUTY PERIOD: ACCLIMATED AUGMENTED FLIGHTCREW

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	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	18	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

APA criticized the proposed Table C for not applying the TNO Report's rationale to the unaugmented FDP limits for the late evening and early morning hours. APA's alternative to Table C had significantly lower FDP limits for the late evening and early morning hours. APA also stated that the TNO Report has not been validated in the aviation context, and that consequently, the FAA should proceed more cautiously in increasing the existing limits for augmented operations.

Table C differentiates between different FDP departure times because of the type of rest that flightcrew members receive prior to beginning the FDP. As discussed in more detail below, section 117.25 requires a 10-hour rest period with a minimum 8-hour sleep opportunity immediately before a flightcrew member begins his or her FDP. Based on this requirement, flightcrew members who begin an FDP in the morning will obtain their pre-FDP sleep at night during the WOCL. Conversely, flightcrew members who begin an FDP later in the day or at night will obtain their pre-FDP sleep during the daytime. Because sleep taken at night during the WOCL is more restful than sleep taken during the day,[63] flightcrew members who begin their FDP in the morning will be better rested than flightcrew members who begin their FDP later in the day or at night. Accordingly, Table C sets higher FDP limits for augmented FDPs that begin in the morning and lower FDP limits for augmented FDPs that begin later in the day or at night.

In selecting the specific timeframes for Table C, the FAA was primarily concerned with the quality of pre-FDP rest obtained by the flightcrew members, and not with whether those flightcrew members' FDP required them to work during the WOCL. This is because the redundancy inherent in an augmented operation ensures that there are extra flightcrew member(s) available to take over the duties of someone who becomes unduly fatigued during the WOCL. Since the timeframes of the unaugmented FDP limits in Table B were calibrated to ensure that unaugmented flightcrew members with long FDPs do not work during the WOCL, the specific timeframes of the augmented FDP limits in Table C (which address a different concern) are different from the timeframes of Table B.

The FAA has considered Drs. Belenky and Graeber's suggestion that, based on unpublished modeling data studying long-haul flights, there is no need to differentiate between the different departure times so long as in-flight rest was provided during the second half of the flight. The FAA notes that the modeling data cited by Drs. Belenky and Graeber relies on in-flight rest being provided during the second half of the flight. However, in order to provide operational flexibility to air carriers, this rule requires that only the pilot who will be flying the aircraft during landing receive his or her in-flight rest during the second half of the FDP. As such, the FAA is unpersuaded by the fatigue modeling data cited by Drs. Belenky and Graeber because that data does not take into account the fatigue levels of all the members of the augmented flightcrew.

The FAA has also considered ATA's argument that augmented flights leaving later in the day would provide in-flight sleep during the WOCL for flightcrew members who would be manipulating the controls during landing. However, there is little real-world data concerning the extent of the mitigation provided by in-flight sleep during the WOCL. The FAA is particularly concerned about whether the benefits of in-flight WOCL sleep would outweigh the less-restful daytime sleep obtained by flightcrew members who begin FDPs later in the day. Consequently, the FAA has decided to retain the shorter FDP limits for augmented FDPs that begin later in the day, but this position may change if FRMS-provided real-world data addresses the FAA's concerns in this area.

The FAA has decided to retain the departure-time-based approach in Table C because, as discussed above, that approach is necessary to take into account the quality of rest that a flightcrew member receives immediately prior to beginning an FDP. However, in response to industry concerns, the FAA has determined that a slight upward adjustment to the FDP limits in Table C would not have an adverse effect on safety. This is because, as discussed in the Flight Time section, the flight-time limits for augmented operations effectively limit the time that each augmented flightcrew member spends flying an aircraft to approximately 8.5 hours. Accordingly, the FAA has increased each of the FDP limits in Table C by one hour. The FAA is also open to the possibility of further increasing the FDP limits in Table C if additional data is provided, as part of the FRMS process, showing that longer augmented FDPs do not have an adverse impact on safety.

The FAA has considered the labor groups' concern that the specific limits in Table C somewhat deviate from the TNO Report's rationale. However, the FAA believes that these deviations are justified in light of the fact that the flight-time limits in this rule curtail the time that flightcrew members spend engaged in the fatiguing activity of piloting an aircraft. As discussed above, each of the augmented flight-time limits has been calibrated so that each flightcrew member only spends approximately 8.5 hours flying the aircraft. Because the remainder of each flightcrew member's FDP is spent either resting or doing less-fatiguing activities, the FAA has determined that an upward deviation from the TNO Report is justified in this case.

The FAA agrees that the TNO Report has not yet been validated in the aviation context. However, the TNO

[63] *See, e.g.,* James K. Wyatt, *et al., Circadian temperature and melatonin rhythms, sleep, and neurobehavioral function in humans living on a 20-h day,* Am. J. Physiol. 277 (4), at R1160–62 (1999); Torbjorn Akerstedt & Mats Gillberg, *The Circadian Variation of Experimentally Displaced Sleep,* Sleep, Vol. 4, No. 2, at 159–69 (1981).

Report contains the latest scientific evaluation of onboard rest facilities, and the report also contains the most comprehensive evaluation of these facilities. Consequently, the FAA finds the TNO Report to be persuasive in this case.

The FAA understands the need to proceed cautiously with setting the limits for augmented operations. That is why this rule largely retains the existing flight-time limits for augmented flights. These flight-time limits curtail the time-on-task of each flightcrew member and serve as a crucial mitigation measure against fatigue. The specific flight-time limits are set at levels with which the FAA has significant operational experience and that have scientifically been shown to be relatively safe.[64] As discussed above, given the time-on-task mitigation provided by the flight-time limits, the FAA has determined that a slight increase to the proposed FDP limits would have no adverse impact on flight safety.

NACA stated that the proposed language was unclear as to whether the two-hour in-flight rest opportunity was required for each augmented flight segment. Drs. Belenky and Graeber criticized the proposed requirement that flightcrew members manipulating the controls during landing receive their in-flight rest during the last flight segment. They stated that the last flight segment on an augmented flight may be short, in which case the flightcrew members manipulating controls during landing would not receive their in-flight sleep during the most optimal FDP time. As an alternative, Drs. Belenky and Graeber suggested allowing in-flight rest to occur before the last flight segment, but then limiting the flightcrew members to only conducting one more landing after their in-flight rest. ATA and CAA endorsed Drs. Belenky and Graeber's analysis.

ATA, CAA, Atlas Air, Delta, and UPS criticized the proposed requirement that in-flight rest for flightcrew members manipulating the controls occur during the last flight segment. ATA stated that to accommodate this requirement, the last flight segment would have to be at least 3.5 hours long, which would not accommodate some current operations. ATA and UPS added that turbulence or other factors affecting the final leg—such as a diversion—may also prevent the landing pilot from receiving a full two hours' rest on the last leg. UPS stated that a customer in a supplemental operation may require a short final segment. Atlas Air stated that some of its customers request short flight segments as the last segments of an FDP.

ATA and Delta recommended that the in-flight rest for flightcrew members landing the aircraft be permitted to take place during the last six hours of the FDP. UPS recommended that the required in-flight rest for the landing flightcrew take place during the last eight hours of the FDP.

NACA recommended doing away with the two-hour and ninety-minute in-flight rest requirements altogether, arguing that shorter amounts of rest were also recuperative. In support, NACA cited a NASA study showing that a short in-cockpit nap mitigated short-term fatigue. NACA also stated that NTSB records do not reveal a single accident involving an augmented crew in which fatigue was a factor.

Drs. Belenky and Graeber also argued that the 2-hour required in-flight rest opportunity could be broken up and distributed over multiple flight segments. In support, they cited the 2003 Bonnet and Arand clinical review for the proposition that rest of less than 2 hours would be beneficial in the augmentation context. They also cited a NASA study showing that short cockpit naps could be used to mitigate short-term fatigue.

ALPA, IPA, CAPA, Flight Time ARC, and other labor groups suggested that the 2-hour sleep requirement for the flightcrew member manipulating the controls during landing apply to both flightcrew members who will be occupying a control seat during landing. These commenters emphasized that both flightcrew members manipulate the controls, *i.e.,* the non-flying pilot normally operates flaps, landing gear and radios and performs monitoring so he must be equally alert. The commenters added that there are also other high workload circumstances where both pilots are manipulating the controls such as when a landing must be rejected or decision-making is required for diversion. Conversely, Delta stated that only one flightcrew member actually manipulates the controls to land an aircraft while the other flightcrew member at the control station performs secondary functions.

NJASAP asked whether the 2-hour and 90-minute rest requirements for augmented operations were cumulative. Specifically, NJASAP asked whether flightcrew members who will be manipulating the controls during landing are required to have in-flight rest totaling 3.5 hours. NJASAP and North American Airlines also asked whether there was a minimum length for a flight segment in an augmented FDP. NJASAP suggested that each flight segment in an augmented FDP should be long enough for a flightcrew member to gain sufficient amounts of in-flight rest. North American Airlines suggested that subsections 117.19(c) and (d) be eliminated in order to prevent confusion. NJASAP also asked when the flightcrew member who will land the plane should end his or her in-flight nap and take his or her space at the flight controls.

The reason that the proposed rule required two hours of rest during the last flight segment for flightcrew members who will be manipulating the aircraft controls during landing was to ensure that the landing flightcrew members obtain fatigue-mitigating rest close to the time that they begin the landing. However, the FAA agrees with commenters that requiring the rest to take place during the last flight segment unnecessarily limits existing operations, some of which use a short flight segment as the last segment of an augmented operation. As such, this section has been amended to require that the flightcrew member who will be flying the aircraft during landing receive his or her in-flight rest during the second half of the FDP. This amendment allows air carriers flexibility with scheduling flight segments for augmented FDPs while at the same time ensuring that the landing flightcrew member receives at least two hours of continuous rest close to the time that he or she will be landing the aircraft.

The FAA has also considered the NASA study cited by NACA. This NASA study showed that a 40-minute sleep opportunity resulting in a 20–26 minute nap created a relative improvement in alertness for the 90-minute period following the nap. However, this study does not justify eliminating the requirement that the flightcrew member who will be flying the aircraft during landing receive two hours of rest during the second half of the FDP. This is because the NASA study did not establish whether the 20–26 minute nap mitigated fatigue for more than 90 minutes after the nap was taken. As such, if a landing flightcrew member takes his or her in-flight rest at the beginning of the FDP, it is unclear from the results of the NASA study whether the benefits from the short in-flight nap would still exist at the end of that flightcrew member's FDP when that flightcrew member is engaged in the safety and work-intensive task of landing an aircraft.

The FAA also notes that it is retaining the requirement that the 2 hours of rest be continuous. This is because there is an overhead cost associated with getting

[64] *See* Folkard, *supra* note 15, at 98 (showing an exponential increase in accident risk after the 8th and 9th hour of work).

to sleep, and a person waking up from a nap also does not immediately become fully alert upon waking up. Consequently, if a person takes only one continuous nap, the going-to-sleep/waking-up costs only have to be paid once. However, if a single nap is split up into multiple naps, those costs have to be paid each time a nap is taken. Because augmented flights will only be in the air for a limited amount of time, the additional going-to-sleep/waking-up costs would reduce the total amount of time available for recuperative in-flight rest. As such, to maximize the amount of recuperative rest obtained by augmented flightcrew members and minimize the costs associated with going to sleep and waking up, the minimum in-flight rest requirements in this section require that the rest be continuous.

As Delta pointed out, only one flightcrew member actually flies the aircraft during landing while the other flightcrew member on the flight deck performs secondary functions. While these secondary functions are important, they are not as task-intensive as landing an airplane. Therefore, this section only requires two hours of in-flight rest in the second half of the FDP for the pilot who will be flying the aircraft during landing. The regulatory language in this section has been clarified accordingly. The regulatory language in this section has also been amended to clarify that the ninety-consecutive-minute rest opportunity is only necessary for the pilot who will be performing the secondary monitoring duties on the flight deck during landing.

In addition, the 2-hour and 90-minute rest requirements for augmented operations are not cumulative. If a flightcrew member only performs secondary monitoring duties during landing, that flightcrew member is only required to have a minimum of 90-minutes of in-flight rest. If a flightcrew member flies an aircraft during landing, that flightcrew member is required to have a minimum of 2 hours of in-flight rest in the second half of his or her FDP.

Based on these rest requirements, at least one flight segment in the second half of the augmented FDP of a flightcrew member who will be flying an aircraft during landing must exceed two hours so that the flightcrew member can obtain his or her minimum continuous in-flight rest. This flight segment need not be the last flight segment of the FDP. The two hours of in-flight rest simply needs to take place in the second half of the FDP of the flightcrew member who will be flying the aircraft during landing.

The flightcrew member who will be flying the aircraft during landing should end his or her in-flight nap and assume control of his or her duty station before the top of the descent, which is about 45 minutes to 1 hour before landing. This is will allow the flightcrew member to take into account all of the surrounding circumstances before reducing the aircraft's altitude in preparation for an eventual landing.

NJASAP asked whether certificate holders could use augmentation on domestic operations. ATA asked that the FAA ''affirmatively state in the rule text that for the purposes of operational reliability and flexibility, carriers can augment any flight that would not otherwise require and/or qualify for augmentation.'' A number of air carriers stated that augmentation on domestic flights should be permitted because the science underlying domestic and international augmentation is the same.

Conversely, three individual commenters, APA, NJASAP, and Captain Sullenberger stated that augmented flightcrews should be used only on international and not domestic flights. NJASAP emphasized that ''[a]ugmented crews were intended to allow an aircraft to fly to a destination which was too far to reach under the flight rules governing two flightcrew members, meaning a flight route too long over a geographical region which prohibited the allowing of changing crews.'' APA stated that domestic flights are capable of replacing the crew between flight segments, and thus, they do not have the same need for augmentation as international flights.

This rule permits augmentation on domestic and international FDPs that meet the criteria set out in section 117.17. This is because, as the air carriers correctly pointed out, augmentation mitigates fatigue the same way on both domestic and international flights. Therefore, augmentation allows air carriers to safely schedule longer FDPs both domestically and internationally.

While augmentation was originally designed to allow air carriers to schedule longer flights, that is not a sufficient justification to limit augmentation to international flights. As an initial matter, some domestic flights are longer than some international flights. Thus, for example, a flight from Atlanta to Mexico City, which is an international flight, is shorter than a flight from Washington DC to Los Angeles, which is a domestic flight. In addition, augmentation provides safety benefits on shorter flights as well as longer flights. A flightcrew member working on an 8-hour augmented FDP will be able to obtain in-flight rest and all of the other benefits of augmentation. Consequently, the augmented flightcrew member will have a less-fatiguing FDP than an unaugmented flightcrew member working on a similar FDP.

The FAA has determined that the ability to replace flightcrew members between flight segments is also not a sufficient justification for prohibiting augmentation on domestic flights. Many of the air carriers that fly international routes have a substantial international presence and could easily replace flightcrew members between flight segments on international flights. Conversely, some air carriers do not have a substantial presence at some of the smaller domestic airports, and these air carriers may find it more difficult to replace flightcrew members between domestic flight segments involving those airports.

Because augmentation provides the same amount of fatigue mitigation on both domestic and international flights and because there is no meaningful justification for prohibiting augmentation on domestic flights, this rule permits augmentation on both domestic and international flights.

NACA, CAA, North American Airlines, and Capital Cargo objected to augmented flights being limited to three flight segments. Capital Cargo stated that multi-segment augmented FDPs are safe because flightcrew members on those FDPs receive in-flight rest. Conversely, ALPA, IPA, CAPA, NJASAP, Flight Time ARC, and other labor groups stated that the TNO report was only intended for one-segment flights, and as such, multi-leg augmentation should only be allowed when no crew change is possible. ALPA emphasized that ''[m]ulti-leg augmentation should never be allowed solely for the purpose of extending a flight duty period.'' NJASAP asserted that multi-leg domestic augmentation is counter to the intent behind augmentation. IPA, CAPA, and IBT Local 1224 suggested that only two flight segments should be permissible for an augmented FDP.

As discussed in the Unaugmented FDP section, there is evidence that additional flight segments increase flightcrew member fatigue. Because existing augmented operations generally do not exceed three flight segments, the FAA has little data concerning the effects of FDPs consisting of more than three flight segments on the fatigue levels of augmented flightcrew members. As such, the FAA has decided to permit augmented FDPs of three flight segments or less, which are used in existing operations, and to require

additional FRMS-provided data from air carriers wishing to exceed the three-flight-segment limit.

ATA and UPS stated that the FDP limits for four-pilot crews are counter to science because they permit longer FDPs for pilots who land during the WOCL than for pilots who do not land during the WOCL. As such, ATA suggested that the limits for four-pilot operations ''be adjusted to uniformly reflect the maximum values currently set forth in the table.'' ATA stated that such an adjustment would make this rule similar to other standards like CAP–371.

Conversely, IPA, CAPA, IBT Local 1224, and Flight Time ARC suggested that the FAA not allow four-pilot augmentation for flights with a Class 3 rest facility. These commenters argued that a Class 3 rest facility only provides marginal rest, and placing more pilots on board with this type of facility would just increase the likelihood that there will be more fatigued pilots.

As discussed above, the specific timeframes in Table C were calibrated to take into account only the quality of rest received by each flightcrew member before beginning an FDP. Because of the redundancy safeguards inherent in augmentation, the FAA determined that there was less of a safety concern associated with augmented pilots flying an aircraft during the WOCL.

Turning to the distinction between three- and four-pilot flightcrews, the reason that Table C sets lower limits for three-pilot crews than it does for four-pilot crews is that, in a three-pilot crew, each pilot spends more time piloting the aircraft. Take, for example, a 12-hour flight segment. Because two pilots are required to operate the aircraft, pilots in a four-pilot crew working in shifts of two would each spend 6 hours on the flight deck. Conversely, pilots in a three-pilot crew working in shifts of two would each spend 8 hours on the flight deck. Because pilots working as part of a three-pilot crew spend more time piloting the aircraft and less time resting, Table C sets lower FDP limits for three-pilot crews.

The FAA understands that this distinction makes this rule different from other regulatory rules, such as CAP–371, which do not distinguish between three and four-pilot augmented crews. Here, while CAP–371 does not distinguish between three- and four-pilot crews, it addresses the safety issues associated with augmentation flights in other ways by requiring three hours of in-flight rest during augmented operations[65] instead of the ninety minutes to two hours required by this rule.

The FAA has also decided to retain augmentation for four-pilot flightcrews on flights with a Class 3 rest facility because, even though these flights have a lower-quality rest facility, each of the pilots in the four-pilot flightcrew will spend less time piloting the aircraft than the pilots in a three-pilot flightcrew. Consequently, the members of the four-pilot augmented flightcrew will accumulate less fatigue during their flight than the members of the three-pilot augmented flightcrew. The lower quality of the Class 3 rest facility is instead reflected in the relatively-low FDP limits associated with that facility.

APA suggested amending subsection 117.19(e) to add a requirement that the PIC-type-rated flightcrew member be fully qualified and landing current. APA stated that the flightcrew member(s) flying the aircraft need to be capable of performing a landing because unforeseen circumstances during the flight may require the flightcrew member(s) in the cockpit to make a prompt emergency landing. NJASAP stated that all flightcrew members in an augmented operation should be type-rated.

In response to APA's concern, the language in section 117.19(e) has been amended to require that at least one flightcrew member on the flight deck must be qualified in accordance with 14 CFR 121.543(b)(3)(i). A flightcrew member qualified in accordance with section 121.543(b)(3)(i) will be both fully qualified and landing current.

Turning to NJASAP's concern about all flightcrew members being type-rated, the FAA notes that the existing regulations require the second in command (SIC) to be type-rated for all non-domestic flights. *See* 14 CFR 61.55(a)(3). While these regulations do not require the SIC to be type-rated on domestic flights, the FAA has determined that 14 CFR 121.543(b)(3)(i) requires a high degree of training, and having at least one flightcrew member on the flight deck who is qualified in accordance with this section provides sufficient staffing to safely operate the aircraft and respond to any unforeseen circumstances that may arise.

Boeing asked for clarification about whether FDPs consisting of a mix of augmented and unaugmented flights are subject to Table B or Table C.

The FDP and flight-time limits for augmented operations were set at higher levels based on the assumption that flightcrew members working on those operations would obtain the fatigue-mitigation benefits of augmentation. A flightcrew member who works on an unaugmented flight does not obtain these fatigue-mitigation benefits. As such, if an FDP contains both an augmented and an unaugmented flight, that FDP is subject to the unaugmented FDP-limits set out in Table B and the unaugmented flight-time limits set out in Table A.

IPA, CAPA, Flight Time ARC, and other labor groups also suggested that, to ensure proper in-flight rest, this rule require a Class I rest facility for any augmented FDP in which the flight time exceeds 12 hours.

As discussed in the Flight Time section, the flight-time limits for augmented FDPs have been set so that each flightcrew member flies the aircraft for approximately 8.5 hours. Because this flight-time restriction limits each flightcrew member's time-on-task to acceptable levels, there is no need to impose minimum rest facility limitations for sub-categories of augmented operations.

NACA suggested, without elaboration, that the FDP limits for unacclimated flightcrew members be decreased by 1 hour instead of the proposed 30 minutes. ALPA, IPA, IBT Local 1224, and Flight Time ARC argued that the proposed 30-minute reduction for unacclimated flightcrew members is too simplistic. As an alternative, these commenters proposed a Table D, containing FDP limits for unacclimated flightcrew members, which decreased unacclimated flightcrew member FDP times by values ranging from 20 to 50 minutes (depending on the time of day).

The 30-minute FDP-limit reduction for unacclimated flightcrew members was imposed to account for the additional fatigue experienced by these flightcrew members. The FAA is unaware of NACA's reasons for suggesting that the FDP reduction for unacclimated flightcrew members be increased to one hour.

Turning to the suggestions put forward by the labor groups, because the unacclimation reductions set out in the commenters' suggested Table D are relatively close to the FAA-proposed 30-minute reduction, the FAA has decided to retain the 30-minute reduction for the sake of regulatory simplicity. As commenters have pointed out elsewhere, parts of this rule are somewhat complex, and as such, the FAA has determined that adding another table solely for unacclimated flightcrew members would add undue complexity to this section.

ALPA, IPA, CAPA, and IBT Local 1224 recommended changing the label in Table C for ''Time of start'' to clarify that the timeframes specified in Table C are based on home base or acclimated

[65] CAP–371, section 15.3.

time. The FAA adopts this recommendation, and the label in Table C has been changed to clarify that the ''Time of start'' in Table C is based on home base or acclimated time.

I. Schedule Reliability

In the NPRM, the FAA proposed reporting requirements to facilitate realistic scheduling by the certificate holders. Proposed § 117.9, Schedule reliability, would have required the certificate holder to adjust (1) its system-wide FDPs if the total actual FDPs exceed the scheduled FDPs more than 5% of the time; and (2) a specific FDP if it is shown to exceed the schedule 20% of the time. The certificate holder would have to adjust its schedule within 60 days for any FDP(s) that exceeded the above-stated percentages.

The FAA also proposed that each certificate holder must submit a report every two months detailing the adjustments described above (the overall schedule reliability and pairing-specific reliability) and include the following information: (1) The carrier's entire crew pairing schedule for the previous two-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 pairing; and (3) the percentage of discrepancy between the two data sets on both a cumulative, and pairing-specific basis.

No commenters supported the requirements for schedule reliability as proposed. Many commenters argued that the proposed requirements were unnecessary as they would not do anything to mitigate transient, cumulative or chronic fatigue. Others believe that the proposal was seriously flawed and that adjustments to the proposed requirements were necessary.

Pinnacle, RAA, ATA, Alaska Airlines, Continental, American Airlines and Capital Cargo International Airlines (CCIA) contend that the schedule reliability section should be deleted entirely. They argue that these proposed requirements do not advance fatigue mitigation and present unjustified costs and burdens on certificate holders. RAA stated that the NPRM did not set forth any discussion of a statistical basis/reality check for the selection of a 5% FDP ''late arrival'' rate for the certificate holder's operation as a whole, or as the trigger point for when the certificated holder must take action to ''adjust.'' Similarly, RAA states that there is no discussion to support the selection of 20% for a particular FDP that actually exceeds the scheduled time. RAA also commented that there is limited likelihood that the flightcrew member FDP reliability analysis under the NPRM would differ greatly from an airline's on-time arrival statistics even if the proposed regulatory text is changed to reflect a 14-minute ''grace period'' that DOT affords in its on-time reporting statistics.

Several commenters, including CAA, UPS, World Airways, American Eagle Airlines (AE), and ALPA, also objected to the schedule reliability provision and suggested that instead of reporting when actual FDPs exceed scheduled FDPs, certificate holders should only report FDPs that exceed the maximum limits under the regulations. They argue that as long as the flightcrew member's FDP falls within the parameters of the maximum permitted under the regulation, the certificate holder must have the operational flexibility to manage schedules as they determine. The commenters also stated that a reporting schedule which requires a certificate holder to detail occurrences that exceed the maximum limits provided in Tables B and C, and to adjust the schedules that consistently exceed those limits, is reasonable.

Commenters also submitted varying timeframes for the reporting. Some recommended 30 days, other suggested quarterly reporting. There were various comments on how long the certificate holder had before taking corrective action.

IBT Local 1224, IPA, the Flight Time ARC, and FedEx ALPA recommended that the schedule reliability section extend to flight segments as well.

IATA commented that any reporting requirements should relate directly to fatigue and not to compliance with published schedules. UPS stated that the reporting requirements should be seasonal to comport with schedule changes. UPS also argued that schedule reliability would actually increase fatigue because certificate holders would pad time spent on the ground during multi-segment FDPs, which would result in a corresponding reduction in restorative layover rest. UPS and NAC contend that this section addresses domestic scheduled operations and is illogical for others, particularly non-scheduled operators.

The FAA acknowledged in its Response to Clarifying Questions that the NPRM discussion on schedule reliability was confusing. The FAA also acknowledges that this section as proposed raised considerable concerns from virtually all commenters. After reviewing the comments, the FAA concludes that the concept of schedule reliability is better addressed by the simpler approach recommended by the group of commenters, who suggested reporting actual FDPs that exceed the maximum regulatory limits. This is discussed in detail in the next section.

J. Extensions of Flight Duty Periods

The FAA agrees that FDPs that exceed the maximum FDP permitted under Table B are the ones that directly impact fatigue and must be addressed by the certificate holder. Adopting this approach will make the certificate holder accountable for scheduling FDPs realistically. While a certificate holder can schedule FDPs up to the maximum presented in the tables, it is unlikely to do so because of the cumulative limits (weekly and monthly) on FDPs. This approach addresses a significant portion of the commenters' concerns. Proposed section 117.9 is deleted and the FAA adopts new § 117.19 Flight Duty Period Extensions.

This new section sets forth the limits on the number of FDPs that may be extended; implements reporting requirements for affected FDPs; and distinguishes extended FDPs due to unforeseen operational circumstances that occur prior to takeoff from those unforeseen operational circumstances that arise after takeoff. For purposes of maintaining all requirements for FDP extensions in a single section, the provisions permitting extended FDPs based on unforeseen circumstances proposed in § 117.15 FDP: Un-augmented operations and § 117.19 FDPs: Augmented flightcrew are now codified in § 117.19.

RAA, Southwest Airlines and World Airways object to the pilot in command being the decision maker on whether to extend an FDP. Continental, however, recommends that the decision to extend a FDP should be a joint decision between the pilot in command and the certificate holder. APA commented that the decision of the pilot in command is crucial in determining whether to extend an FDP.

The FAA agrees that the responsibility for determining whether a FDP needs to be extended rests jointly with the pilot in command and the certificate holder. This ensures that one party is not taking excessive action over another party, and that proper considerations are factored into the decision-making. Paragraph (a)(1) of this section permits, under unforeseen operational circumstances that arise prior to takeoff, the pilot in command and the certificate holder to extend the maximum FDP permitted in Table B and C by two hours.

In the NPRM, the FAA specifically questioned whether the proposed two-hour extension was appropriate.

SWAPA opposed any extension beyond the free 30-minute extension and argued that this would invite abuse. NJASAP supported one extension up to two hours, as long as compensatory rest was applied following the extension. IPA supported the two-hour extension as reasonable but opposed the three-hour extension for augmented operations because greater rest opportunities are not provided for those operations. APA supports the limits on extensions and argues in particular that the 12–13 hour period repeatedly has been cited as a point at which accident risk increased dramatically. APA also commented, however, that there are certain circumstances in which a FDP can be safely extended beyond the two hours contemplated in the NPRM. NACA supports a two-hour extension for both augmented and unaugmented operations.

The FAA agrees that an extension must be based on exceeding the maximum FDP permitted in Table B and C. It is unreasonable to limit extensions on FDPs that are less than what the certificate holder can legally schedule. In addition, there is a 30-minute buffer attached to each FDP to provide certificate holders with the flexibility to deal with delays that are minimal. However, after the 30-minute buffer, any time that the FDP needs to be extended, the requirements and limitations of this section apply. In the NPRM, the FAA proposed a two-hour FDP extension for unaugmented operations due to unforeseen operational circumstances and a three-hour FDP extension for augmented operations under similar situations. The FAA concludes that there is no distinction for FDP extension based on whether the operation is conducted by an augmented flightcrew. The difference between unaugmented and augmented operations is accounted for by the different hourly limits in Tables B and C. The hourly limits of Table C were developed in consideration of the extra flightcrew members and rest facilities onboard the aircraft for augmented operations that mitigate the effects of longer FDPs. There is no further mitigation that warrants an additional hour for an augmented crew. The FAA believes that two hours is reasonable and provides the certificate holder with sufficient operational flexibility to adjust for unforeseen operational circumstances. If an unforeseen operational circumstance occurs prior to takeoff, a flightcrew member cannot accept an extended FDP if the completion of that FDP would be more than two hours beyond the maximum FDP permitted under Table B and C for that flight.

In the NPRM, the FAA proposed that an extension of an FDP of more than 30 minutes may occur only once in any 168 consecutive hour period. Hawaiian Airlines, IPA, IBT Local 24, Alaska Airlines, Aloha Air Cargo and several individual commenters supported this proposal. One commenter suggested one extension in a 90-day period. SkyWest, United, FedEx Express, ATA, and CAA argue that one extension is too restrictive and does not allow any operational flexibility to recover a schedule after an event. SkyWest suggested up to three extensions per week with a total of eight per month. ATA argued that the once in 168 hours rule ''is another example of a requirement made unnecessary by other mitigations in the NPRM and which will result in unjustified adverse impacts.'' ATA and CAA support the statements submitted from Drs. Belenky and Graeber, who commented ''that clear science supports that extended work hours over consecutive work days reduces the opportunity for sleep, which can lead to cumulative sleep loss and fatigue. However, there is no scientific evidence to support limiting an extension to once in seven days.'' They further comment that extensions should not be permitted on consecutive days in order to allow for sleep recovery and no more than two extensions within any one 168 hour period. RAA, Continental, North American, Southwest and two individuals requested two extensions in a 168 consecutive hour period. Kalitta Air and North American Airlines support two non-consecutive extensions in 168 hours, with a 16-hour rest period required if the second extension actually occurs.

Lynden Air Cargo, Southern Air and NACA object to the limit on extensions. They argue that supplemental, non-scheduled operations require flexibility to schedule their operations that is not needed by the domestic scheduled community because they have crews on reserve for use in lieu of extensions.

The FAA is not persuaded by the commenters that more than one extension is appropriate within a 168 consecutive hour period with one exception, discussed below. The elements of the flight and duty requirements adopted in this rule present a conceptual departure from the practice that is in place under the current rules. Under the current rules, extensions of flight time were largely unrestricted as long as a flightcrew member was provided with compensatory rest. Under the requirements adopted today, rest is prospective and the certificate holders are responsible to schedule realistically so that FDP limits can be maintained. Permitting weekly extensions simply encourages scheduling to those extensions and undercuts the purposes of strict limits on FDPs.

In response to the commenters however, the FAA is modifying one aspect of this requirement. In the NPRM, an FDP extension was limited to once every 168 consecutive hour period. While this limited potential abuse of extensions, it did result in an illogical outcome based on certain facts. For example, a flightcrew member that has an FDP extended on Day 1 and then has two days off would be unable to accept another extended FDP on Day 4. After having 48 hours rest, that flightcrew member would not be subject to fatigue based on a two-hour extended FDP. Paragraph (a)(2) provides that an extension of the FDP of 30 minutes or more may occur only once prior to receiving a rest period described in § 117.25(b).[66] This provides certificate holders with one extended FDP but resets the clock for the 168 consecutive hours limit if a rest period of 30 hours or more has been received. Furthermore, the FAA is mindful of the daily tracking and recordkeeping/compliance burden placed on both individual flightcrew members and the certificate holders by a rolling 168 consecutive hour period. This modification will alleviate this tracking requirement.

The FAA has included, in paragraph (a)(3), that a flightcrew member's FDP may not be extended due to unforeseen operational circumstances that occur prior to takeoff if such extension could cause the flightcrew member to exceed the cumulative FDP limits specified in § 117.23(c). The basis for this provision is that prior to takeoff a flightcrew member will know whether the delay will result in the flightcrew member exceeding the cumulative limits. If so, the flightcrew member cannot continue the flight.

In lieu of the reporting requirements proposed under the schedule reliability, the FAA adopts a two-prong requirement for reporting extended FDPs. In addressing unforeseen operational circumstances, it is critical to distinguish those situations that arise prior to takeoff and those that arise after takeoff. Under both situations, the certificate holder must report to the FAA within 10 days any FDP that

[66] Section 117.25(b) provides that before beginning any reserve or FDP, a flightcrew member must be given at least 30 consecutive hours free from all duty in any 168 consecutive hour period, subject to certain limitations.

exceeded the maximum FDP permitted by Table B or C by more than 30 minutes. In this report, the certificate holder must describe the FDP and the circumstances surrounding the need for an extension. If the situation giving rise to the extension occurred prior to takeoff, the certificate holder must address in this report whether the circumstances giving rise to the extension were within its control. Since it is prior to takeoff, once the certificate holder becomes aware of such issue, the certificate holder and pilot-in-command have discretion to evaluate the situation and determine whether it is permissible and appropriate to extend the applicable FDPs and continue with the flight or whether it is more appropriate to replace the affected flightcrew member. Therefore, in situations where the circumstances were within the certificate holder's control, the certificate holder must include in its report the corrective actions that it intends to take to minimize the need for future extensions. The certificate holder then has 30 days to implement such corrective actions. For situations that are not within the certificate holder's control, it is unlikely that there is a corrective action that can be taken. Therefore, under these scenarios, the certificate holder must simply report the extension within 10 days and provide the details surrounding the need for the extended FDP.

Similarly for situations that arise after takeoff, the certificate holder and pilot in command have very little discretion concerning FDPs and flight time limits. Therefore, if an FDP or flight time needs to be extended due to unforeseen circumstances that occur after takeoff, the pilot-in-command and the certificate holder may extend the subject FDPs and flight time, to the extent necessary to safely land the aircraft at the next destination airport or alternate airport, if appropriate. In addition, the extended portion of the flightcrew member's FDP and flight time will be permitted in the flightcrew member's weekly and annual cumulative limits on FDP and flight time limitations. The certificate holder also must report the extension to the Administrator within 10 days of occurrence with the same level of detail as described above.

The reports for extended FDPs and flight time will be forwarded to the appropriate certificate-holding district office where the FAA will monitor all extensions filed. The FAA will review the circumstances surrounding the need for the extensions and if appropriate, whether the circumstances were, in fact, beyond the certificate holder's control. As explained in the NPRM, this determination is on a case-by-case basis. Certificate holders must be aware of scheduling operations into and out of chronically delayed airports. Similarly, certificate holders must be mindful of anticipated weather conditions, *e.g.,* predicted snow storms/blizzards affecting certain airports in the winter. Obviously, not all weather occurrences, ATC delays, or a variety of other situations can be anticipated and addressed by the certificate holder. However, situations that result from inadequate planning are within the certificate holder's control and will warrant corrective action.

The FAA believes that the above requirements will result in realistic scheduling of FDPs. The FAA selected 10 days for the time period to file a report because it is within the time period for retrieval of ATC and weather data in the event that data is necessary for an investigation. This information may be necessary in addressing extended FDPs so it is critical that the FAA receive the report within the same timeframe. In addition, when situations occur that require an extension, the certificate holder must look at the offending segment and identify whether adjustments are needed.

It must be noted that the FAA will investigate each filed report denoting an extended FDP and flight time. This investigation would be conducted by the certificate management office responsible for day-to-day oversight of the air carrier. If the circumstances are found to be within the certificate holder's control, the certificate holder has responsibility to determine the corrective action and to implement that corrective action within the time period required under the regulations. Failure to adhere to the adopted requirements may result in enforcement by the FAA.

K. Split Duty

Sleep studies show that sleep which takes place during the day is less restful than sleep that takes place at night.[67] Other studies indicate that working during the WOCL substantially degrades the ability of a flightcrew member to safely perform his or her duties.[68] One of the problems that this rule was intended to address is the performance degradation experienced by flightcrew members who conduct overnight FDPs and perform their duties during the WOCL after receiving less-restful daytime sleep. This rule addresses this problem by incentivizing fatigue mitigation measures.

One of these fatigue mitigation measures is split duty which is based on the premise that there are times during an unaugmented nighttime FDP when a certificate holder could reasonably provide a flightcrew member with an opportunity for rest. This rest opportunity (opportunity to sleep) would allow a flightcrew member to get some sleep during the night. The nighttime sleep could be used to mitigate the performance degradation created by working through the WOCL.

To incentivize split duty rest, the FAA proposed that a flightcrew member who received a split duty rest opportunity be allowed to extend his or her FDP by 50% of the available split duty rest opportunity. Under the FAA's proposal, the split duty rest opportunity had to be at least 4 hours long, and it could not be used to extend an FDP beyond 12 hours. The rest opportunity had to be calculated from the time that the flightcrew member actually reached the suitable accommodation (sleep facility).

NJASAP opposed the proposed split duty extension, but noted that the proposed rule presented an improvement over existing limitations on such operations. NJASAP argued that split duty sleep is a theoretical concept that may result in cumulative fatigue and circadian disruption. In support of its argument, NJASAP cited to a study showing that pilots who obtained 7 hours of sleep at night scored consistently worse than pilots who obtained 9 hours of sleep at night. Given this study and the theoretical nature of split duty, NJASAP cautioned the FAA against awarding an FDP extension based on split duty rest.

Conversely, ATA stated that ''science and operational experience supports the concept that a flightcrew member can recuperate because of the opportunity to sleep during a period of their FDP.'' CAA strongly supported the recognition of split duty as a fatigue mitigation measure. One individual commenter also supported the extension of FDPs through split duty schedules.

NJASAP also asked whether the four-hour threshold was mandatory or whether split duty credit could be obtained for split duty rest that was less than four hours. ATA and UPS argued that the four-hour split duty threshold is arbitrary and not science-based. ATA also criticized as unscientific the NPRM's assumption that there is increased overhead involved with falling asleep during a split duty rest. Conversely, FedEx ALPA supported the four-hour split duty threshold, stating

[67] *See, e.g.,* Wyatt, *supra* note 64, at R1160–62; Akerstedt, *supra* note 64 at 159–69.

[68] *See* NASA, *supra* note 22, at 19–34.

that the four-hour threshold is a valid conservative approach until more scientific data is collected.

Drs. Belenky and Graeber cited a 2003 Bonnet and Arand clinical review for the proposition that ''any sleep longer than 20 minutes provides full minute-by-minute recuperative value.'' Based on this review, Drs. Belenky and Graeber asserted that, for night operations, ''any time behind the door of more than 30 minutes would have recuperative value.'' As such, Drs. Belenky and Graeber argued that the four-hour split duty threshold is not supported by science. ATA, CAA, and FedEx supported this conclusion.

NACA, Kalitta Air, Atlas Air, and NAA cited a NASA study, which states that a 45-minute cockpit nap, including use of a jump seat, with a 20-minute recovery resulted in increased alertness for a minimum of 90 minutes of the flight. These commenters argued that, if this type of benefit could be achieved through a cockpit nap, it could definitely be achieved through a ground rest facility.

The FAA agrees with ATA and CAA that split duty is a valid fatigue mitigation measure. Science has shown that naps can serve to mitigate fatigue.[69] Consequently, split duty naps taken at night will permit a flightcrew member to obtain restful nighttime sleep in the middle of his or her FDP. This restful nighttime sleep will decrease that flightcrew member's fatigue level, and will allow him or her to safely work for a longer period of time. As such, the FAA has retained the split duty FDP extension in this rule.

In response to comments about specific split duty provisions, the FAA conducted further SAFTE/FAST modeling to examine the safety-relevant effects of changing the provisions of the split duty section. The SAFTE/FAST model works by predicting flightcrew member effectiveness on a 0 to 100 scale for each minute of that flightcrew member's FDP. Lower predicted flightcrew member effectiveness results in a lower SAFTE/FAST number. An effectiveness level of 77 is approximately equivalent to the effectiveness of someone with a blood alcohol concentration of 0.05.

With regard to the 4-hour threshold, that threshold was included in the proposal to ensure that all flightcrew members obtain a minimum amount of restful sleep during split duty. Upon further modeling, the SAFTE/FAST model showed that a split duty break of less than 3 hours with the corresponding FDP extension would, over a 5-night period, result in flightcrew member effectiveness dropping below 77 for a portion of the FDP. Conversely, a split duty break of at least 3 hours resulted in flightcrew member effectiveness consistently staying above 77 over a 5-night period. Accordingly, this section has been amended to reduce the threshold for the split duty extension to a 3-hour split duty break. In response to NJASAP's question, split duty rest that is less than 3 hours simply counts as part of a flightcrew member's FDP and does not serve to extend the maximum FDP limits.

The FAA disagrees with Drs. Belenky and Graeber's assessment of the Bonnet and Arand clinical review. The studies examined in this clinical review tested the impact that sleep fragmentation had on restfulness and the potential resultant daytime sleepiness. During the course of the studies, subjects would be allowed to fall asleep, and their sleep would then be intermittently disrupted. The studies found that if one's sleep is interrupted every 20 minutes following sleep onset during the night (when one is normally sleeping), that person's daytime sleepiness, as measured by the Mean Sleep Latency Test (MSLT), is the same as someone who has not had their sleep interrupted.

There are two problems with applying the Bonnet and Arand clinical review to split duty. The first problem is that the MSLT results measured by the studies analyzed in the clinical review do not necessarily mean that the performance capabilities of subjects who had their sleep interrupted at 20-minute intervals were equivalent to subjects who did not have their sleep interrupted. All the MSLT results mean is that, when MSLT measurements were taken of subjects who had their sleep interrupted, these subjects did not fall asleep within the MSLT's protocol termination at 20 minutes.

The second problem with applying these studies to split duty sleep is that split duty sleep does not involve sleep fragmentation, but rather a restriction on the total amount of sleep provided during the night. A flightcrew member engaging in split duty sleep will presumably not have his or her sleep cycle intermittently disrupted. Instead, that flightcrew member's total split duty sleep amount may be significantly lower than the 8-hour minimum necessary to recover from fatigue. Because the Bonnet and Arand clinical review did not analyze any studies that actually examined the ''recuperative value'' of receiving less than 8 hours of sleep, that review is not applicable to the minimum threshold necessary to ensure a sufficient amount of split duty sleep.[70]

As the commenters correctly pointed out, a NASA study showed that a 40-minute sleep opportunity resulting in a 20–26 minute nap created a relative improvement in alertness for the 90-minute period following the nap. However, there are three problems with using this study to justify extending a night FDP. First, the NASA study was conducted to see if alertness might be maintained or improved long enough to more safely complete a scheduled flight. The NASA study was not conducted to determine the conditions necessary to extend the flight duty period. Second, the study did not establish whether the 20–26 minute nap mitigated fatigue for more than 90 minutes after the nap was taken.

The third problem with using the above study to extend an FDP is that this study did not explore the full extent of the fatigue mitigation created by the 20–26 minute nap. For example, if a 20-minute split-duty nap was to be used to extend an FDP so that it infringes deeper into the WOCL, would the 20-minute rest provide sufficient mitigation to counter the extra fatigue created by the additional infringement on the WOCL? Because the study concerning the 20–26 minute nap did not provide an answer to the issues discussed above, the FAA has declined to utilize it in determining the threshold rest amount for the split duty FDP extension.

NJASAP asked whether the split duty rest must be scheduled in advance or whether it could be adjusted as necessary by the certificate holder. ATA stated that the 4-hour threshold is operationally unsound because split duty periods are ''calculated dynamically in real time, based upon the actual amount of rest opportunity afforded.'' ATA provided an example of ''split duty rest periods [that] may occur during breaks at a hub while cargo is loaded on an aircraft.'' In those cases, ''[c]rewmembers [would] receive rest in ground facilities during the aircraft loading process.'' UPS disagreed with the extension being based on the flightcrew member's actual rest time ''behind the door'' because it removes an air carrier's ability to shorten split

[69] *See* Daniel J. Mollicone, *et al., Optimizing sleep/wake schedules in space: Sleep during chronic nocturnal sleep restriction with and without diurnal naps,* Acta Astronautica 60, at 354–61 (2007) (examining the fatigue mitigation potential of naps taken during the day).

[70] In a previous Bonnet article, the author also states that ''* * * [i]t does appear that any repetitive stimulation of sufficient magnitude to precipitate any changes in ongoing EEG is sufficient to make sleep nonrestorative.'' Bonnet MH. *Sleep restoration as a function of periodic awakening, movement, or electroencephalographic change.* Sleep, Vol. 10, at 371 (1987).

duty rest in response to an unforeseen circumstance, such as a weather event. UPS stated that this is a significant change from current practice because, currently, split duty rest most often occurs during an unforeseen circumstance. To adjust for this change, UPS asserted that air carriers would have to delay outbound flights, which will increase pilot fatigue by delaying the onset of post-FDP rest.

The FAA has amended the split duty section to clarify that split duty rest must be scheduled in advance, and that the actual split duty rest break may not be less than the scheduled split duty break. The reason for the advance scheduling requirement is that section 117.5(b) requires flightcrew members to determine at the beginning of their FDP whether they are sufficiently rested to safely perform the assigned FDP. In order to accurately perform this assessment at the beginning of their FDP, flightcrew members need to know approximately when their FDP is going to end. Thus, flightcrew members must be notified of any planned split duty extensions before they begin their split duty FDP so that they can accurately self-assess, at the beginning of the FDP, whether they are capable of safely performing their duties throughout the entire FDP. Thus, for example, a flightcrew member who feels fit to accept an overnight FDP that contains five hours of split duty sleep may not feel fit to accept an overnight FDP that contains only three hours of split duty sleep.

In addition, knowing in advance about split duty rest allows a flightcrew member to prepare for, and to maximize, the rest opportunity. For example, a flightcrew member who does not know whether he or she will have a split duty break may drink a cup of coffee only to subsequently find out that he or she must take a three-hour split duty rest 20 minutes later. In contrast, a flightcrew member who knows in advance when he or she is taking a split duty break will not drink coffee shortly before the break. Because flightcrew members must determine their fitness for duty before beginning an FDP and because they must conduct themselves in a way that maximizes their rest opportunities, they must be informed prior to commencing an FDP, about the full extent of the split duty rest that they will receive during the FDP.

The FAA understands that this departs from the current air carrier practice of reducing split duty rest in order to recover a schedule during unforeseen circumstances. To mitigate the impact of this change and account for unforeseen circumstances, this rule provides air carriers with a two-hour FDP extension (discussed previously) that they can use to recover their schedules if unforeseen circumstances arise.

NJASAP asked whether an air carrier could obtain the split duty credit if its flightcrew members do not actually occupy the suitable accommodation during the split duty rest opportunity. UPS criticized the split duty regulation as not taking into account the actual amount of sleep that a pilot receives.

Split duty rest taken under this section does not begin to count until the flightcrew member reaches the suitable accommodation. If the flightcrew member never reaches the suitable accommodation, then that flightcrew member's split duty break will not qualify for a longer FDP. The FAA also emphasizes that, as discussed above, section 117.5(a) requires a flightcrew member to report for duty rested. By virtue of that requirement, flightcrew members must take advantage of any rest periods that are provided, and use them for their intended purpose, which is to sleep.

The FAA has considered UPS' suggestion of amending the split duty extension to track the actual amount of sleep that a flightcrew member receives instead of the length of the split duty break. However, this type of standard would be very difficult to implement because air carriers would need to track when each flightcrew member actually falls asleep. Because this would place a substantial burden on air carriers, the FAA ultimately decided to give credit for the length of the split duty rest opportunity instead of the amount of actual sleep received by the flightcrew members.

Drs. Belenky and Graeber asserted that the 50% split-duty credit was unreasonably conservative for split-duty rest that is taken during usual bedtime hours. However, Drs. Belenky and Graeber cautioned that the 50% credit ''may be warranted for split duties that require daytime sleep.'' ATA stated that the 50% credit was unjustified because a sleep opportunity longer than 20 minutes provides a full minute-by-minute recuperative value. ATA criticized the NPRM's underlying assumption that a four-hour sleep opportunity would only result in two hours of sleep, arguing that this assumption did not apply to ground-based suitable accommodations.

Northern Air Cargo asked for a more generous split duty credit. ATA proposed a split duty credit that increases in proportion to the length of the split duty rest. CAA and FedEx proposed a split duty credit ranging from 100 to 300%, based on the time of day in which the credit is given.

As stated above, in response to comments, the FAA conducted further SAFTE/FAST modeling to determine whether the split duty provision could be modified without decreasing safety. The modeling has revealed that a 100% credit for split duty rest would not result in flightcrew member effectiveness dropping below 77 for any portion of a series of 5-night FDPs. As such, the split duty credit has been increased to provide for an extension equal to 100% of the split duty rest. The FAA has considered CAA and FedEx's suggestion of providing more than a 100% credit, but, due to the concerns associated with nighttime flying, the FAA would need additional data to provide more than a 100% credit for split duty.

The FAA was also concerned with the fact that the above comments appear to show some misunderstanding of how the split duty section works. In order to clarify the meaning of the split duty section, the FAA has amended this section as follows.

First, the split duty framework, as set out in the NPRM, would count split duty rest as part of a flightcrew member's FDP, and then extend that FDP by the amount of the split duty credit. Now that the split duty credit has been increased to 100%, the FAA has determined that the NPRM's split duty framework is needlessly complicated. As such, this section has been amended so that split duty rest that meets the requirements of this section will simply not count as part of the FDP.

Second, split duty rest was intended to be taken at night so that it could provide flightcrew members with restful nighttime sleep. *See* 75 FR 55866. To ensure that the split duty rest credit is not awarded for rest taken during the day, this section has been amended to require that split duty rest only be taken between 22:00 and 05:00 local time.

Third, as the name implies, ''split duty'' rest should be provided in the middle of a flightcrew member's FDP. To ensure that split duty rest is not taken earlier, the FAA has added a condition that split duty rest cannot be provided before the completion of the first flight segment in an FDP. Finally, the FAA has moved all of the split duty conditions into subsections to improve their readability. These changes should provide additional clarity, and ensure that the split duty section is used in the intended manner.

UPS, Kalitta Air, and ATA stated that the credit given for split duty rest in ground-based suitable accommodations was less than the credit given for some

augmented flights, which provide a lower quality rest in aircraft-based rest facilities. UPS pointed out that, under the proposed rule, ''[a] 90-minute rest opportunity for a relief officer on an augmented flight in an aircraft with a Class I rest facility permits five additional hours of operation versus an un-augmented flight.'' UPS added that this disparity between augmented flights and split duty ''is even more illogical given that at a ground facility, all flightcrew members receive the same sleep opportunity, whereas while on board, only one pilot can sleep at a time.'' NACA proposed a split duty credit that is consistent with the credit given for Class 1, 2, and 3 rest facilities in augmented FDPs.

Augmented flights and split duty provide different amounts of credit because they pose different safety risks. An augmented flight contains more than the minimum number of flightcrew members, which allows the flightcrew members to work in shifts during a flight to safely fly the aircraft. If, during the flight, a flightcrew member realizes that he or she is too tired to safely perform his or her duties, the extra flightcrew member(s) can simply take over those duties and safely land the flight at its intended destination.

Split duty, on the other hand, applies only to unaugmented flights, which contain the minimum number of flightcrew members necessary to safely fly an aircraft. If, during an unaugmented flight, a flightcrew member realizes that he or she is too tired to safely perform his or her duties, there is no one there who could take over those duties. Instead, the fatigued flightcrew member must eventually land the aircraft to the best of his or her ability. Because a fatigued flightcrew member on an unaugmented flight presents a far greater safety risk than a fatigued augmented flightcrew member, the FAA used a more conservative approach in determining the split duty credit than it did in determining the limits for augmented operations. However, the FAA is open to the possibility of awarding greater credit for split duty within the scope of an FRMS if a certificate holder is able to provide data that shows that additional credit would not reduce safety.

ATA suggested that the FAA allow split duty FDPs to extend beyond the proposed limit on split duty extensions in order to consistently apply the principles that underlie augmented operations. RAA criticized the 12-hour split-duty FDP limit as arbitrary, arguing that it unnecessarily limits FDPs that contain a large amount of restful split duty sleep. RAA also pointed out that the 12-hour limit permits greater split duty extensions for less-safe overnight flights that have a shorter FDP limit. RAA proposed abolishing the limit on split duty extensions. SkyWest proposed setting the split duty FDP limit at 14 hours if the split duty rest is at least 4 hours long. CAA and FedEx stated that the split duty FDP limit should be set at 15 hours.

The SAFTE/FAST modeling that was conducted in response to comments shows that there are no safety concerns with increasing the split duty limit to 14 hours. This section has been amended accordingly. However, the FAA has reservations about a split duty limit that exceeds 14 hours. This is because section 117.25 now requires a 10-hour rest period, and if an FDP is longer than 14 hours, a flightcrew member's FDP/rest cycle will exceed 24 hours. This type of cycle, if done consecutively, will result in the beginning of a flightcrew member's FDP being pushed back each day by the number of hours that the previous day's FDP/rest cycle exceeded 24.

As an example, take an FDP that begins at 5 p.m. That FDP is normally 12 hours long, but with a 7-hour split duty break, that FDP would end at noon. The flightcrew member must then obtain 10 hours of rest, which means that he or she would start the next day's FDP at 10 p.m. The 10 p.m. FDP is normally 11 hours, but with 6 hours of split duty rest, it would end at 3 p.m. the next day. The flightcrew member would then receive 10 hours of rest, which would result in his or her next FDP starting at 1 a.m. Thus, with no limit on split duty FDPs, a flightcrew member could, in three days, go from a 5 p.m. to a 10 p.m. to a 1 a.m. FDP start time. This type of shifting of FDP start times could have serious adverse effects on cumulative fatigue, and without more data, the FAA has determined not to take the risk of allowing split duty FDPs to exceed 14 hours.

NACA, Atlas Air, and NAA stated that, because section 117.5 gives a flightcrew member the discretion to terminate an FDP, there is no need to further restate the flightcrew prerogative to accept or decline split duty accommodations or FDP extensions here.

The FAA agrees with the above commenters, and this section has been amended accordingly. The FAA once again emphasizes that, as discussed above, section 117.5(a) requires a flightcrew member to report for duty rested. By virtue of that requirement, flightcrew members must use their rest periods for the intended purpose which is to obtain sleep.

L. Consecutive Nights

As discussed above, one type of fatigue that this rule addresses is cumulative fatigue. In formulating this rule, the FAA was particularly concerned about cumulative fatigue caused by repeatedly flying at night. *See* 75 FR 55867. SAFTE/FAST modeling showed substantially deteriorating performance after the third consecutive nighttime FDP for flightcrew members who worked nightshifts during the WOCL and obtained sleep during the day. *Id.* However, the FAA noted that if a sleep opportunity is provided during each nighttime FDP, that sleep opportunity may sustain flightcrew member performance for five consecutive nights.

To account for the above factors, the FAA proposed to limit nighttime FDPs to three consecutive nights. However, the FAA proposal allowed a flightcrew member to exceed the three-night limit if that flightcrew member received at least four hours of split duty rest during each of his or her nighttime FDPs.

ATA, NACA, AAC, five individual commenters, and a number of air carriers objected to the consecutive-night limit, arguing that it was unreasonable and ignored operational experience. ATA stated that ''[t]he industry's substantial experience with nighttime operations shows that pilots who frequently perform night duty are well suited to consecutive night duties because they have training and experience specific to such operations.'' NACA, NAA, and Kalitta Air suggested completely removing the consecutive-night limit, arguing that restricted nighttime FDP limits made the consecutive-night limit redundant. AAC also suggested removing the consecutive nighttime limit, arguing that some pilots are capable of adjusting their circadian rhythm to effectively sleep during the day. AAC asserted that a three-consecutive-night limit would unfairly penalize those pilots.

Conversely, one individual commenter stated that consecutive nighttime operations lower alertness. NJASAP, IPA, and IBT Local 1224 supported the consecutive-nights limit. IPA and IBT Local 1224 indicated that, according to science and operational experience, a flight duty period encompassing the hours of 0200 and 0600 is challenging, as fatigue is more likely. These commenters stated that the additional fatigue is a result of working during the WOCL and having the rest period occur during the daytime.

Nighttime operations are particularly fatiguing because flightcrew members who work during these operations do so

during the WOCL after obtaining less-restful daytime sleep. Studies have shown that this type of work not only leads to transient fatigue, but also leads to cumulative fatigue if repeated over a series of consecutive nights.[71] SAFTE/FAST modeling also shows flightcrew member effectiveness decreasing after a flightcrew member works on consecutive nighttime FDPs. In addition, a study conducted by the Federal Motor Carrier Safety Administration (FMCSA) found in a laboratory setting that working five nights in a row while sleeping during the day leads to impaired continued performance even if a 34-hour ''restart'' rest period is provided at the conclusion of the five-night work period.[72] This study indicates that simply relying on the required 30 hour rest period in a rolling 168 hour (one week) period is insufficient to assure sustained performance for individuals working nighttime FDPs.

In order to address cumulative fatigue caused by consecutive nighttime FDPs, the FAA has decided to retain the consecutive-night limitation. This limitation is necessary because the restricted nighttime FDP limits in Table B only address the transient fatigue caused by working at night. The limits in Table B remain the same regardless of how many consecutive nighttime FDPs a flightcrew member works, and as such, they do not address the cumulative fatigue caused by repeatedly working through the nighttime hours. With regard to AAC's suggestion that some flightcrew members can effectively sleep during the day, this suggestion (which may be true for certain individuals) generally goes against scientific evidence showing that working on consecutive nighttime FDPs creates a sleep debt.[73] Since regulations are drafted to address the majority of the population, the FAA believes the approach adopted here is appropriate.

Drs. Belenky and Graeber cited the Mollicone 2007 and 2008 laboratory studies for the proposition that a sleep period that was split into two naps (one at night and one during the day) had the same effect as a single continuous block of sleep taken at night. Drs. Belenky and Graeber suggested that 2 hours of split duty rest ''should sustain performance across more than three consecutive nights'' as long as flightcrew members obtained at least 5 hours of sleep during the day. ATA, CAA, and UPS endorsed Drs. Belenky and Graeber's analysis and recommendation.

RAA, ATA, UPS, FedEx and a number of other air carriers added that requiring a 4-hour split duty break in order to exceed 3 consecutive nights would result in more first-night shifts and more day and night duty schedule switches because air carriers will schedule pilots for multiple 3-night series of FDPs rather than a single 5-night FDP series. SkyWest stated that a consecutive-night restriction may disrupt its continuous duty operations, which operate at night and provide flightcrew members with a 4–6 hour rest opportunity. UPS emphasized that the proposed consecutive-night restriction would significantly disrupt its existing business operations. Atlas Air added that cargo air carriers cannot reasonably provide a 4-hour mid-duty break under their current business models.

ATA and CAA emphasized that the consecutive-night limit would disproportionately impact the cargo industry because that industry relies heavily on night operations. UPS stated that, during a night shift, its ''flightcrew members typically enjoy, on average, at least a two hour rest in [its] state of the art sleep facilities.'' FedEx stated that its flightcrew members are typically provided mid-duty rest ranging from 2 to 4.5 hours while freight is offloaded, sorted, and reloaded. UPS asked the FAA to recognize the recuperative value of mid-duty sleep that exceeds 20 minutes.

The Mollicone studies cited by Drs. Belenky and Graeber have, at best, only a limited applicability to the consecutive-night limit because the subjects in those studies received a large block of anchor sleep at night and mid-duty rest breaks during the daytime. In contrast, flightcrew members working on night shifts receive their large block of anchor sleep during the daytime, which, as other studies have shown, provides them with sleep that is less restorative than nighttime sleep.[74]

The FAA was concerned, however, with comments indicating that the 4-hour-mid-duty rest threshold for exceeding the 3-consecutive-night limit was operationally unworkable. The FAA notes that, even though all-cargo operations are not required to abide by part 117, those all-cargo operations that opt into part 117 would be subject to the consecutive-night limit. In response to concerns raised by the commenters, the FAA conducted further SAFTE/FAST modeling to examine the safety ramifications of changing the length of the mid-duty rest break necessary to exceed the 3-consecutive-night limit. The SAFTE/FAST modeling showed that a 5-night FDP, in which a flightcrew member was provided with a 2-hour mid-duty rest break each night, was actually safer than a 3-night FDP with no rest break. The modeling also showed that breaks of less than 2 hours were insufficient to account for the cumulative fatigue of working on multiple consecutive nights.

In response to the data provided by the SAFTE/FAST modeling, the FAA has amended the consecutive-night limit to allow a flightcrew member to work for up to 5 consecutive nights if he or she receives a 2-hour mid-duty rest break each night. This amendment will greatly reduce the burden of the consecutive-night limit on cargo industry that opts into this rule because FedEx and UPS' comments indicate that these carriers already provide their crewmembers who work nightshifts with an average of 2 hours of mid-duty rest. This will allow continuous duty operations to be conducted 5 nights a week if these operations provide flightcrew members with at least 2 hours of mid-duty rest.

RAA, Kalitta Air, Kalitta Charters, Capital Cargo, and four individual commenters suggested amending the consecutive-night limit to permit four nights without any mid-duty rest breaks. ALPA, IPA, SWAPA, IBT Local 1224, and Flight Time ARC suggested allowing four consecutive nighttime FDPs if there is a 12-hour rest period after each FDP. UPS suggested that, if the FAA restricts consecutive nighttime operations, unaugmented flightcrews should be allowed to operate at Table C FDP limits so long as they have received a sleep opportunity in a rule-compliant ground-based facility.

This rule does not allow 4 consecutive nighttime FDPs without a mid-duty rest break because flightcrew member performance deteriorates after a third consecutive nighttime FDP. Increasing the length of the rest between FDP periods is not the preferred way of resolving the issue because nightshift workers get their between-FDP rest during the daytime. Because daytime sleep is less restful than nighttime sleep, the FAA has chosen to focus its regulatory efforts on nighttime mid-duty rest breaks instead of longer daytime

[71] *See* Philippa H. Gander, *et al., Flight Crew Fatigue IV: Overnight Cargo Operations,* Aviation, Space, and Environmental Medicine, Vol. 69, No. 9, Sec. II (Sep. 1998) (discussing sleep debt that builds up over successive nighttime work shifts); Philippa H. Gander, *et al., Crew Factors in Flight Operations VII: Psychophysiological Responses to Overnight Cargo Operations,* NASA Technical Memorandum 110380 (Feb. 1996) (discussing the impact of night shifts on flightcrew members).

[72] *See* Hans P.A. Van Dongen, Gregory Belenky, *Investigation Into Motor Carrier Practices to Achieve Optimal Commercial Motor Vehicle Driver Performance,* Report No: FMCSA–RRR–10–005.

[73] *Id.*

[74] *See* Wyatt, *supra* note 64; Akerstedt, *supra* note 64.

rest breaks. However, if air carriers provide the FAA with FRMS data showing that longer daytime breaks can sufficiently mitigate cumulative fatigue, the FAA may allow those air carriers to exceed the consecutive-night limit. In addition, as discussed in the preceding section, the FAA has reduced to 2 hours the mid-duty-break threshold necessary to work during 5 consecutive nights. This reduction will greatly reduce the burden of the consecutive-night limit on air carriers.

The FAA also declines UPS' proposal of allowing an unaugmented flightcrew working a nightshift to work at the FDP levels specified in Table C. As discussed above, the augmented FDP limits in Table C are higher than the unaugmented FDP limits in Table B because augmentation provides a number of fatigue-mitigation benefits. In contrast, the consecutive-night limit is simply intended to account for the cumulative fatigue caused by working at night and does not replicate the benefits provided by augmentation. Accordingly, imposition of the consecutive-night limit is not sufficient to allow unaugmented flightcrews to work on the longer FDPs that are permitted for augmented flightcrews.

A number of commenters asked the FAA to define ''nighttime FDP.'' Many of the commenters suggested that ''nighttime FDP'' be defined as an FDP that infringes on the WOCL. The consecutive-night limit is intended to apply to FDPs that infringe on the WOCL because operations conducted during the WOCL significantly increase cumulative fatigue. Consistent with the commenters' suggestion, the consecutive-nighttime-operations section has been amended to clarify that the consecutive-night limit only applies to FDPs that infringe on the WOCL. In addition, in light of the amendments that have been made to the split-duty section, the consecutive-nighttime-operations section has also been amended to clarify that an FDP whose split-duty rest infringes on the WOCL counts as a nighttime FDP for the purposes of this section.

NJASAP asked the FAA for clarification about how the rule determines whether two nighttime FDPs are ''consecutive.'' Consecutive nights are determined based on calendar nights. Thus, if a flightcrew member works on a WOCL-infringing FDP during one night, and then works during a WOCL-infringing FDP during the following night, that flightcrew member will have worked on two consecutive nights. If, however, the flightcrew member works one night, has the next night off, and then works the following night, these nighttime FDPs would not be considered ''consecutive'' for the purposes of this section.

ATA also objected to applying the consecutive-night limit to augmented operations. It stated that augmented flightcrew members receive significant inflight rest, and that the consecutive-night limit was redundant as applied to augmented FDPs.

Rest on the ground in a suitable accommodation is superior to rest onboard an aircraft while that aircraft is in flight. As such, any augmented operations that span more than three consecutive nights must mitigate the fatigue of these operations by providing flightcrew members with the two hours of mid-duty rest in a suitable accommodation required by this section.

ATA stated that, because simulator training is now considered part of an FDP, the consecutive-night limit would also limit training opportunities for flightcrew members. ATA argued that this is an unnecessary burden because flightcrew members would receive a full rest period after training.

Simulator training is only considered to be part of an FDP if it takes place before a flightcrew member flies an aircraft and there is no intervening rest period taken pursuant to section 117.25. This is because all duty after a legal rest and prior to flight is part of an FDP. If the simulator training does not take place before a flightcrew member flies an aircraft, the simulator training is not considered to be part of an FDP, and it is unaffected by the consecutive-night limit.

Two individual commenters asked the FAA to prohibit air carriers from switching pilots from night to day shifts. These commenters also asked that circadian rhythms not be shifted by more than two hours from the prior day. However, these suggestions are outside the scope of this rulemaking.

M. Reserve

As stated in the NPRM, the term ''reserve'' has not been addressed in the part 121 regulations; however this term has been the subject of several legal interpretations which include a determination of when a flightcrew member is on duty and whether the required rest associated with a duty period is impeded by a flightcrew member being in a reserve status. The FAA proposed that unless specifically designated otherwise, all reserve is considered long-call reserve. Additionally, the time that a flightcrew member spent on airport/stand-by reserve would be part of that flightcrew member's FDP. For short-call reserve, the NPRM proposed that all time spent within the reserve availability period is duty; the reserve availability period may not exceed 14 hours; no flightcrew member on short call reserve may accept and no certificate holder may schedule the flightcrew member's next reserve availability period unless that flightcrew member is given at least 14 hours rest; and the maximum reserve duty period for an unaugmented operation is the lesser of:

—16 hours, as measured from the beginning of the reserve availability period;
—The assigned FDP, as measured from the start of the FDP;
—The FDP in Table B of this part plus 4 hours, as measured from the beginning of the reserve availability period; or
—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 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.

For an augmented operation, the NPRM proposed that the maximum FDP is the lesser of the assigned FDP, as measured from the start of the FDP; the FDP in Table C plus 4 hours, as measured from the beginning of the reserve availability period; or if the reserve availability period falls between a portion of 0000–0600, the maximum reserve availability period may be increased by one-half the length of the time during which the certificate holder did not contact the flightcrew member but capped at 3 hours.

The FAA proposed that long-call reserve does not count as duty and that a flightcrew member would need to receive a 12-hour notice of report time from the certificate holder if the flightcrew member is being assigned an FDP that would begin before and operate into his or her WOCL.

Lastly, the NPRM proposed provisions that would permit a certificate holder to shift a flightcrew member's reserve availability period subject to meeting certain conditions.

Commenters stated overall that the entire section was overly complicated and complex, with some commenters stating that it also was confusing and illogical. Industry largely objected to the classification of short-call reserve as duty. ALPA, COPA, FedEx ALPA, SWAPA and APA all commented favorably on short-call reserve as part of duty. These comments were addressed

in the Definitions section, which removed short-call reserve from the definition of the term ''duty.''

NACA, Atlas, NAA, and Kalitta argue that limiting short call reserve to 14 hours is unwarranted for their operations. Kalitta separately recommended that the reserve availability period should be 16 hours followed by 8 hours off. Under Kalitta's recommendation, if a flightcrew member on short-call reserve is called out within the first six hours of that reserve availability period, he or she can utilize the entire maximum FDP, as described in Table B or C. If the flightcrew member is called out after the first six hours of the reserve availability period, then all the time in short-call reserve should be subtracted from the maximum FDP, unless the un-interrupted short-call reserve included the flightcrew member's WOCL. Then the full period of the WOCL should be considered rest. Kalitta argues that this will permit long-haul, non-scheduled operators the ability to continue current operations.

NACA, Atlas, and NAA also argue the proposal is too restrictive because the controlling limitation will always be the assigned FDP, which is a maximum of 13 hours. UPS and ATA state that there is no justification for limiting unaugmented short call reserve to assigned FDP. They contend that this restriction materially deviates from the ARC recommendation concerning this element of reserve.

ATA further comments that using the FDP to set the maximum reserve duty period directly contradicts the NPRM's definition of ''reserve duty period'' as the reserve availability period plus the flight duty period.

RAA proposed instead that for unaugmented operations, if a flightcrew member is given an FDP while on short-call reserve, the FDP, measured from the time for reporting for assignment, is limited to the Table B maximum FDP minus the full time spent on reserve during the Reserve Availability Period (RAP) up to the report time. Northern Air Cargo (NAC) contends that there is no logic in not allowing for the full FDP after callout. Delta argued that while on reserve, limiting reserve duty periods to scheduled FDP rather than maximum is overly restrictive.

ALPA, COPA, FedEx ALPA, SWAPA and APA submitted the chart below depicting the maximum FDP permissible based on the start of time of the reserve availability period:

Table E—Short Call Reserve Duty Period

Time of Start of RAP (Home Base or Acclimated Local Time)	Maximum Flight Reserve Duty Period (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

They argue that the maximum reserve duty period, which would include phone availability and/or FDP assignments, is measured from the start of the RAP and ends at the earlier of the start of the RAP time plus the value in Table E or the FDP in Table B. The purpose of this process is to ensure that the reserve pilot does not have an allowable FDP limit that is greater than the FDP of the line holder whom that reserve flightcrew member is paired with and does not impact the certificate holder because the line holder and reserve flightcrew member end point will be the same.

Peninsula Airways questions whether under this section, a flightcrew member on short-call reserve must have had 14 hours of rest period at the beginning of the current reserve availability period.

The FAA agrees that the proposed reserve provisions were overly complicated and has made numerous changes to reduce the complexity. The ARC came to a number of conclusions during its discussion of reserve. The FAA has decided to rely on the expertise represented in the ARC to address the issue of reserve duty. The FAA does not support Kalitta's proposal described above, which would increase the permissible reserve availability period to 16 hours. Kalitta has not provided supporting rationale that warrants modifying the collective opinion of the ARC. Therefore, this rule adopts the proposal that limits the short-call reserve availability period, in which the flightcrew member is not called to report to work, to 14 hours.

The FAA has modified the regulatory provisions addressing the reserve duty period and unaugmented FDPs. Under the NPRM, the maximum reserve duty period would be the lesser of 16 hours, the assigned FDP, or the FDP under Table B plus four hours. The FAA agrees with the commenters that limiting the reserve duty period to the assigned FDP was overly restrictive and could result in situations where the reserve duty period was unnecessarily short, and would be unworkable for the certificate holders. The FAA has deleted that provision but retains the other two proposed limitations for unaugmented operations. Therefore, the adopted regulatory provisions addressing reserve and unaugmented operations provide that the total number of hours a flightcrew member may spend in a flight

duty period and reserve availability period may not exceed 16 hours or the maximum applicable flight duty period in Table B plus four hours, whichever is less. This will allow most FDPs to be accommodated by a flightcrew member on short-call reserve. Additionally, the proposed provisions for giving credit for not calling during the window of circadian low are complicated and unnecessary given the above adopted modifications. Therefore, the credit provisions have been dropped from this rule.

In response to the question posed by Peninsula Airways regarding whether the flightcrew member, who has concluded a reserve availability period, must have a 14 hour rest period before beginning the next reserve availability period, the FAA modified this provision in accordance with the amendments in § 117.25 Rest period. A flightcrew member must be given a 10 consecutive hour rest period immediately before beginning the reserve or flight duty period. The regulation governing reserve has been adjusted for consistency with the rest provisions. Therefore, if a flightcrew member completes a reserve availability period, he or she must receive a rest period, as required in § 117.25(e), prior to accepting a subsequent reserve availability period.

The FAA also does not agree with the comments from the labor organizations that another Table is necessary for the short-call reserve duty period. Those organizations argue that incorporating the above chart would ensure that the reserve flightcrew member would not have an allowable FDP that is greater than the line holder with whom he or she is paired. This argument is not persuasive. Each flightcrew member is subject to the maximum permissible FDP given that flightcrew member's recent assignments and rest requirements. Consequently, it isn't reasonable to artificially limit a reserve pilot to the FDP limit of the line holding pilot when no such limit applies to the line holding flightcrew members.

Kalitta and UPS questioned why a flightcrew member on long-call reserve and assigned an FDP that begins before and operates in the WOCL, would require a 12-hour rest. These commenters argue that a line holder may be scheduled for duty during the WOCL with 9 hours rest and that the long-call reserve flightcrew member should have similar treatment as the line holder.

This provision simply requires that the affected flightcrew member must receive 12 hours notice that he or she will be on duty during the WOCL and will need to plan his or her rest during the day. This way, the flightcrew member can structure the rest period in order to provide the best sleep opportunity. As daytime rest is not as restorative as nighttime rest, the flightcrew member may choose to take multiple naps rather than attempting to get a full consecutive 8 hours of sleep during the day. This is comparable to a lineholder who knows in advance that he or she is scheduled for duty during the WOCL, and adjusts his or her sleep opportunity accordingly.

NJASAP questions why the rule does not limit long-call reserve. APA also added that flightcrew members on long call reserve should receive a rest period that includes a physiological night prior to assignment. There is no reason to limit long-call reserve because, by definition, the certificate holder must notify the flightcrew member prior to receiving rest under 117.25(e). Similarly, as the flightcrew member is receiving a 10 hour rest period prior to the flight, it is not reasonable to limit that rest to only the hours between 0100 and 0700. This would unnecessarily restrict the certificate holder's ability to use long-call reserve.

Kalitta and UPS oppose the provisions limiting the shifting of reserve availability periods. RAA also opposes these provisions and argues that they actually hinder fatigue reduction by forcing more flightcrew schedule disruptions through delay or cancellations than would otherwise be necessary. NACA, Atlas, and NAA contend that the provisions addressing the shift of reserve availability periods are unworkable because it restricts forward shifts to a maximum of 12 hours, which can ultimately result in stranded flights. These commenters illustrate, as an example, if a flight is delayed for 13 hours, this rule would require the aircraft to sit on the ground for hours because the reserve flightcrew would be unable to operate the next flight until they have completed the required rest.

The organizations representing labor also seek to limit, to once in a rolling 168 hour period, the provision that would require a short call reserve flightcrew member coming off of a 14 hour reserve availability period to have a 14 hour rest before accepting an FDP that begins before the flightcrew member's next reserve availability period. The commenters contend that without this once per 168 hour limitation, a flightcrew member could be in a cycle of continuous reserve availability periods.

Since the rest requirements mandate a rest period prior to accepting any short-call reserve period and given the above modifications to the rule, the FAA concludes that the limits on shifting reserve availability periods are unnecessary and would have added a level of complication that is not warranted. This provision is not adopted.

N. Cumulative Limits

In formulating this rule, the FAA found that ''[s]cientific 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.'' [75] To limit the accumulation of cumulative fatigue by flightcrew members, the FAA proposed a cumulative duty-period limit of 65 hours in a 168-hour period (7 days) and a limit of 200 hours in a 672-hour period (28 days). These cumulative duty-period limits were slightly increased for short-call reserve and for deadhead transportation in a seat that allows for a flat or near flat sleeping position.

The FAA also proposed cumulative FDP limits based on the standards of other aviation authorities. The proposed cumulative FDP limits restricted FDP to 60 hours in a 168-hour period and 190 hours in a 672-hour period. In addition, the FAA proposed retaining the existing cumulative flight-time limits, which are 100 hours in a 28-day period and 1,000 hours in a 365-day period.

Alaska Airlines stated that the proposed subsection 117.23(a) concerning cumulative FDP limits was ambiguous and arguably made this section apply to flights that a flightcrew member conducted on his or her days off. Alaska Airlines and Delta argued that an air carrier should not be held responsible for flights that a flightcrew member performs on his or her days off that are not assigned by the air carrier. Conversely, SWAPA stated that, due to the complexity of the cumulative limits, the certificate holder should have the sole responsibility of determining whether flightcrew members are in compliance with the applicable cumulative limits.

The cumulative limits in section 117.23 include any flying performed by the flightcrew member on behalf of any certificate holder, or 91K Program Manager during the applicable periods. It does not include personal flying. Subsection 117.23(a) has been amended to clarify this point. The reason that this section includes all flights conducted for a certificate holder or program manager is because a flightcrew member accumulates fatigue on those flights. A

[75] 75 FR 55871 and n.42 (citing scientific studies).

flightcrew member accumulates fatigue whenever he or she flies an aircraft. The flightcrew member does not accumulate less cumulative fatigue simply because the flying is conducted for another operator.

The FAA has considered the air carriers' argument that the proposed subsection 117.23(a) may affect their scheduled flights as a result of flights that they do not assign to their flightcrew members. However, the FAA believes that its cumulative-limit approach is justified in light of the fact that compliance with this rule is a joint obligation that applies to flightcrew members as well as air carriers. Thus, the FAA expects flightcrew members to inform their employing air carriers of flying that they conduct on days off that would impact the cumulative limits set out in this rule, thus allowing all parties to abide by the applicable cumulative limits.

The FAA also declines SWAPA's suggestion that air carriers bear sole responsibility for determining compliance with the cumulative limits. As discussed in the preceding paragraph, without flightcrew member assistance, air carriers may not even know about some of the flying performed by flightcrew members. While the rolling time periods used in this section may not be as easy to keep track of as calendar periods, the FAA expects both flightcrew members and air carriers to be aware of how many hours the flightcrew members have worked and to abide by the cumulative limits of this section.

RAA opposed the cumulative duty-period limits, arguing that duty was a nebulous concept that was hard to define, and that cumulative duty-period limits are unnecessary in light of the cumulative FDP limits. NACA and NAA stated that an air carrier should be able to assign additional duty time if no further FDPs are contemplated because ''[t]here is no further risk of an aviation accident unless flight is involved.'' NACA, UPS, and a number of other air carriers added that the inclusion, in duty limitations, of administrative duties adversely affected flight-qualified management personnel and addressed work-life issues that had nothing to do with aviation safety. IPA disagreed, arguing that ''[j]ust as the certificate holder tracks flight time and flight duty periods, administrative duties should also be tracked.'' IPA stated that subordinate officials who work in an office all day and fly at night are more likely to be fatigued.

ATA and UPS stated that the proposed rule unfairly expands the concept of duty to ''circumstances beyond the carriers' control such as, random drug tests.'' RAA stated that the duty-period limits essentially limited the time that flightcrew members spend on non-flying tasks, but that this was not a significant factor in flightcrew scheduling. These commenters added that air carriers could not always control the types of seats available to deadheading flightcrew members, and that they should not be penalized for being unable to provide deadheading flightcrew members with flat or near flat seats.

The FAA agrees with industry comments that cumulative duty-period limits are unnecessary in this rule. Cumulative duty-period limits were intended to address the following: (1) Deadheading, (2) short-call reserve, and (3) air carrier directed non-flight activities that lead to fatigue during flight. As discussed in other portions of this preamble, the FAA has amended other parts of this rule to address fatigue-related concerns raised by deadheading and short-call reserve.

Turning to the fatigue-related issues of non-flight activities, on reevaluation, the FAA has determined that the FDP limits in this rule fully address the non-flight activities that could contribute to flightcrew member fatigue. This is because the only non-flight activities that have a significant impact on fatigue during flight are activities that occur immediately before the flight without an intervening rest period. Since there is no intervening rest between the non-flight activities and piloting an aircraft, the fatigue accumulated while performing these non-flight activities remains with the flightcrew member when that flightcrew member pilots an aircraft. Therefore, all non-flight activities that occur immediately before a flight without an intervening rest period are part of an FDP and are appropriately restricted by the FDP limits.

The other non-flight (non-FDP) activities do not significantly affect the fatigue experienced during flight because there is an intervening rest period between these activities and the beginning of an FDP. Consequently, the FAA has eliminated the cumulative duty period limits from this rule.

RAA, NACA, and a number of air carriers opposed the cumulative flight-time limits, arguing that FDPs were the actual source of flightcrew member fatigue. Because FDPs are limited by the proposed cumulative FDP limits, these commenters argued that the cumulative flight-time limits are unnecessary.

Existing regulations impose 30-day flight-time limits of 100 hours and calendar-year flight-time limits of 1,000 hours. The FAA has administered these cumulative flight-time limits for over four decades, and based on its operational experience, the FAA has found that cumulative flight-time that falls within these limits is safe. Because the FAA is unaware of any data showing that flight times exceeding these limits are safe, the FAA has decided to retain cumulative flightcrew member flight-time limitations within the existing limits.

As the commenters correctly point out, because FDPs include flight time, the FAA could have addressed the concern discussed in the preceding paragraph by calibrating the cumulative FDP limits. However, as discussed in the Flight Time Limits section of this preamble, the FAA chose to retain the concept of flight-time limits in order to set higher FDP limits and provide air carriers with more flexibility. If the FAA eliminated the cumulative flight-time limits from this rule, it would need to drastically reduce the cumulative FDP limits from the limits that were proposed. This is because without cumulative flight-time limits, the proposed cumulative FDP limits would allow flightcrew members to accumulate flight time that significantly exceeds the cumulative flight time permitted by existing regulations. To keep that from happening and provide air carriers with more scheduling flexibility, this rule largely retains the existing flight-time cumulative limits and sets higher cumulative FDP limits than would otherwise have been permissible.

ATA, RAA, and a number of air carriers stated that imposing cumulative limits for three different regulatory concepts (FDP, duty, and flight time) was unjustified and overly burdensome. ATA stated that cumulative limits would result in additional flight cancellations that inconvenience the general public. RAA stated that the multiple limits overlapped to a significant degree, and the numerous cumulative regulatory restrictions would be very difficult to keep track of in practice.

RAA stated that the standards of other authorities were not applicable to this rulemaking because, instead of simply being concerned with safety, ''CAP–371 and the EASA regulations envision a system of 'fair and equitable' crew scheduling that is justified in a European context by its intent of spreading more fatiguing assignments among the entire flightcrew member community.'' While RAA accepted the proposition that some cumulative restrictions were necessary, it believed that this proposal included too many cumulative restrictions.

As discussed above, the FAA has decided to eliminate the cumulative duty-period limits, which should greatly simplify compliance with this section. Thus, the only remaining cumulative limits are FDP and flight-time limits. The FAA has decided to retain both of these cumulative limits because (1) the FDP limits restrict the amount of cumulative fatigue that a flightcrew member accumulates before and during flights, and (2) the flight-time limits allow the FAA to provide air carriers with more scheduling flexibility by setting higher cumulative FDP limits in this rule. This additional scheduling flexibility justifies the added complexity of the cumulative flight-time limits, which can easily be tracked by scheduling programs currently in use throughout the industry. The FAA also notes that complying with the cumulative flight-time limits in addition to the FDP limits should not present a significant burden to many air carriers because they are already required to keep track of pilot flight time in order to comply with a statutory provision that limits flight time on interstate domestic flights to 85 hours per month.[76]

The FAA understands that standards such as CAP–371 and EASA were drafted to achieve goals that may be somewhat different from the safety goals of this rule. In light of this fact and the requirements of the Administrative Procedure Act, while the FAA has examined the provisions of the various standards of other authorities, the FAA ultimately made its own independent decisions based on the needs and concerns of the stakeholders and the FAA about how to structure this rule. That is why some of this rule's provisions are similar to other standards and other provisions are very different from the standards adopted by other aviation authorities.

RAA, NACA, AMA, Boeing, and a number of air carriers opposed the 365-day cumulative flight-time limit, arguing that there was no safety-based justification for this limit. These commenters stated that the 28-day flight-time limits, as well as the other proposed cumulative limits, restricted cumulative fatigue to acceptable levels on a continuing basis without the need for an annual flight-time limit. Four individual commenters and SWAPA suggested that the 365-day flight-time limit be increased to 1,200 hours. SWAPA noted that the proposed regulations allow a flightcrew member to have 100 flight-time hours in a month, and ''[i]f flying 100 hours per month for ten months in a row does not create a cumulative fatigue problem, we find it hard to imagine that there would be a cumulative fatigue issue in month 11 or 12.'' One individual commenter asserted that the individual monthly flight-time limits should add up to the annual limit.

The 1,000-hour 365-day flight-time limit comes from existing regulations, which limit yearly flight-time to 1,000 hours and monthly flight time to 100 hours. To meet the 1,000-hour limit, air carriers must restrict the average monthly flight times of flightcrew members to approximately 83 hours. However, because the 1,000-hour limit is a yearly limit, air carriers have the flexibility to exceed the 83-hour monthly average and fly up to 100 hours during peak months so long as they fly a reduced number of hours during off-peak months.

The FAA has significant operational experience with the 1,000-hour annual limit, and based on this experience, the FAA has determined that a flight-time average of approximately 83 hours per month is safe. For the sake of regulatory simplicity, the FAA has also considered eliminating the 1,000-hour annual flight-time limit and reducing the monthly flight-time limit to 83 hours. However, the FAA ultimately determined that such a reduction would unnecessarily limit air carriers by prohibiting them from scheduling extra flight-time hours during peak months. Thus, in order to preserve existing air carrier scheduling flexibility, this rule retains the 1,000-hour flight-time limit imposed by the existing regulations.

A number of commenters suggested using calendar periods for cumulative limits instead of rolling periods of hours and calendar days. Boeing, Allegiant, and a number of individual commenters suggested that the annual flight-time limit be based on calendar months instead of 365 days. Boeing and Allegiant stated that the existing regulations have a 12-calendar-month limit, and switching to a 365-day limit would: (1) Increase costs because air carriers would have to change their existing scheduling systems; and (2) make it more difficult for individual flightcrew members to keep track of the annual limit.

Boeing also argued that the cumulative FDP limits should, for the sake of regulatory simplicity, use 28 calendar days as a time-period measurement instead of 672 hours. SkyWest also suggested using calendar periods instead of hourly limits for the sake of simplicity. Conversely, NJASAP supported the use of hourly time periods instead of calendar days or months as a cumulative-limit measurement. IPA supported the use of hourly time periods for daily and weekly limits, but stated that the monthly and annual limits should be based on calendar days. AMA also supported the proposal's use of rolling calendar day and hourly cumulative time periods, asserting that the use of calendar periods would be subject to abuse.

The FAA has largely used consecutive hours to express time periods in this section in order to create a consistent and uniform enforcement standard. One problem with calendar periods is that different air carriers use calendar periods in different ways. Thus, for example, one air carrier's calendar day may start at midnight, while another air carrier's calendar day may start at 9am.

Another problem with calendar periods is that a single calendar period can cover different lengths of time. Thus, a calendar month could cover a time period ranging from 28 to 31 days. A calendar year would also present problems if it is measured in months instead of days because a 28–31-day monthly period would create lookback problems. To avoid these types of issues with calendar periods, this section expresses the cumulative time periods largely as a function of consecutive hours, which are an unchanging uniform standard that applies the same way to all air carriers. The FAA does not believe that this will create an undue burden for air carriers and flightcrew members because modern scheduling programs and spreadsheets can easily keep track of time periods consisting of consecutive hours.

In light of its preference for consecutive hours, the FAA has amended subsection 117.23(b)(1) so that it expresses the corresponding cumulative limit as a function of consecutive hours instead of calendar days. However, the FAA has decided to retain the flight-time limit in subsection 117.23(b)(2) as an expression of calendar days because expressing 365 days as a function of hours would result in a very high number of hours that would be difficult to apply in practice.

Boeing, Kalitta Air, and Omni Air objected to the FDP limits for the 672-hour (28-day) time period, arguing that cumulative fatigue is already taken into account by the 168-hour cumulative limits. Boeing stated that there is no scientific evidence ''proving that an event 672 hours ago has a predictable effect on alertness now.'' Conversely, NACA and a number of labor groups

[76] 49 U.S.C. 42112(b)(1). This statutory provision incorporates National Labor Board Decision number 83, which, among other things, limits monthly flight time to 85 hours.

supported the concept of cumulative limits for 28-day periods.

The different cumulative FDP limits work on the same flexibility principle as the 672-hour and 365-day cumulative flight-time limits. The cumulative FDP limit for the 672-hour period is 190 hours. To comply with this 190-hour limit, an air carrier has to average approximately 47.5 cumulative hours of FDP in each 168-hour period. However, the 60-hour cumulative FDP limit for each 168-hour period allows air carriers to exceed the 47.5-hour FDP average during peak weeks as long as they go below this average during off-peak weeks. Just like the different flight-time limits, this system provides air carriers with scheduling flexibility while keeping the average weekly cumulative FDP times within acceptable bounds.

APA asked that the FAA add in a cumulative flight-time limit for the 168-hour period, arguing that, without this limitation, air carriers could schedule a significant amount of flight time in this period of time.

The existing regulations for domestic and flag operations impose 30–32 hour cumulative flight-time limits for 7-day periods. However, the existing regulations for supplemental operations do not impose cumulative flight-time limits for 7-day periods. Based on its operational experience administering supplemental operations without a 7-day cumulative flight-time limit, the FAA has determined that there is no need to impose a 168-hour flight-time limit in addition to the other cumulative limits in this rule.

NACA, NAA, and Northern Air Cargo asked the FAA to increase the cumulative FDP limits to match the limits suggested for cumulative duty periods, arguing that the proposed limits did not take into account the needs of supplemental operations. Conversely, AAC, AFA–CWA, ALPA, and a number of other union groups asserted that the proposed cumulative limits were appropriate. ALPA stated that the proposed limits should neither be expanded nor reduced and AAC stated that the FAA should not impose additional cumulative limits.

The proposed cumulative-duty-period limits in this rule were higher than the proposed cumulative FDP limits because duty encompassed more non-flight activities than FDP. Since most of the additional non-flight activities covered by duty did not raise significant fatigue-related concerns, the FAA set the cumulative-duty-period limits at a higher level. As discussed above, because duty periods did not have a significant effect on aviation safety independent of FDPs, cumulative-duty-period limits have been eliminated from this rule.

The FAA has also decided against increasing the proposed cumulative FDP limits. Because this rule retains cumulative flight-time limits, the cumulative FDP limits in this section are set at sufficiently high levels that should allow air carriers full utilization of the cumulative flight-time limits in this section. Thus, for example, the cumulative FDP limit for the 672-hour period is 190 hours, which is almost double the cumulative flight-time limit of 100 hours for this time period. Because the proposed cumulative FDP limits were already set at relatively high levels, the FAA has decided against increasing these limits further without additional FRMS-provided data.

NJASAP asked whether the time spent on reserve will count towards the cumulative FDP limits of this section. Only the time that is spent on airport/standby reserve is considered to be FDP. As such, only the time that is spent on this type of reserve counts toward the cumulative FDP limits of this section.

O. Rest

Rest is a significant element of this rule because it is the most critical component of fatigue mitigation. In this rulemaking, the FAA has addressed the following concerns with the present regulatory scheme governing rest: (1) Part 121, subparts Q, R, and S provide rest limits within a 24-hour period, however certificate holders conducting operations with airplanes having a passenger seating 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 135.261 and 135.273; (2) the lack of any mechanism to assure that rest is provided prior to flight; and (3) no clear requirement that the 9 hour rest period must provide for an 8 hour sleep opportunity. The FAA also sought to specifically articulate what it means for a flightcrew member to be free from duty, as this and other related issues under the current scheme have resulted in more than 55 legal interpretations issued by the FAA regarding rest.

Sleep science has 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.[77] For most people, 8 hours of sleep in each 24 hours sustains performance indefinitely.[78] 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.[79]

In the Flight Time ARC meetings, 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 find an adequate sleep opportunity, and sufficient time free from duty.[80] A minimum of two nights of sleep might be necessary to acclimate to a different time zone.[81]

The scientific presenters also 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.[82] 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,

[77] 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.

[78] 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.

[79] 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), 29–9.

[80] 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.

[81] 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.

[82] 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.

may be more restorative because of circadian issues.

In the NPRM, the FAA proposed requirements for FDP/reserve period rest, acclimation rest upon returning to home base, and reduced rest under limited conditions. For pre-FDP/reserve assignments, the FAA proposed that prior to accepting a reserve duty period or FDP, the flightcrew member must be given a rest period of at least 9 consecutive hours measured from the time the flightcrew member reaches the hotel or other suitable accommodation.

In addition, the FAA proposed that a flightcrew member must be given at least 30 consecutive hours free from all duty in any 168 consecutive hour period prior to beginning a reserve period or FDP. This provision included two exceptions. The first is that during an FDP or series of FDPs, if a flightcrew member crosses more than 4 time zones on FDPs that exceed 168 consecutive hours, that flightcrew member must be given a minimum of three physiological nights' rest upon return to home base. The second is if a flightcrew member is operating in a new theater, he or she must receive 36 consecutive hours of rest in any 168 consecutive hour period.

The proposal also would have permitted a one-time reduction in the pre-FDP/reserve rest period from 9 to 8 consecutive hours in any 168 consecutive hour period. Additionally and in the event of unforeseen circumstances, the pilot in command and the certificate holder could reduce the 9 hour rest period to 8 consecutive hours. Lastly, the FAA proposed that during a rest period, the certificate holder could not assign and no flightcrew member could accept any assignment for reserve or duty.

Commenters raised two issues concerning the proposed pre-FDP/reserve rest requirement. The first issue was the FAA's selection of the 9 hour rest period. The second issue was the beginning measurement of the rest period. As these two issues interrelate, the comments for both are summarized below.

In the NPRM, the FAA noted that the ARC members supported a domestic rest requirement of 10 hours that was comprised of an 8 hour sleep opportunity, with 30 minutes on each end for transportation and 30 minutes on each end for physiological needs such as eating, exercising and showering. The ARC members also discussed whether the rest requirement should be increased to 12 hours for international operations. The ARC members cited the following reasons for the two added hours for international operations: To provide a longer layover rest period for non-acclimated flightcrews; potential to address increased stress associated with communicating with air traffic control in countries where English is not the native language; and time to transit customs/immigration or travel a long distance to hotel accommodations in foreign destinations.

The FAA decided not to propose two different rest periods and instead put forth one standard rest period for all operations. The FAA was not persuaded that added rest was necessary to deal with air traffic control communications in a foreign airspace. Furthermore, acclimation for determining the length of an FDP was addressed by other provisions in the proposal. Lastly, the time to clear customs/immigration was addressed by refining the point where rest begins.

The FAA received over 2,500 comments from individuals who contend that the proposed 9 hour rest period was inadequate and did not allow sufficient time to eat, bathe, exercise or unwind, and still have an opportunity for 8 hours rest. The NTSB strongly encouraged the FAA to increase the duration of the required rest period to accommodate an opportunity for 8 hours of sleep. CAPA, APA, and SWAPA pointed to FAA Advisory Circular No. 120–FIT, which recognizes that 9 hours of rest typically does not yield 9 or 8 hours of sleep. Peninsula Airways, the Families of Continental Connection Flight 3407, APA, IPA, Southwest Airlines, SWAPA, AE and Delta Air Lines supported a 10 hour rest period for domestic operations.

Approximately 150 individual commenters believe that the rest period for international operations should be 12 hours. Other commenters suggested varying times of 13, 14, and 20 hours respectively for operations that travel across multiple time zones. Pinnacle Airlines suggested a rest period of 48 hours. ALPA advocated a minimum of 13 hours rest period for flightcrew members that fly to a new theater—once they become acclimated, they go back to 10 hours rest. ATA commented that the terminology should be changed from ''domestic'' and ''international'' to ''in theater'' and ''in new theater'' (and use the term ''theater'' as defined in the NPRM). ATA argues that the distinction of domestic/international in this context is not relevant and provides the following example. A pilot completing a north-south flight between the U.S. mainland and Canada or the Caribbean that crosses no time zones should not be treated differently than one that makes the same north-south trip within the continental U.S. APA, CAPA, SWAPA and Kalitta Air endorsed a 12 hour rest period for non-acclimated flights.

Conversely, Hawaiian Airlines supported the single hour rest requirement of 9 hours, and commented that this provision is not competitively disadvantageous for its operations. CCIA supported a longer rest period than that provided under the present regulations. American Airlines supported the proposed 9 hours and Alaska Airlines simply argued that the proposed rest provisions should be withdrawn, reevaluated, and republished for comment.

For the NPRM, the FAA chose to begin the rest period at the time that the flightcrew member reached the hotel or suitable accommodation. The basis for this tentative decision largely rested on the premise that transportation is not rest and therefore, cannot be factored into the rest period. In addition, the time spent in transportation may vary widely.

Commenters were divided with respect to the proposal's measurement of when the rest period begins. Most commenters representing industry did not support measuring the rest period from the time the flightcrew member reached the hotel or suitable accommodation. These commenters described this aspect as wholly unworkable, and open to too many variables that would be beyond the certificate holder's control, *e.g.* vehicular breakdowns, accidents, unexpectedly heavy traffic and lost or overbooked facility reservations. In addition, they state that the certificate holder would be responsible to account for the flightcrew member's whereabouts throughout the rest period. They argue that the certificate holder's responsibility is to control the scheduling of compliant rest periods, not to control an individual's private life and activities when off duty.

The labor organizations and the Families of Continental Connection Flight 3407 supported the proposed beginning measurement of the rest period. These entities were concerned with being able to ''get 9 hours behind the door,'' which would provide a better opportunity for a meaningful 8 hour sleep opportunity. APA also recommended, in addition to the proposal, that the FAA add language that to be compliant with this rest requirement, the hotel room must be available for immediate occupancy upon arrival. A number of pilot groups commented that rest time can be spent waiting for check-in or delay in getting room keys. Conversely, a number of certificate holders stated that check-in sometimes occurs in the vehicle on the

way to the hotel, or that hotels offer separate check-in counters for flightcrew members.

As discussed above, the FAA was not persuaded at the NPRM stage to pursue a separate rest period for international operations. The agency concluded that an additional two hours of rest was not warranted to address potential fatigue from communicating with air traffic controllers in foreign airspace, nor did it support added rest due to time to clear customs and immigration. A number of airports have custom and immigration queues devoted to processing flightcrew members quickly.

The adopted regulations providing FDP limits for augmented and unaugmented operations address acclimation. For an unacclimated flightcrew member, the maximum flight duty period in Table B is reduced by 30 minutes and the flightcrew member enters the applicable FDP table based on the local time at the theater in which the flightcrew member was last acclimated. Under these provisions, the determined FDP limits take into account the flightcrew member's WOCL and general circadian rhythm. As long as the flightcrew member is receiving an 8 hour sleep opportunity, the nature of whether the FDP was international is not relevant. The FAA has decided to retain a single standard rest period provision that applies to all FDPs and reserve periods.

Based on the comments received from the certificate holders, the FAA agrees that using the time when a flightcrew member reaches the hotel or other suitable accommodation would present more issues for implementation than it actually solved. The FAA's main objective with this provision was to ensure that flightcrew members have an 8 hour sleep opportunity. Building from that and mindful of the comments received, the FAA has decided to adopt a 10 consecutive hour rest requirement that immediately precedes the beginning of a reserve or FDP measured from the time the flightcrew member is released from duty. At this point, if the flightcrew member cannot have 8 uninterrupted hours of rest opportunity, the flightcrew member cannot report for the assigned FDP until he/she receives that rest. If the reason for the shortened rest opportunity is travel delays, reservation confusion, or the flightcrew member's actions, the certificate holder is free to address the root cause. However, it must provide the required 8-hour rest opportunity.

The FAA finds that the modifications adopted in this rule address concerns raised by the labor organizations, the NTSB and the Families of Continental Connection Flight 3407 concerning an actual 8 hour opportunity devoted to sleep. Furthermore, it provides reasonable time for travel to the hotel, check-in, and meals. The FAA acknowledges there will be unforeseen circumstances that are beyond the control of either the certificate holder or the flightcrew member and these situations are difficult to capture in a regulatory standard. In situations such as this, where the flightcrew member ultimately is not provided with the necessary rest period and/or sleep opportunity, the flightcrew member must notify the certificate holder that he/she will be unable to obtain the required rest. It is advisable that the flightcrew member alert the certificate holder as soon as possible in order for the certificate holder to make alternative arrangements that may include adjusting the next FDP or flight departure time, or calling in a reserve crew.

NACA, Kalitta Air, NAA and Atlas disagree with the proposed rest requirement for a flightcrew member that crosses more than four different time zones and is away from home base for more than 168 consecutive hours. These commenters specifically state that three physiological nights' rest is excessive, not based on science, and that only a 30 hour rest period is necessary because fatigue has been mitigated throughout the flightcrew member's trip. They also commented that there is no justification for a different standard for rest at home and that rest at home generally is more fatigue mitigating than rest at operating locations. UPS also objected to the use of three physiological nights' rest upon return to home base. UPS contends that rest at home should be treated the same as rest in layover cities and that off-duty time between pairings ''is traditionally, and correctly, addressed via the collective bargaining process.'' [83]

NACA and Kalitta Air also recommended a reduced rest period of 30 hours, instead of the proposed 36 consecutive hours of rest, in any 168 consecutive hours for flightcrew members operating in a new theater.

The FAA adopts as proposed the requirement that a flightcrew member must be given at least 30 consecutive hours free from duty in any 168 consecutive hour period. The NPRM included two exceptions to this requirement. The first exception was a longer rest period upon return to home base after a flightcrew member has been away for more than 168 consecutive hours and has crossed at least four time zones. The second exception was for flightcrew members operating in a new theater to receive 36 hours of rest.

In the NPRM, the FAA stated that it was ''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.'' 75 Fed. Reg. 55862. The corresponding regulatory text proposed three physiological nights' rest. By using three physiological nights' rest, the FAA intended this provision to provide for a minimum 56-hour rest period, as indicated in the NPRM preamble discussion. As proposed, the regulatory text would permit a flightcrew member, upon return to home base after 168 hours away from home and crossing numerous time zones, to be assigned to FDPs that would occur during the day only, but require the flightcrew member to sleep at home for three nights. The intention was for that flightcrew member to receive a minimum of 56 consecutive hours of rest.[84]

The FAA does not agree with the commenters that a 30 consecutive hour rest period is adequate for flightcrew members that have flown a schedule that has the flightcrew member crossing several time zones and is away from home for more than 168 hours. This longer rest period serves an important purpose. The longer rest period provides a recovery period that facilitates the restoration of the flightcrew member's circadian rhythms. Sleep loss or sleep disturbance can significantly deteriorate performance. Moreover, performance impairment can occur when the sleep-wake cycle has only been phase-advanced by 2–4 hours and maintaining a normal sleep period. These results suggest that performance deterioration can directly result from circadian rhythm disturbance and not only solely from sleep loss that would occur with time zone changes. The onset of sleep and the duration of that sleep can ''* * * depend upon the circadian body temperature phase and provides a physiological basis for the performance deterioration or circadian desynchronization.'' [85] Typically, flights

[83] The FAA notes that not all pilot groups are organized and therefore, do not have a collective bargaining process.

[84] If a flightcrew member begins this rest at 1 a.m. on day 1 and concludes this rest at 7 a.m. on day 3, this provides a minimum of 56 hours of rest.

[85] Winget CM, Deroshia CW, Markley CL, Holley DC. (1984). A review of human physiological and

Continued

across multiple time zones involve a differential restructuring in an internal circadian desynchronization and associated symptoms.[86]

Flightcrews routinely deal with multiple time zone adjustments and work schedule changes. Flight operations involve night and ''shift work'' in general and exposures to different social and environmental cues can vary after both the outbound and inbound segments of flights, which can make the prediction of an individual's resynchronization very difficult. ''Advances'' in rhythms occur with eastward travel and ''delays'' with westward travel. Flights of multiple time zones involve circadian adjustments that vary in length depending on the direction of travel. Physiological, performance, and subjective measures are also found to adjust at different rates to changes in time zones.[87]

Some studies also indicate that a complete adjustment following six time zone transitions was found to take up to 13 days after eastbound flights, and 10 days in westbound flights.[88] Other research indicates that there is considerable variation in the rates of resynchronization of individual rhythms. After a time shift, such as that experienced by pilots flying several days in a new theater, with all rhythms phase-adjusted, upon return to their domicile, a resynchronization process begins anew and is not complete until each rhythm has rephrased back to the home time zone. ''The different rates of rhythm readjustment lead to transient internal dissociation, in which the normal phase relationships between rhythms are disrupted.''[89]

Consequently, the FAA finds it critical to address the desynchronization/resynchronization of circadian rhythms that occurs when transiting multiple time zones. This recovery rest not only acclimates flightcrew members but also resets the circadian rhythms before the next assigned flight duty period. The FAA corrects the regulatory text to provide for a 56 consecutive hour rest instead of the three physiological nights' rest, as previously discussed. Depending upon when the rest period begins, this requirement provides for 2 to 3 physiological nights' rest.

With respect to the NACA and Kalitta's concern with using the higher value of 36 hours rest instead of 30 hours to acclimate, the FAA is not persuaded by the comment. The ARC members agreed that a flightcrew member should have at least 30 to 36 continuous hours free of duty (rest) in any 168 consecutive hours and that once a flightcrew member is given this rest, he or she is considered acclimated to the local time. As rest is critical, the FAA choose to propose the more conservative 36 hour rest period, given that adequate rest provides the most fatigue mitigation. NACA and Kalitta do not offer information supporting 30 hours instead of 36 hours. However, an approved FRMS may appropriately determine whether additional mitigations may permit the limited reduction in rest.

For clarity, the regulatory text in this section has been restructured. Paragraph (b) of this section adopts the 30 consecutive hour minimum rest requirement per week as proposed. Under paragraph (c), if a certificate holder gives a flightcrew member operating in a new theater 36 consecutive hours of rest, then that flightcrew member is acclimated and must enter the FDP Table for his/her next assignment as acclimated to the local time in that new theater. A certificate holder does not need to provide the 36 hour rest once a flightcrew member is in a new theater unless the carrier wants to acclimate that flightcrew member. The flightcrew member may be given a 10 hour rest period in accordance with paragraph (e) of this section and then be assigned a subsequent FDP based on the home base time. However, if the flightcrew member has received 36 consecutive hours of rest, that flightcrew member is acclimated at that point to the new theater, and subsequent FDP assignments must be made according to the acclimated time. The text also specifies that if a flightcrew member has received 36 consecutive hours of rest under this paragraph, then that rest meets the requirements of paragraph (b) for the required rest in any 168 hour period and that resets the 168 hour period. Paragraph (d) now contains that provision that requires at least 56 consecutive hours of rest if a flightcrew member traverses 60° longitude[90] during an FDP or a series of FDPs that require him or her to be away from home base more than 168 consecutive hours. This rest must encompass three physiological nights' rest based on local time.

ALPA, APA, CAPA, and SWAPA argued that where flightcrew members are not acclimated, a recovery period must be provided upon return to home base to ensure a flightcrew member's body clock has recovered home base local time before the start of the next day. They propose that Table F, provided below, be used to determine the number of nights required to re-acclimate. They also propose that Table F be used to provide ''recovery rest'' for time away from home when operating in a different theater for less than 168 consecutive hours away from home. They cite the current regulations[91] as providing this rest for international operations over a period less than 168 consecutive hours.

performance changes associated with desynchronosis of biological rhythms. Aviat. Space Envion. Med. 1984; 55:1085–96, p. 1090.

[86] *Id.* at p. 1085.

[87] Wegmann HM, Klein KE. Jet lag and aircrew scheduling. In: Folkard S, Monk TH, eds. Hours of work. Chichester; John Wiley & Sons Ltd., 1985; 263–76.

[88] Wegmann HM, Gundel A, Naumann M, Samel A, Schwartz E, Vejvoda M. Sleep, sleepiness, and circadian rhythmicity in aircrews operating on transatlantic routes. Aviat. Space Environ. Med. 1986; 57(12, Suppl.); B53–64.

[89] Winget *et al.* (1984) at page 1087.

[90] This change is consistent with the modification to the term theater in the definitions section, discussed earlier.

[91] *See* 14 CFR 121.483, 121.485, 121.523 and 121.525.

Table F – Number of Local Nights for Recovery on Return to Home Base

Elapsed Time Since Leaving Home base (h)	Maximum Time Difference from Home Base (h)					
	4	5	6	7	8-9	10-12+
60-84h	1*	2*	2*	2*	2*	3
84-108h	2*	2*	3	3	3	3
108-132h	3	3	3	3	3	3
132-156h	3	3	3	3	3	3
156+h	3	3	3	3	3	3

Note 1: The values in Table F refer to eastward transitions (eastward outbound/ westward homebound) only. * denotes that for westward transitions (westward outbound/eastward homebound) one extra day is required to be added to the value depicted.

Note 2 : When the elapsed time away from home base is less than 60 hours one full physiological night's recovery rest should be provided on return to base, except when the returning flight duty period encroaches the WOCL, then an additional physiological nights rest will be added.

The FAA cannot support the inclusion of Table F. First and as a practical matter, it is not clear that the Table could be accommodated given the rest period that was proposed without seriously constraining the certificate holder's ability to schedule operations. As discussed previously, the FAA agrees and adopts a provision that specifically addresses the resynchronization of circadian rhythms. That rest however, must also be balanced with the certificate holder's flexibility to schedule operations, particularly those carriers conducting supplemental operations. The FAA used 168 hours as the minimum trigger point for when this rest must be provided for flightcrews returning home after completing FDPs that crossed multiple time zones. Under Table F, flightcrew members would have to be provided a minimum of two nights' rest at home every week. This is an unrealistic constraint on the certificate holder's ability to set and maintain a schedule. Under the concept furthered by this rulemaking, the cumulative limits on FDP during the same 168 hour period, coupled with cumulative rest requirement, should adequately mitigate the effect of cumulative fatigue.

Not unexpectedly, the provisions proposed in the NPRM permitting a limited reduction in rest generally were opposed by the entities representing labor groups and either supported or expanded by the industry groups. ALPA accepted the proposal. SWAPA commented that reduced rest should never be permitted since science supporting reduced rest assumes that one is starting from a full sleep bank, which is not always the case. SWAPA further commented that reduced rest is likely to follow an extended FDP and that if the FAA retains a reduced rest provision it should never be permitted after an FDP has been extended past the maximum provided in Table B. APA only supports reduced rest if restorative rest is provided. In addition, APA argues that if the FAA allows a reduction in rest it should be limited to only once in a 168 consecutive hour period, due to unforeseen circumstances subject to pilot in command concurrence, and never if associated with an extended FDP. FedEx ALPA argued that only a one-hour reduction in rest be permitted and only in cases of unforeseen circumstances. AE supports a permitted one-hour reduction in rest. AA supports the one-hour reduction but never on consecutive nights. Delta commented that the once in 168 consecutive hour period be reset after a 30-hours rest is given.

Conversely, UPS supported multiple reductions in rest without concurrence by the pilot in command. UPS contends that one reduction in a 168 consecutive hour window simply is not feasible. UPS also argues that requiring PIC concurrence will complicate the certificate's holder ability to utilize the reduced rest provisions and its ability to return a disrupted system back to a more normal state.

In view of the comments, the FAA has decided to remove the provisions that would permit a reduction in rest. As one of the stated goals of this rulemaking was to ensure that flightcrew members had an eight hour sleep opportunity, the FAA has reconsidered incorporating criteria in the regulations to permit a reduction in this sleep opportunity. While it is reasonable to anticipate that unforeseen circumstances may warrant a limited extension of an FDP, particularly for situations that arise after takeoff, the flightcrew members at this point have already had the benefit of an eight hour rest opportunity. The FDPs limits implemented by this rule were derived under the premise that flightcrew members were reporting for duty with a full rest. Permitting reduced rest undercuts that premise. This rule includes provisions for extensions of FDPs and flight time, as necessary to accommodate the situations that cannot be planned. Otherwise, certificate holders should not be scheduling FDPs to the point that a rest period needs to be reduced.

P. Deadhead Transportation

In the NPRM, the FAA proposed that all time spent in deadhead transportation is duty. The FAA further proposed that time spent in deadhead transportation would be considered part of an FDP if it occurred before a flight segment without an intervening

required rest period. Lastly, the proposal provided a rest requirement for deadheading flightcrew members: the time spent in deadhead transportation during a duty period may not exceed the flight duty period in Table B for the applicable start time 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.

Several commenters contend that this proposed rest requirement should be deleted because it is punitive and not supported by science. They argue that this provision implies that the certificate holder should prevent a flightcrew member from deadheading home at the end of an FDP, even if the flightcrew member requests to do so.

The FAA has made changes to the section addressing deadhead transportation. Paragraphs (a) and (b) of proposed § 117.31 have been moved. Paragraph (a) provided that all time spent in deadhead transportation is duty and that statement is relocated to the definition for deadhead transportation. Paragraph (b), which provided that deadhead transportation is part of an FDP if it occurred before a flight segment without an intervening required rest period, is deleted as that information is already contained in the definition of the term ''flight duty period.''

The FAA agrees with the commenters that the proposed text for § 117.29(c), Deadhead transportation, does not correctly articulate the purpose of rest relative to deadhead transportation. The rest is appropriate if the deadhead transportation occurs prior to the FDP. The situation that FAA sought to address in the NPRM was a flightcrew member deadheading on a long flight and then going onto a FDP without the appropriate rest. The language as proposed would require a rest period for a flightcrew member who is deadheading home after completion of an FDP. The FAA has corrected the regulatory text to provide that before beginning a flight duty period, if a flightcrew member has engaged in deadhead transportation that exceeds the applicable flight duty period in Table B, the flightcrew member must be given a rest period equal to the length of the deadhead transportation but not less than 10 consecutive hours.

Q. Emergency and Government Sponsored Operations

This rulemaking also addresses various supplemental operations that require flying into or out of hostile areas, and politically sensitive, remote areas that do not have rest facilities. These operations range from moving armed troops for the U.S. military, conducting humanitarian relief, repatriation, Air Mobility Command (AMC), and State Department missions.[92] The discussions during the ARC recognized that these operations are unique and need to be specifically addressed in this rulemaking. Flights operated by a certificate holder under contract with a U.S. Government agency must comply with the flight and duty regulations in parts 121 and 135, as appropriate, unless the Administrator has granted a deviation under 14 CFR 119.55 or 14 CFR 112.57.

The FAA proposed that certificate holders may extend the applicable maximum FDPs to the extent necessary to allow flightcrew members to fly to a destination where they can safely be relieved from duty by another flightcrew or can receive the required rest before beginning the next FDP. Upon reaching the destination, the flightcrew members will receive the required rest, which would be equal to the length of the actual FDP or 24 hours, whichever is less. Furthermore, the proposal would not permit extensions of the cumulative FDP or cumulative flight time limits. In the event that an FDP was extended pursuant to this section, the NPRM provided reporting requirements.

A number of commenters disagreed with the FAA's use of the title ''Operations in unsafe areas'' as the title of this section. Commenters, including UPS, Atlas Air, NAA, NACA, and NAC recommended various terms instead such as ''Unique areas,'' ''Enhanced Security Consideration Area: Prescriptive Exemption,'' and ''Designated Areas.''

In addition, Atlas questioned the FAA's statement that under this section, the flightcrew members' FDP can be extended to permit them to continue the flight operation and land at the nearest suitable airport. *See* FAA Response to Clarifying Questions at page 24. Atlas commented that this airport may not be operationally feasible or economically viable.

RAA commented that operations may need to use this section to rapidly remove or recover aircraft and crews from an airport about to be impacted by a heavy storm, hurricane, or blizzard.

In the NPRM, the preamble discussion for this proposed section was titled ''Exception for Emergency and Government Sponsored Operations.'' The FAA regrets that the title was not carried over to regulatory text. Introducing the term ''unsafe areas'' could be subject to differing interpretations within the industry. Section 117.29 is now titled ''Emergency and government sponsored operations,'' which is an accurate depiction of the operations addressed in this section and is consistent with the discussion of the proposal.

The purpose of this section is to address true emergency situations and operations that are being conducted under contract with the U.S. Government that pose exceptional circumstances that would otherwise prevent a flightcrew member from being relieved from duty or safely provided with rest at the end of the FDP. This section is not meant to address self-induced emergencies that arise from inadequate planning. Certificate holders must be responsible for having appropriate onboard rest facilities or the proper number of flightcrew members available for the length of the duty day, if necessary.

The FAA reviewed the regulatory text and determined that this clarification warrants certain modifications. First, the applicability provision of this section now specifically articulates the two categories of operations that are affected. This section applies to operations conducted pursuant to contracts with the U.S. Government department and agencies. A number of these types of flights are conducted under contract with the Departments of Defense, State, Homeland Security, Justice, FEMA, and Customs and Immigration. This provision is not limited to operations conducted pursuant to § 119.55, which permits certificate holders to deviate from the requirements of parts 121 and 135, as authorized by the Administrator in order to conduct operations pursuant to a military contract. Rather, this provision could apply to multiple government agencies depending on the mission. The FAA also recognizes that there are operations in which the Department of Defense may need relief from the flight and duty regulations even though the circumstances do not meet the certification requirements of § 119.55.

This section also applies to operations conducted pursuant to a deviation issued by the Administrator under § 119.57 that authorizes an air carrier to deviate from the requirements of parts 121 and 135 to perform emergency operations. For example, under this section the FAA issued operations specifications for emergency operations

[92] This could also apply to the Civil Reserve Air Fleet (CRAF). However CRAF is only activated by presidential order in a time of war. The last time CRAF was activated was in 2003. Currently no operations are being conducted under the CRAF program.

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.

Upon review, the FAA concludes that these two categories are the only types of operations that warrant separate consideration because of the unique operating circumstances that otherwise limit a certificate holder's flexibility to deal with unusual circumstances. Therefore, unless a certificate holder's operations fall under either category, the ability to extend an FDP under this section does not apply.

In response to RAA's comment as to this section regarding moving aircraft and crews from an airport about to be impacted by a blizzard or hurricane, these certificate holders have recourse to extend an FDP as necessary under § 117.19. The FAA's modifications to this section are to allow for true emergency situations and to address the uniqueness of certain government contract operations.

Second, this section adopts the provision permitting the FDP and the flight time for a particular operation to be extended if deemed necessary by the pilot-in-command. This provision was slightly modified to allow for an extension to the flightcrew members' flight time limitations if necessary. In addition, the pilot-in command is given the authority to determine the closest destination to safely land the aircraft and allow for the flightcrew to be relieved and afforded the proper rest. The FAA does not expect the flightcrew to extend the FDP simply to complete the next commercially scheduled leg.[93]

Third, the FAA has addressed the reporting requirements for situations when a FDP is extended. Under the NPRM, the FAA proposed two different reporting requirements depending upon whether the operation was conducted pursuant to a U.S. government contract. This section has been modified to incorporate the reporting requirements listed in § 117.19 Flight Duty Period Extensions. Therefore, the certificate holder must file within 10 days any extended FDP and flight time that exceed the maximum permitted under the adopted regulations. The report must contain a description of the extended FDP and flight time limitations and the circumstances surrounding the situation requiring the extension. In addition, if the circumstances surrounding the situation were within the certificate holder's control, the report must contain information on the certificate holder's intended course of corrective action. This action must be implemented within 30 days from the date that the FDP was extended.

The reporting of FDP extensions in this manner can facilitate the certificate holder and the FAA's determination as to whether the certificate holder is properly planning its operations and mitigating the chances of its flightcrews exceeding the FDP limits. If a certificate holder cannot restructure its operations so that very few of these operations need to take advantage of this provision, the certificate holder is advised to develop an FRMS to address these operations.

Several commenters were concerned with the proposal's prohibition on any extension of the cumulative FDP and flight time limits if an extension to a daily FDP was triggered under this section. The FAA partially agrees with the commenters. For operations conducted pursuant to a deviation authorized under § 119.57, the FAA agrees that these circumstances may necessitate the flightcrew member's ability to exceed the cumulative flight time and FDP limitations respectively found in §§ 117.23(b) and (c). Therefore, this section permits an extension of the flightcrew member's FDP and flight time limitation even if it exceeds the cumulative requirements in 117.23 for operations that are conducted pursuant to a deviation authorized under § 119.57.

The FAA does not make such finding with respect to other operations conducted pursuant to a U.S. government contract. Even though these operations may fly into and out of hostile areas or areas that preclude the flightcrew members from proper rest facilities, the certificate holder is well aware of the operating environments where it is agreeing to conduct such operations. Therefore, these situations must be taken into account during the planning stages. A certificate holder needs to have considered and planned for whether the operations under contract will necessitate staging crews at other airports or installing rest facilities onboard the aircraft to enable augmentation, in order to ensure that flightcrews will not exceed FDP limit. For these operations, the cumulative limits on FDP and flight time apply.

R. Miscellaneous Issues

The FAA has also received a number of comments raising other significant issues. These comments, and the associated responses, are discussed below.

Statutory Authority

ATA stated that this rule exceeds the FAA's statutory authority and that this rule cannot be promulgated pursuant to the authority delegated to the FAA in 49 U.S.C. 44701(a)(5) because this rule does not increase aviation safety or national security.

As the NPRM indicated, the authority for this rulemaking stems from 49 U.S.C. 44701(a)(5), which requires the Administrator to promulgate ''regulations and minimum standards for other practices, methods, and procedure the Administrator finds necessary for safety in air commerce and national security.'' Subsection 44701(a)(5) ''grants the FAA 'broad authority to regulate civil aviation.''' *Gorman* v. *National Transp. Safety Bd.,* 558 F.3d 580, 590 (DC Cir. 2009) (quoting *Ass'n of Flight Attendants-CWA* v. *Chao,* 493 F.3d 155, 157 (D.C. Cir. 2007)).[94]

Here, the FAA finds that this rulemaking is necessary for safety in air commerce. As discussed in other portions of this preamble, the existing flight, duty, and rest regulations permit flightcrew members to accumulate unsafe amounts of fatigue. This unsafe accumulation of fatigue undermines aviation safety by increasing the risk of an accident.[95] This rulemaking addresses this issue by imposing limits that will ensure that flightcrew members' fatigue stays within safety-acceptable bounds. This will decrease the risk of an aviation accident, and thus, this rulemaking will increase safety in air commerce. Because this rulemaking will increase safety in air commerce, it is authorized by 49 U.S.C. 44701(a)(5).

As the NPRM also notes, additional authority for this rulemaking stems from 49 U.S.C. 44701(a)(4). Subsection 44701(a)(4) requires the Administrator to promulgate ''regulations in the interest of safety for the maximum hours or periods of service of airmen and other employees of air carriers.'' This rule reduces the fatigue experienced by flightcrew members during flight by limiting the maximum FDP and flight-time hours of airmen and other covered

[93] FAA Response to Clarifying Questions.

[94] *See Drake* v. *Laboratory Corp. of America Holdings,* 458 F.3d 48, 56 (2d Cir. 2006) (stating that ''Congress granted the FAA broad authority over aviation safety''); *Kraley* v. *National Transp. Safety Bd.,* 165 F.3d 27 (6th Cir. 1998) (unpublished opinion) (stating that ''Congress vested the Administrator of the FAA with broad power to prescribe regulations, standards, and procedures relating to aviation safety'').

[95] *See, e.g.,* Goode, *supra* note 17, at 311 (stating that 16-hour unaugmented FDPs, which are permissible under the existing regulations, result in an accident rate that is over five times higher than the accident rate for shorter FDPs).

employees of air carriers. Because this reduction in fatigue will increase aviation safety, the flight, duty, and rest limits that make up this rule are also authorized by subsection 44701(a)(4).

Constitutional Due Process

UPS argued that this rule is unconstitutional because its provisions substantially impair the collective bargaining agreement between UPS and IPA. Although UPS conceded that the Contracts Clause is not applicable to the federal government, UPS argued that ''similar principles apply [to the federal government] under the Due Process Clause.'' UPS concluded that this rule violates the Fifth Amendment's Due Process Clause because, UPS alleged, there is no justification for the contractual impairment imposed by this rule.

The FAA agrees with UPS that the Contracts Clause is not applicable to actions, such as this rulemaking, that are undertaken by the federal government. *Pension Ben. Guar. Corp.* v. *R.A. Gray & Co.,* 467 U.S. 717, 732 n.8 (1984). With regard to UPS' Fifth Amendment argument, the Supreme Court has explicitly rejected the premise that the Fifth Amendment's Due Process Clause is ''coextensive'' with the Contracts Clause. *Id.* at 733. The Court emphasized that ''to the extent that recent decisions of the Court have addressed the issue, we have contrasted the limitations imposed on States by the Contract Clause with the less searching standards imposed on economic legislation by the Due Process Clauses.'' *Id.* Thus, under the standard set out by the Supreme Court, a federal regulation does not offend the Due Process Clause so long as that regulation is not ''arbitrary and irrational.'' *Id.*

This rule is neither arbitrary nor irrational. While the FAA initiated this rulemaking by establishing an ARC, we subsequently received a Congressional directive, which came about because the existing flight, duty, and rest regulations allowed flightcrew members to accumulate dangerous levels of fatigue. To address this issue and keep flightcrew-member fatigue within reasonable bounds, this rule: (1) Limits daily FDP and flight-time hours based on a flightcrew member's circadian rhythm, (2) sets minimum rest requirements, and (3) encourages fatigue-mitigating measures such as split-duty rest and augmentation. This rule also contains a number of other provisions, which are based on specific fatigue and operational concerns and which are discussed in other parts of this preamble. In addition, each of the proposed provisions in this rule was amended, where possible, to respond to the specific concerns raised by the commenters. Because each provision in this rule has been carefully calibrated to mitigate flightcrew-member fatigue while providing air carriers with as much scheduling flexibility as possible, this rule is neither arbitrary nor irrational. Accordingly, this rule does not violate the Fifth Amendment's Due Process Clause.

Administrative Procedure Act

ATA and a number of other industry commenters criticized the timetable used for this rulemaking. These commenters stated that the ARC for this rulemaking met on an unreasonably compressed schedule that did not provide it with sufficient time to carefully consider the pertinent issues and come to a consensus as to the proper resolution of those issues. CAA stated that, rather than provide the ARC with sufficient time to come up with a comprehensive set of recommendations, ''the overwhelming majority of all regulatory activity has focused exclusively on reductions to the current limitations on hours of duty and flight time limits without ever determining whether such hours of service considerations are in fact the underlying cause of any fatigue.'' CAA concluded that ''[a]s a result, the proposals contained in the NPRM are, on the whole, simply designed to reduce the flightcrew hours of service.''

The industry commenters also stated that the NPRM was an ''incomplete and ambiguous document'' that did not provide them with sufficient detail to make meaningful comments. A number of commenters argued that the regulatory impact analysis used to develop the NPRM omitted important information, and thus, precluded the commenters from providing meaningful critique of this analysis.

CAA also stated that the FAA should have waited to publish an NPRM until the National Research Council's Committee on the Effects of Commuting on Pilot Fatigue provided a final report on the fatigue-related effects of pilot commuting. CAA stated that commuting is the primary cause of pilot fatigue, and that an understanding of pilot commuting is a necessary part of any flight, duty, and rest rule.

In addition, the industry commenters argued that the FAA did not provide them with sufficient time to evaluate the NPRM and submit their comments. They stated that the FAA unreasonably refused their requests to extend the 60-day comment period and provided responses to their numerous clarification questions with less than 30 days left in the comment period. Some commenters also stated that the FAA did not release a technical document that was used in the regulatory evaluation until there were only 23 days left in the comment period. The commenters pointed out that when the FAA conducted a similar rulemaking in 1995, it extended the comment period, citing ''the scope and complexity of the proposal.'' The commenters also stated that an analogous rulemaking conducted by the Department of Transportation Federal Motor Carrier Safety Administration to establish rules on hours of service for commercial motor vehicles permitted an extension of the comment period for that rulemaking. The industry commenters stated that the existence of the ARC was not a sufficient justification for the short comment period because this rule includes a number of provisions that the ARC never considered.

RAA suggested that the FAA issue a supplemental NPRM instead of finalizing this rule. RAA emphasized that the FAA received a large number of comments asking that substantial changes be made to this rule, and to account for the number and breadth of the comments, the FAA should issue a supplemental NPRM setting out its proposed resolution to the issues raised by the comments.

In response to the above comments, the FAA notes that while it began this rulemaking by establishing an ARC, we subsequently received a Congressional directive contained in the Airline Safety and Federal Aviation Extension Act (ASFAEA). Section 212 of ASFAEA required the FAA to issue new flight, duty, and rest regulations. This section, in subsection 212(a)(3), set a deadline of 180 days for the FAA to publish an NPRM and 1 year for the FAA to issue a final rule.

Under normal circumstances, the FAA has broad discretion to extend the timeframe for some parts of the rulemaking process. As the above commenters correctly pointed out, the FAA has used this discretion in the past to extend the timeframe for parts of other rulemakings. However, in this case, the FAA has recognized that implicit within the shortened statutory deadline that Congress set for completing this rulemaking was a presumption against extending the timeframe for any part of this rulemaking.

The FAA limited the ARC's schedule to approximately six weeks. The ARC actually met on a weekly basis for at least 2 days per week. The FAA recognizes the tremendous amount of effort expended by the ARC members

during this time. At the six-week point, the FAA found that the ARC had achieved its goal of highlighting issues for the FAA to consider as part of the FAA's subsequent rulemaking deliberations. Because most of these issues elicited strong divergent opinions from the labor and industry ARC members and because these divergent opinions could not be reasonably reconciled, the FAA concluded that extending the ARC's timeframe would not result in a consensus set of ARC recommendations.

The FAA disagrees with CAA's assertion that the ARC's timeframe was not extended because the FAA wanted to design a rule that ''reduce[s] the flightcrew hours of service.'' While some parts of this rule reduce flightcrew members' hours of service, other parts increase those hours in a way that is consistent with safety considerations. Thus, for example, this rule increases the existing 8-hour unaugmented daily flight-time limit to 9 hours for periods of peak circadian alertness.

Turning to the length of the comment period that was used for this rulemaking, the FAA chose not to extend this rule's comment period due to the detailed comments that it received and the implicit statutory presumption against extensions in this rulemaking. At the end of the 60-day comment period, the FAA examined the comments that were submitted in response to the NPRM, and determined it was unlikely that an extension of the comment period would have a significant effect on comment quality. During the 60-day comment period, thousands of comments were submitted in response to this rulemaking, and many of those comments contained lengthy comprehensive analyses of every single part of the NPRM, as well as a critique of the regulatory evaluation. A number of commenters hired their own experts to provide detailed substantive reports on the NPRM, and these reports were submitted to the FAA during the 60-day comment period. Based on the comprehensive and detailed comments received during the 60-day comment period, the FAA determined that it had received sufficient information to proceed with this rulemaking. In light of this fact and the need to comply with the statutory deadline for this rulemaking, the FAA chose not to extend the comment period.

The FAA also notes that, as the NPRM pointed out, the FAA has a policy of considering comments that are ''filed after the comment period has closed if it is possible to do so without incurring expense or delay.'' 75 FR 55884. Thus, for example, as part of its consideration of augmented FDPs, the FAA took into account Continental and ALPA's comments about ULR flights, even though those comments were filed four months after the comment period closed. Because the FAA has a very liberal late-filed-comments policy, if the affected parties had important new comments that they wanted to file after the 60-day comment period closed, those parties had ample opportunity to file their comments after the closure of the comment period.

As the commenters pointed out, about halfway through the comment period, the FAA provided answers to clarifying questions that the commenters submitted, as well as a technical report that was referred to by the regulatory evaluation. While this information, which was provided with over 23 days left in the comment period, was important, it was not a central component of the NPRM. Moreover, the commenters appear to have fully incorporated this information into their filed comments, as the comments contained a comprehensive analysis of both the clarifying answers and the regulatory evaluation.

Turning to the sufficiency of the NPRM, the FAA finds that the NPRM provided enough detail for the commenters to provide the FAA with meaningful comments. The NPRM set out the regulatory provisions that the FAA proposed for the new flight, duty, and rest regulations, and the NPRM also explained the rationale for each of those provisions. After reading the NPRM and the accompanying regulatory evaluation, the affected parties provided the FAA with thousands of comments, many of which analyzed in detail every provision of the NPRM and provided a critique of the FAA's rationale for each of those provisions. While many of the commenters disagreed with parts of the NPRM, most of them appear to have had a clear understanding of the NPRM. The affected parties also submitted very detailed critiques of the regulatory evaluation that accompanied the NPRM which showed an understanding of the regulatory evaluation.

As a result of the comprehensive and detailed analyses that were submitted by the commenters, the FAA incorporated many of the commenters' suggestions into the final rule and the final Regulatory Impact Analysis. This process improved the final rule and accomplished the requirements of the Administrative Procedure Act.

Turning to CAA's comment, the FAA notes that since commencing this rulemaking activity, the National Research Council has completed its report. The authors of the report independently determined that it is premature to initiate rulemaking related to commuting. See *The Effects of Commuting on Pilot Fatigue,* National Research Council, July 6, 2011.[96] While pilot commuting is an important fatigue-related issue, this rulemaking does not foreclose the FAA from conducting a rulemaking in the future to address pilot commuting issues should better and more complete information of the risks posed by commuting and methods to alleviate that risk become available.

The FAA has also decided not to issue a supplemental NPRM as part of this rulemaking. As discussed above, the FAA received numerous thorough and high-quality comments in response to the original NPRM. Many of the comments have been incorporated into the final rule. We have made no changes that were not either originally contemplated in the NPRM or a logical outgrowth of that document.

Information Quality Act and OMB Bulletin M–05–03

ATA asserted that the NPRM violated the Information Quality Act (IQA), as applied by the Department of Transportation's (DOT) Information Dissemination Quality Guidelines (Guidelines).[97] ATA argued that the Guidelines require FAA rulemakings to meet defined standards of quality, objectivity, utility and integrity. ATA then argued that ''[d]espite the IQA's clear mandate and DOT's guidance, however, the present NPRM contains no accurate, clear, objective and unbiased information supporting the FAA's proposed overhaul of the existing flightcrew member flight and duty time limitations and rest requirements.'' ATA stated that the scientific information used to support the provisions of the NPRM could not meet the standards set out in the Guidelines because it was not validated in the aviation context. CAA added that the FAA's failure to provide additional regulatory-impact information requested by CAA was also a violation of the IQA. UPS argued that the scientific information used in this rulemaking violated OMB Bulleting M–

[96] In addition to reviewing the possibility of regulating pilot commuting, the National Research Council determined that fatigue mitigation needed to take into account multiple factors, including the duration of work periods within a single day and over time; the time of day that work occurs; duration of sleep on work days and non-work days, the volume and intensity of the work; and the different vulnerabilities of individuals to these factors (among others). This assessment is consistent with the FAA's assessment of fatigue risk.

[97] Citing 67 FR 61719 (Oct. 1, 2002).

05–03 because it was not subjected to peer review.

The DOT Guidelines state that, in the context of a rulemaking, the method by which an agency should correct alleged violations of the IQA is by responding to the pertinent public comments in the preamble to the final rule. Guidelines section VIII. In this case, a number of commenters argued that certain provisions of the NPRM were not supported by scientific information. A significant number of scientific studies were referenced in the NPRM. However, in response to the commenters' scientific concerns, the FAA has included either additional scientific information supporting the studies cited in the NPRM or an explanation for why the scientific information and operational experience cited in the NPRM is sufficient to justify the pertinent regulatory provision.

The FAA notes that, while some of the studies used in the final rule have not been validated in the aviation context, the major provisions of this rule are based on uncontroversial scientific findings that apply to all human beings. As the NPRM pointed out, sleep science, while still evolving, is clear in several 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.

75 FR 55857. These uncontroversial scientific findings form the basis for almost all of the major provisions in this rule. The FAA has concluded that, even though some of these findings were not based on aviation data, flightcrew members have the same fatigue concerns as other human beings, and as such, there is no reason to believe that these findings would not apply to flightcrew members.

However, in the process of considering the comments, the FAA found that some of the provisions of the NPRM, such as portions of the proposed fitness-for-duty section and the cumulative duty-period limit, were not justified by scientific studies and operational experience. Consequently, these provisions were removed from the final rule. Because, in this preamble, the FAA responded to comments questioning the scientific basis for the NPRM and removed regulatory provisions that could not be justified through scientific findings or operational experience, this rule does not violate the IQA and the DOT Guidelines.[98]

Turning to OMB Bulletin M–05–03, this Bulletin requires that ''[t]o the extent permitted by law, each agency shall conduct a peer review on all influential scientific information that the agency intends to disseminate.'' OMB Bulletin M–05–03, section II(1). The studies cited in this document were not conducted on behalf of the FAA and only generally note trends in sleep science. As noted earlier in this document, sleep science does not now, and likely never will, reach the level of certainty that would allow an agency to make public policy decisions based solely on scientific studies. While the science is informative, final decisions will necessarily be based on a balancing of interests in the real world rather than on rigid adherence to scientific studies. This rule complies with this Bulletin because almost all of the scientific information cited in this preamble comes from peer-reviewed scientific journals. Two notable exceptions are the TNO Report and the SAFTE/FAST modeling that was used in parts of this rule. However, the FAA has determined that both the TNO Report and the SAFTE/FAST model have been evaluated sufficiently to provide useful information to the agency in making policy decisions on how best to balance the needs of carriers to maximize their operations while still providing sufficient and meaningful rest opportunities to mitigate the risk of fatigue to those operations. The TNO Report's findings were reviewed by the Scientific Review Board of the Netherlands Organization for Applied Scientific Research, Department of Behavioral and Social Sciences (which complies with ISO 9001:2000 certification standards) and the review board of the Directorate General Transport and Aviation of the Netherlands Ministry of Transport. Turning to the SAFTE/FAST model, as the NPRM pointed out ''[t]his 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.'' 75 FR 55867 n.35. The NPRM also noted that a copy of the technical report evaluating this model has been placed on the docket, and, in addition, the NPRM cited a number of studies that either evaluated or utilized the SAFTE/FAST model. *See id.* n.34.

Executive Order 12866

A number of industry commenters stated that this rulemaking does not comply with Executive Order 12866 because: (1) Its benefits do not justify its costs, (2) it is not based on scientific information, (3) the FAA has not assessed alternatives, and (4) the rule is unduly burdensome.

The commenters stated that the FAA admitted that sleep science has not been validated in the aviation context and portions of this rule, such as cumulative duty-period limits and lower unaugmented FDP limits for additional flight segments, are not based on scientific evidence. ATA and UPS argued that this rule also violated Section 212 of the Airline Safety and Federal Aviation Extension Act because, according to ATA and UPS, this rule is not based on the best science.

ATA and RAA criticized the FAA's approach to this rulemaking. RAA stated that the ARC members whose recommendations were used in this rulemaking have considerable operational experience, and that the less conservative, air carrier ARC recommendations were based on this experience and did not undermine safety. RAA added that some of the specific limits set out in this rule could have been increased due to the fact that this rule contains significant safety oversight provisions.

The industry commenters also stated that the FAA has not considered alternatives to this rule because its ''one-size fits all'' proposal does not take into account ''the unique needs of individual carriers or types of operations.'' ATA stated that this rule is unduly burdensome because the NPRM ''improperly treats passenger, cargo, short-haul, long-haul, domestic, and international carriers and operations the same despite their crucial, differing operational demands and crew scheduling requirements.''

NACA asserted that the FAA never considered the alternative proposals submitted by supplemental air carriers. NACA added that the FAA never explained why it excluded part 135 operators from this rule, but did not exclude other small business entities such as supplemental air carriers. ATA stated that the FAA did not carefully consider the impact that maintaining the status quo would have on small business entities, and that this violated the Regulatory Flexibility Act.

Executive Order 12866 requires, among other things, that a federal agency: (1) ''propose or adopt a

[98] The FAA also notes that the DOT Guidelines are simply the ''policy views of DOT.'' Guidelines section III. These Guidelines ''are not intended to be, and should not be construed as, legally binding regulations or mandates.'' *Id.*

regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs;'' (2) base its decision on the best available scientific information; (3) consider alternatives to the proposed regulation; and (4) ''tailor its regulations to impose the least burden on society, including individuals, businesses of differing sizes.''

The FAA has determined that the benefits of this rule justify its costs. A detailed discussion explaining the FAA's basis for this determination is contained in the Regulatory Impact Analysis. The FAA has also used the best available scientific information as the basis for this rule. As discussed in the preceding section, most of the provisions in this rule are supported by the latest peer-reviewed scientific studies. While some of these peer-reviewed studies have not been validated in the aviation context, as discussed above, the major provisions of this rule are based on uncontroversial scientific findings that apply to all human beings.

The FAA acknowledges that the proposed cumulative duty-period limits were largely unnecessary, which is why they have been removed from the final rule. With regard to lower unaugmented FDP limits for additional flight segments, as the pertinent section of this preamble points out, a number of scientific studies support the premise that an increase in the number of flight segments leads to an increase in flightcrew member fatigue.[99] The FAA also acknowledges that certain provisions of the NPRM were unduly conservative, and these provisions have been amended in response to concerns expressed by the commenters. For example, the unaugmented FDP limits, which were based on the most conservative ARC recommendation, have been amended in accordance with higher FDP-limit alternatives that were proposed by industry commenters.

The FAA has also considered alternatives to the provisions set out in the NPRM. As the NPRM stated, the FAA has considered the alternative of maintaining the status quo, but rejected that alternative because the status quo subjects society to an ''unacceptably high aviation accident risk.'' 75 FR 55882. For example, as discussed in the Applicability section of this preamble, some of the FDPs permitted by the existing regulations can result in a five-fold increase to accident risk.

The FAA has also considered the alternative of differentiating between different types of part 121 operations. As a result, the FAA has decided to make the provisions of this rule voluntary for all-cargo operations, as subjecting all-cargo operations to the same mandatory flight, duty, and rest regulations as passenger operations would result in costs that far outweigh the commensurate societal benefit.

The FAA also considered differentiating between the different types of part 121 passenger operations. However, the FAA ultimately decided against this approach because, as discussed in the Applicability section, the factors that lead to fatigue are universal and, unlike all-cargo operations, imposing this rule on passenger operations is cost-justified. A flightcrew member who is working on a 16-hour unaugmented FDP will feel the same level of fatigue regardless of the type of operation that he or she is participating in. Accordingly, this rule uniformly regulates the universal fatigue factors in passenger operations regardless of the specific part 121 passenger operation that is involved.

The FAA has also considered the impact that this rule would have on supplemental passenger operations, and it has incorporated a number of suggestions from carriers who conduct supplemental operations and organizations that represent those carriers, into the final rule. The reason that the FAA excluded part 135 businesses regardless of size, but did not exclude air carriers who conduct supplemental operations from this rule, is that the air carriers who conduct supplemental operations operate under part 121 which contains more stringent safety standards than those found in part 135. Pursuant to the Regulatory Flexibility Act, the FAA also considered the impact of this rule on small businesses, and the pertinent discussion can be found below.

Throughout this rulemaking, the FAA has attempted to impose the least possible burden on air carriers, consistent with the need to improve safety. As many commenters pointed out, some provisions of this rule are complex because the FAA has consistently decided against imposing across-the-board flight, duty, and rest limitations, which would have been more stringent than necessary. Instead, this rule imposes stringent limits in safety-critical areas, such as the WOCL, and less stringent limits in other areas, such as unaugmented FDPs that begin in the morning.

The FAA also notes that the uniform approach used in this rulemaking provides additional scheduling flexibility to air carriers. For example, because this rule does not differentiate between international and domestic flights (aside from acclimation and time-zone-crossing issues), this rule permits augmentation on domestic flights, which existing regulations do not allow. In addition, because this rule does not differentiate between supplemental passenger operations and other part 121 passenger flights, this rule does not require supplemental passenger operations to provide flightcrew members with additional compensatory rest that is mandated by existing regulations. Accordingly, this rule complies with Executive Order 12866 because it: (1) Has benefits that justify its costs, (2) is based on the best available scientific information, (3) was finalized after the FAA considered a number of other alternatives, and (4) is tailored to impose the least burden on society.

Voluntary Consensus

ATA argued that this rule should have used a voluntary consensus standard instead of a government-unique standard. ATA stated that OMB Circular A–119 requires agencies to use voluntary standards whenever possible, and that the short time span given to the ARC was not sufficient for the ARC to address the complex issues present in this rulemaking.

As an initial matter, the FAA notes that there is no voluntary consensus standard for the issues addressed by this rulemaking. The FAA disagrees with ATA's assertion that OMB Circular A–119 requires the FAA to use a voluntary consensus standard in this rulemaking. Subsection 6(c) of OMB Circular A–119 states that:

> This policy does not preempt or restrict agencies' authorities and responsibilities to make regulatory decisions authorized by statute. Such regulatory authorities and responsibilities include determining the level of acceptable risk; setting the level of protection; and balancing risk, cost, and availability of technology in establishing regulatory standards.

This rulemaking consists of the FAA exercising its regulatory responsibility and establishing the acceptable level of fatigue-related risk, setting the appropriate level of protection from fatigue, and balancing the risks of fatigue with the costs that will be borne by air carriers as a result of this rule. Because subsection 6(c) of OMB Circular A–119 excludes this type of agency action from the circular's requirements, OMB Circular A–119 does not preempt or restrict the FAA's statutory authority to conduct this rulemaking. *See id.*

[99] *See supra* notes 36–38.

Public Interest

ATA stated that this rule would also harm the public interest by: (1) Reducing the number of U.S. jobs by hurting the competitive nature of the U.S. air carrier industry; (2) harm the U.S. economy by imposing excessive costs on air carriers; (3) disrupt air travel and waste passengers' air time as a result of additional cancelled and delayed flights; and (4) disrupt critical air deliveries.

As discussed above, this rule does not hurt the competitive nature of the U.S. air carrier industry. This rule simply reflects a different conceptual approach that the FAA utilized in light of its significant operational experience with daily flight-time limits. With regard to the remaining concerns expressed in the comments, as discussed in the Regulatory Impact Analysis, the costs that are imposed by this rule are justified by the associated benefits of reducing the risk that passengers will be involved in an accident.

Two-Year Effective Date

RAA also stated that a two-year effective date for this rule may be too short given the magnitude of the changes being proposed, and the complex process, development, training, and system programming, testing and implementation that would be required to effect those changes cannot be properly accomplished in such a time period. RAA emphasized that the changes being proposed by this rule ''go to the very heart'' of an airline's operations.

The FAA understands that this rule imposes complex new requirements that go to the heart of an airline's operations. That is why this rule provides air carriers with two years to make changes to their existing flight schedules and operations and if necessary, to address any labor agreement issues. The FAA has determined that two years is a substantial period of time, and that a longer effective date is unwarranted in light of the fact that, as discussed above, existing regulations allow flightcrew members in passenger operations to accumulate unsafe amounts of fatigue.

Federal Motor Carrier Safety Administration Hours of Service Rulemaking

FMCSA has been engaged in long-term rulemaking related to its hours of service regulations for commercial truck drivers. Like the FAA, FMCSA is working to address the universality of factors that lead to fatigue. However, the FAA has taken a different approach in addressing fatigue risk among pilots than FMCSA has with respect to commercial truck drivers. This is because the two industries operate differently both in terms of the likely number of days the affected individuals work per month and the respective operating environments. For example, pilots regularly cross multiple time zones in a very short period of time—something that is simply not possible in other modes of transportation. Additionally, pilots may work several days that are very long, but then be off for an extended period of time, a practice that naturally imposes a non-regulatory restorative rest opportunity. Finally, the nature of commercial flying is such that under typical conditions, the actual operation is likely to require intense concentration primarily during take-offs and landings, with a constant, but generally predictable level of concentration required for other phases of flight.

In contrast, commercial truck drivers face an environment where they are required to share the highways with drivers who have not received specialized training and are not subject to any regulatory constraints that pilots are subject to. This environment could logically lead to a regulatory approach with different fatigue mitigators for daytime operations on congested highways, compared to nighttime operations, where the roads are less crowded but the risk of fatigue is greater.

IV. Regulatory Notices and Analyses

A. Regulatory Evaluation

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 and Executive Order 13563 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 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 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 (Pub. L. 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 final rule: (1) Has benefits that justify its costs even though under the base case scenario the quantified costs are greater than the quantified benefits, (2) is not 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) will have a significant economic impact on a substantial number of small entities; (5) will not create unnecessary obstacles to the foreign commerce of the United States; and (6) will not 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.

Total Benefits and Costs Over a 10 Year Period

We have analyzed the benefits and the costs associated with the requirements contained in this Final Rule over a 10 year period. We provide a range of estimates for our quantitative benefits. Our base estimate is $376 million ($247 million present value at 7% and $311 million present value at 3%) and our high case estimate is $716 million ($470 million present value at 7% and $593 million at 3%). The total estimated cost of the Final Rule is $390 million ($297 million present value at 7% and $338 million at 3%).

Additionally, the FAA believes there are substantial, non-quantified health benefits associated with the final rule. The agency has not evaluated the effect of fatigue on the overall, long-term health of the pilot community because those health impacts are unlikely to have an impact on aviation safety in a quantifiable manner. However, as ALPA noted in one of its meetings with OMB under its E.O. 12866 procedures, the societal cost associated with long-term fatigued-related health problems can be substantial.[100] Decreasing these costs

[100] See OMB submission from ALPA dated October 28, 2011. *http://www.whitehouse.gov/omb/oira_2120_meetings/.*

represents a societal benefit. While we have not quantified these potential benefits, they may well exceed the projected costs of the rule when added to our base case estimate.

The actual benefits of the final rule will depend upon the type and size of accident that the rule averts. We have provided a base case estimate, based on historical accidents and the regulatory structure in place at the time those accidents occurred, and a high estimate, based on a projection of future accidents that broadly reflect the historical accident profile. Neither estimate assumes a catastrophic accident aboard a large passenger aircraft. This is because no large passenger aircraft were represented in the historical accident analysis rather than because there is no fatigue-related risk to those operations. We note that preventing a single catastrophic accident with 61 people on board would cause this rule to be cost beneficial.

Total benefits over 10 years			
Estimate	Nominal (millions)	PV at 7% (millions)	PV at 3% (millions)
Base	$376	$247	$311
High	716	470	593
Total costs over 10 years			
Component	Nominal (millions)	PV at 7% (millions)	PV at 3% (millions)
Flight Operations	$236	$157	$191
Rest Facilities	138	129	134
Training	16	11	13
Total	390	297	338

Benefits of the Rule

The benefit analysis first examines the nature of fatigue, followed by its causes and how it relates to transportation. Second, it summarizes some recent findings on fatigue and occupational performance. Third, it looks at the magnitude of crew fatigue in Part 121 commercial aviation by briefly examining fatigue reports in the context of this final rule. We then re-analyze the likely effectiveness of the requirements contained in this final rule and the potential to decrease these types of accidents in the future. The FAA projects a likely number of preventable events that will occur in absence of this final rule. Finally, the agency estimates the benefits that will be derived from preventing such events and a range of benefits based upon likely scenarios.

Here the FAA provides a quantitative benefit estimate of historical-based accidents (base case), and a high case of expected benefits from future averted accidents once this rule is promulgated. Generally our benefit analysis begins using past history as an important reference from which to begin the benefit analysis. We believe the base case benefit estimate, which is based solely on the outcome of past accidents, may be low because today passenger load factors and aircraft size are already greater than they were in the past decade. We also note that this estimate may not fully take into account changes in regulatory requirements that postdate those accidents and that may mitigate the projected risk. As such, our base case estimate represents a snapshot of risk.

Airplane accidents are somewhat random both in terms of airplane size and the number of people on board. For these reasons, projections of future fatalities may be based on future risk exposure, and our projections are typically based on expected distributions around the mean. Our typical scenario incorporates increasing airplane size, expected load factors, and a breakeven analysis. However, our evaluation of the historical accidents showed a disproportionate risk among smaller, regional carriers. Accordingly, as we discuss below, the FAA has decided to base its high case estimate on preventing an accident in a regional jet airplane.

In response to comments, we have reduced the analysis period from the 20 years provided in the proposed regulatory analysis to 10 years here. We received comments disputing the use of a 20 year time frame for accidents stating the accident rate has declined over time. While noting the wide range of operations over the last 20 years, we shortened the accident history to the last ten years. A reduction in the length of the sample period introduces other problems, most importantly with less time there are fewer observations. Observations are important, as the nature of aviation accidents is that while they are rare events, very often these accidents result in severe, high consequences.

The FAA Office of Accident Investigation assessed the effectiveness of this rule to prevent the 6 fatigue-related accidents which occurred on passenger-carrying aircraft in a recent ten year period. This office used the Commercial Aviation Safety Team (CAST) methodology to assign a value to how effective the rule will be at preventing each accident. On average, we expect this rule would have been 52.5 percent effective in preventing the types of accidents had it been in effect over the last 10 years.

Base Case Estimate

The base case estimate only looks at the historical events as a specific reference point. In this estimate the exact number of fatalities for each past event is multiplied by the relative rule effectiveness score to obtain the historical number of deaths that would have been averted with the requirements contained in this final rule, had this rule been in effect at the time. The base case estimate supposes roughly six deaths will be averted annually. Multiplying six annual averted deaths by the $6.2 million value of statistical life equals $37 million annually. In addition, had the requirements been in place at the time of these historical accidents, $2 million in hull damage for each accident would have been averted, which equals $6 million for ten years or $0.6 million annually. When summed over the ten year period of analysis, the base case estimate is $376 million ($247 million present value at 7% and $311 million present value at 3%).

High Case Estimate

Because airplane accidents are relatively rare they are not necessarily representative of actual risk, especially with regard to airplane size and the number of people on-board. In addition, future conditions will be different than they were when the accident occurred. Thus, the base case represents a snapshot of the risk that fatigue introduces in the overall operating environment. It considers neither the forecasted increase in load factors nor the larger aircraft types. The future preventable events that this rule addresses will not exactly mirror the past events because the airplane types, utilization, and seating capacity have changed.

To quantify the expected benefits in the high case scenario, we narrowed the analysis to three of the six historic accidents which were catastrophic (all on board died). In this case the expected number of preventable catastrophic accidents equals the three accidents multiplied by the 52.5 percent effectiveness rate. Thus over a ten-year time period the expected number of preventable accidents is 1.575. Using the Poisson distribution there is roughly a 20 percent chance for no accident; however, there is also a 50 percent probability of two or more accidents.

While the 20 year accident history has a broader range of catastrophic accidents, in the shorter ten year historical period all the three catastrophic accidents were on regional airplanes. We recognize that as regional airplanes are smaller than the 'typical' passenger jet, assuming all future accidents would be on a regional jet may understate the relative risk across the fleet of aircraft affected by this rule. It does, however, represent historical accidents and may be somewhat representative actual future risk, since the mainline carriers typically have collective bargaining agreements that are already largely reflective of the requirements of this rule.[101]

The average size airplane in the forecast period is a B737/A320 with an expected number of passengers and crew of 123 given a forecasted 142 seat airplane and a load factor of 83 percent.[102] Even though there was a (relatively large) B757 passenger airplane accident in the 20 year history, if one looks at the past 10 years as truly representative of risk, the preventable accident would likely be on a regional airplane.

For the high case the FAA backed away from a benefit outcome based on mean fleet, flight hours, and occupant numbers because ultimately we were persuaded there was information which could not be ignored by the three regional passenger accidents occurring without a mainline passenger accident. For this reason, we selected an 88 seat regional jet (like an ERJ–175) to be the representative airplane for the high case. This size airplane is also consistent with the fact that regional operators are expected to fly somewhat larger airplanes in the future.

The expected benefit from this high case follows a simple methodology for estimating and then valuing the expected number of occupants in a prevented accident. With a total of 0.3 accidents per year over the ten year period multiplied by the 52.5 percent effectiveness rate, the analysis assumes 0.1575 average accidents per year. The estimated occupant value for each averted accident equals the average number of seats (88) multiplied by the load factor of 77% plus 4 crew members for a total of 72 averted fatalities. Each of these prevented fatalities is multiplied by a $6.2 million value of statistical life. The expected value of a preventable accident equals the sum of the averted fatalities at $446.4 million added to the value of the airplane hull loss ($8.15 million replacement value), for a prevented accident benefit of $454.6 million.[103] Over a ten year period the value of preventing the expected 1.575 accidents equals approximately $716 million ($470 million present value at 7% and $593 million present value at 3%).

Cost of the Rule

The total estimated cost of the Final Rule is $390 million ($297 million at 7% present value and $338 million at 3% present value). The FAA classified costs into three main components and estimated the costs for each component. Data was obtained from various industry sources; the sources of the data used in cost estimation are explained in each section. Flight operations cost accounts for 53 percent of the total present value cost of the rule. Rest facilities and fatigue training accounts for approximately 43 percent and 4 percent, respectively. Each of the main cost components is explained in-depth in the Regulatory Evaluation.

Cost component	Nominal cost (millions)	PV at 7% (millions)	PV at 3% (millions)
Flight Operations	$236	$157	$191
Rest Facilities	138	129	134
Training	16	11	13
Total	390	297	338

Alternatives Considered—The alternatives are shown in the section ''Final Regulatory Flexibility Analysis''

B. Final Regulatory Flexibility 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

[101] It is unusual that collective bargaining agreements would closely mirror regulatory requirements. However, flight and duty limitations are unique because they address both safety considerations, which are regulatory in nature, and lifestyle considerations, which are properly addressed in collective bargaining agreements. Because of the impact of collective bargaining agreements on the number of hours that pilots work, those agreements were considered by the FAA in calculating both the costs and benefits of this rule.

[102] Table 6, FAA Aerospace Forecasts Fiscal Years 2011.

[103] In contrast, the value of an averted all-cargo fatal accident would range between $20.35 million (loss of hull and 2 crewmembers) and $32.55 million (loss of hull and 4 crewmembers).

regulatory flexibility analysis as described in the RFA.

The FAA believes that this final rule will have a significant economic impact on a substantial number of small entities and therefore has performed final regulatory flexibility analysis in accordance with section 604(a)(1)–(5), highlighted below:

1. A succinct statement of the need for, and objectives of, the rule.

2. A summary of the significant issues raised by the public comments in response to the IRFA, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments.

3. A description and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available.

4. A description of the projected reporting, recordkeeping, and other compliance requirements of the rule, including an estimate of the classes of small entities that will be subject to the requirement and the types of professional skills necessary for preparation of the report or record.

5. A description of the steps the agency has taken to minimize the significant adverse economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each of the other significant alternatives to the rule considered by the agency were rejected. We address each requirement.

1. A Succinct Statement of the Need for, and Objectives of, the Rule

This final rule amends the FAA's existing flight, duty and rest regulations applicable to certificate holders and their flightcrew members operating under 14 CFR Part 121. The rule recognizes 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 eliminate the current distinctions between domestic, flag and supplemental operations as they apply to passenger operations. The rule 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. 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.

2. A Summary of the Significant Issues Raised by the Public Comments in Response to the IRFA, a Summary of the Assessment of the Agency of Such Issues, and a Statement of Any Changes Made in the Proposed Rule as a Result of Such Comments

NAA, NJASAP, Southern Air, Lynden Air Cargo, NACA and U.S. Chamber of Commerce stated that RFA of the proposed rule failed to address the full burden to be borne by small entities, such as nonscheduled air carriers, and that the FAA did not follow RFA requirements in addressing alternative means of compliance that would lessen the economic burden on small entities.

Since the NPRM, the FAA has made substantial changes to the duty and rest requirements that will significantly reduce the cost to small entities.

3. A Description and an Estimate of the Number of Small Entities to Which the Rule Will Apply or an Explanation of Why No Such Estimate Is Available

The final rule applies to all certificate holders operating under part 121 who conduct passenger operations. There are 67 such operators, of which 55 operators have fewer than 1,500 employees.

4. A Description of the Projected Reporting, Recordkeeping, and Other Compliance Requirements of the Rule, Including an Estimate of the Classes of Small Entities That Will Be Subject to the Requirement and the Types of Professional Skills Necessary for Preparation of the Report or Record

As described in the Paperwork Reduction Analysis, there are additional compliance requirements for reporting and recordkeeping.

5. A Description of the Steps the Agency Has Taken To Minimize the Significant Adverse Economic Impact on Small Entities Consistent With the Stated Objectives of Applicable Statutes, Including a Statement of the Factual, Policy, and Legal Reasons for Selecting the Alternative Adopted in the Final Rule and Why Each of the Other Significant Alternatives to the Rule Considered by the Agency was Rejected.

Current crew schedules vary by operator, labor contract, and size of pilot pools. As such, the impact to small entity operators will vary. 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 and we have taken steps to minimize the economic impact on small entities. In response to several comments from small entities, the FAA has made significant changes from the proposal in this final rule which will minimize the economic impact on small entities. In addition, the FAA has largely removed schedule reliability from this rule. The FAA has instead adopted provisions that limit extensions of the FDP and requires reporting of FDP extensions and activities that were not otherwise permitted by the provisions of § 117.11, § 117.19 and § 117.29 in the Final Rule. Under this amendment, costs to airline carriers are limited to reporting exceptional activities by sending electronic mails to the FAA.

Alternative—Require Four Hours' Mid-duty Rest To Work on Give Consecutive Nighttime FDPs

This final rule reduces (to two hours) the amount of mid-duty rest necessary to work on five consecutive nighttime FDPs. The FAA rejected the higher mid-duty rest requirement proposed in the NPRM because of the potential negative impact on small businesses and the safety risks that are discussed in the pertinent part of the preamble.

Alternative—Different Limitations on Supplemental Passenger Operations

The FAA has considered imposing different limitations on small supplemental passenger operations but has rejected this alternative. The FAA has decided to impose the same FDP limits on passenger supplemental operations as other part 121 operations. While there are relatively few supplemental passenger operations, the FAA has determined that these pilots should be as rested as those in scheduled service since the numbers of passengers onboard the aircraft are similar to those on board an aircraft operating as a scheduled service. Furthermore, a significant number of these operations involve the transport of troops. The United States government believes these passengers should not be exposed to a level of risk different from if they were transported via a scheduled service operation.

Alternative—Exclude/Exempt Supplemental Passenger Operations

The FAA has also considered excluding supplemental passenger operations from this rule but rejected this alternative for the same reasons that it rejected the alternative of imposing different limitations on supplemental passenger operations. In addition, the FAA has noted that its decision to include supplemental operations in this

rule was not specifically targeted at small businesses because many large air carriers also have supplemental authority.

Alternative—Require All-Cargo Operators To Comply With the Final Rule

The FAA has also considered requiring all-cargo operators to comply with part 117. However, the FAA decided to make compliance with this part voluntary for all-cargo operations because their compliance costs significantly exceed the quantified safety benefits.

C. International Trade Impact Assessment

A number of industry commenters argued that finalizing the NPRM as written would undermine the ability of U.S. air carriers to compete with foreign air carriers. These commenters stated that 49 U.S.C. 40101(a)(15) and (e)(1) require the Secretary of Transportation to ensure that U.S. air carriers compete on equal terms with foreign carriers. The commenters then pointed out that this rule contains provisions, such as daily flight-time limits, that are not a part of analogous foreign regulations, and that these provisions hurt the international competitive position of U.S. air carriers who are subject to this rule.

The industry commenters added that the imposition of daily flight-time limits, which are not contained in foreign aviation regulations, creates an unnecessary obstacle to the foreign commerce of the United States, and thus violates the Trade Agreements Act of 1979 (TAA) (codified at 19 U.S.C. sections 2531–2533). The commenters also argued that by imposing daily flight-time limits, the FAA did not properly consider other international standards, and thus violated the TAA, OMB Circular A–119, and Executive Order 12866, all of which require the FAA to consider international standards.

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards.[104] The FAA has assessed the potential effect of this final rule and determined that it would enhance safety and is not considered an unnecessary obstacle to trade.

The flight-time limits in this rule do not undermine the international competitive position of U.S. air carriers. While this rule sets daily flight-time limits that many foreign aviation rules do not contain, the additional fatigue mitigation created by the daily flight-time limits permits the FAA to set less stringent requirements in other parts of this rule. For example, this rule only requires a 10-hour rest period between FDPs instead of the 12-hour rest period required by many foreign flight, duty, and rest regulations. This rule also permits 14-hour FDPs for periods of peak circadian alertness while some foreign regulations, such as EU Rules, Subpart Q, only permit FDPs that do not exceed 13 hours.[105]

As the above examples demonstrate, the imposition of daily flight-time limits is simply the result of a different conceptual approach that was utilized by the FAA. The FAA chose this approach because it has significant operational experience administering daily flight-time limits, and the FAA chose to employ this experience to better calibrate the specific provisions of this rule. This difference in approach does not undermine the competitive position of U.S. air carriers because the imposition of daily flight-time limits permitted the FAA to make other parts of this rule less stringent than the analogous provisions of foreign flight, duty, and rest regulations.

D. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 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 final rule does not contain such a mandate; therefore, the requirements of Title II do not apply.

E. Paperwork Reduction Act

The paperwork burden comprises of five areas, fatigue risk management system § 117.7, fatigue training § 117.9, flight time limitation § 117.11, and flight duty period extension reporting § 117.19 and Emergency and government sponsored operations § 117.29. The following analyses were conducted under Paperwork Reduction Act of 1995 (44 U.S.C. 3501).

(1) PRA analysis for reporting fatigue risk management system (FRMS) § 117.7 provision

The final rule will allow each air carrier to develop a Fatigue Risk Management System (FRMS) if it wishes. FRMS is a voluntary program in the final rule. It will result in an annual recordkeeping and reporting burden if some of industry carriers eventually adopt the system so that they need to report the related activities to the FAA. Total FRMS annualized paperwork burden is determined by the numbers of FRMS to be developed and FRMS reporting cost per responders. FAA estimated that FRMS will incur the paperwork burden about $14,950 annually, $149,500 nominal cost for 10 years or $99,186 present value at 7%. FAA took steps to arrive the estimate as follows.

a. Number of respondents (air carriers): the FAA estimated approximately 20 carriers or respondents;

b. Estimated time of paperwork: about 11.5 hours per air carrier and 230 hours in total for data collection, annual FRMS record-keeping and reporting required by the FAA;

c. Average hourly wage rate of a FRMS information respondent (manager level): $65 per hour for reporting and analyzing FRMS data;

d. FRMS paperwork hour estimation: total 230 hours (11.5 hours × 20 estimated carriers);

e. Total annualized cost of FRMS paperwork is about $14,950 ($1,253.50 × 20) for the estimated 20 carriers.

f. The nominal cost for 10-year is $149,500 or $99,186 present value at 7%.

(2) PRA analysis for fatigue training § 117.9 provision

The fatigue training requirement in the final rule will also result in an annual recordkeeping and reporting burden. Total fatigue training annualized paperwork burden costs are determined by the numbers of responders and fatigue training reporting cost per responders. FAA

[104] As discussed in the International Compatibility section, there are no ''international standards'' to consider.

[105] *See* EU Rules, Subpart Q, OPS 1.1100, section 1.3 and OPS 1.1110, section 1.1.

estimated that the fatigue training will incur the paperwork burden approximately 2,345 hours, $152,425 for the first year, $1.5 million nominal cost for 10 years or $1 million present value at 7%. FAA took steps to arrive the estimate as follows.

a. Number of responders (dispatchers and managers): 67 operators;

b. Estimated time needed for each responder: 35 hours, or 2,345 hours incurred by 67 responders;

c. Average hourly wage rate of trainee: $65 per hour;

d. Fatigue training paperwork cost: $152,425 per annum ($65 hourly wage rate × 2,345 hours);

(3) PRA analysis for § 117.11, § 117.19 and § 117.29 provisions

The FAA combined the cost estimates in one PRA analysis for three provisions of the final rule (§ 117.11, § 117.19 and § 117.29), since paperwork burdens for carriers to report activities that were not otherwise permitted by § 117.11, § 117.19 and § 117.29 are the same. Reporting and recordkeeping by carriers can be done electronically by addressing the facts of events. Under the above provisions, carriers do not need to conduct complicated analyses, so that there will be no paperwork burden of analyses. In this analysis, the estimate of paperwork burden will be determined by the numbers of respondents, the frequencies of their reporting, hours required and the reporter's wage rate. The FAA estimated the final annual paperwork burden for three provisions is $92,250, and $0.9 million for the 10-years nominal cost, or the present value of $0.6 million at 7%, by taking steps to arrive the estimate as follows.

a. Number of respondents (air carriers): there are 67 carriers or respondents;

b. Estimated frequencies for reporting requirements under each provision: Although a definitive frequency is unknown and will decrease as certificate holders adapt the changes, the FAA assumes an average of 6 times per year for each provision;

c. Estimated total frequencies of annual responses: 18 times (6 × 3) per carrier and 1,206 times (67 × 18) by 67 carriers for these three provisions of the final rule;

d. Estimated time needed for each report for each occurrence: 30 minutes, one hundred percent of these responses will be collected electronically. The time needed for each carrier to report is about 9 hours (18 × 30 minutes), and 603 hours in total by 67 carriers for these three provisions of the final rule;

e. Estimated hourly wage rate of reporting staff: $65 per hour;

f. The estimated total annual cost of reporting is about $39,195 (603 hours × $65);

g. The nominal cost for 10-years is about $0.4 million or the present value of $0.24 million at 7%.

Summarizing the above, the annualized cost is approximately $194,950 and the total nominal cost for 10-years about $2.1 million ($0.15 million + $1.5 million + $0.4 million) or the present value of approximately $1.3 million at 7% ($0.1 + $1 million + $0.2 million). The public reporting burden is estimated to be an average of 47 hours for each Part 121 certificate holder and 3,178 hours, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The total annual cost burden is approximately $204,950 in total for 67 carriers. There will be no additional annualized cost to the Federal Government, because FAA will not add additional staff or pay additional contractors for collecting, viewing and keeping electronic report-emails.

F. International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that there are no ICAO Standards and Recommended Practices that directly correspond to these regulations.[106]

G. 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 rulemaking action qualifies for the categorical exclusion identified in paragraph 312f and involves no extraordinary circumstances.

[106] Chapter 4 of ICAO 6, Amendment 33, section 4.2.10.2 states the following:

Fatigue management. An operator shall establish flight time and duty period limitations and a rest scheme that enable it to manage the fatigue of all its flight and cabin crew members. This scheme shall comply with the regulations established by the State of the Operator, or approved by that State and shall be included in the operations manual.

This provision of ICAO is not inconsistent with this rule. Moreover, because the ICAO provision defers to the regulations promulgated by the State of the Operator, it does not even directly correspond to this rule.

V. Executive Order Determinations

A. Executive Order 12866 and 13563

See the ''Regulatory Evaluation'' discussion in the ''Regulatory Notices and Analyses'' section elsewhere in this preamble.

B. Executive Order 13132, Federalism

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

C. Executive Order 13211, Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this final rule 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 and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

VI. How To Obtain Additional Information

A. Rulemaking Documents

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

1. Search the Federal eRulemaking Portal (*http://www.regulations.gov*);

2. Visit the FAA's Regulations and Policies Web page at *http://www.faa.gov/regulations_policies/* or

3. Access the Government Printing Office's Web page at *http://www.gpoaccess.gov/fr/index.html.*

Copies may also be obtained by sending a request (identified by notice, amendment, or docket number of this rulemaking) to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267–9680.

B. Comments Submitted to the Docket

Comments received may be viewed by going to *http://www.regulations.gov* and following the online instructions to search the docket number for this action. Anyone is able to search the electronic form of all comments received into any of the FAA's dockets by the name of the individual submitting the comment (or signing the

comment, if submitted on behalf of an association, business, labor union, *etc.*).

C. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. A small entity with questions regarding this document, may contact its local FAA official, or the person listed under the **FOR FURTHER INFORMATION CONTACT** heading at the beginning of the preamble. To find out more about SBREFA on the Internet, visit *http://www.faa.gov/regulations_policies/rulemaking/sbre_act/.*

List of Subjects

14 CFR Part 117

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

14 CFR Part 119

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

14 CFR Part 121

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

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends 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 Fatigue education and awareness training program.
117.11 Flight time limitation.
117.13 Flight duty period: Unaugmented operations.
117.15 Flight duty period: Split duty.
117.17 Flight duty period: Augmented flightcrew.
117.19 Flight duty period extensions.
117.21 Reserve status.
117.23 Cumulative limitations.
117.25 Rest period.
117.27 Consecutive nighttime operations.
117.29 Emergency and government sponsored operations.
Table A to Part 117—Maximum Flight Time Limits for Unaugmented Operations
Table B to Part 117—Flight Duty Period: Unaugmented 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.

(a) This part prescribes flight and duty limitations and rest requirements for all flightcrew members and certificate holders conducting passenger operations under part 121 of this chapter.

(b) This part applies to all operations directed by part 121 certificate holders under part 91, other than subpart K, of this chapter if any segment is conducted as a domestic passenger, flag passenger, or supplemental passenger operation.

(c) This part applies to all flightcrew members when participating in an operation under part 91, other than subpart K of this chapter, on behalf of the part 121 certificate holder if any flight segment is conducted as a domestic passenger, flag passenger, or supplemental passenger operation

(d) Notwithstanding paragraphs (a), (b) and (c) of this section, a certificate holder may conduct under part 117 its part 121 operations pursuant to 121.470, 121.480, or 121.500.

§ 117.3 Definitions.

In addition to the definitions in §§ 1.1 and 110.2 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 flightcrew member 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 flightcrew member is required by a certificate holder to be at 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 using Coordinated Universal Time or local time.

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.

Deadhead transportation means transportation of a flightcrew member as a passenger or non-operating flightcrew member, by any mode of transportation, as required by a certificate holder, excluding transportation to or from a suitable accommodation. All time spent in deadhead transportation is duty and is not rest. For purposes of determining the maximum flight duty period in Table B of this part, deadhead transportation is not considered a flight segment.

Duty means any task that a flightcrew member performs as required by the certificate holder, including but not limited to flight duty period, flight duty, pre- and post-flight duties, administrative work, training, deadhead transportation, aircraft positioning on the ground, aircraft loading, and aircraft servicing.

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

Fatigue risk management system (FRMS) means a management system for a certificate holder 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 at 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 the duties performed by the flightcrew member on behalf of the certificate holder that occur before a flight segment or between flight segments without a required intervening rest period. Examples of tasks that are part of the flight duty period include deadhead transportation, training conducted in an aircraft or flight simulator, and airport/standby reserve, if the above tasks occur before a flight segment or between flight segments without an intervening required rest period:

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

Lineholder means a flightcrew member who has an assigned flight duty

period and is not acting as a reserve flightcrew member.

Long-call reserve means that, prior to beginning the rest period required by § 117.25, the flightcrew member is notified by the certificate holder to report for a flight duty period following the completion of the rest period.

Physiological night's rest means 10 hours of rest that encompasses the hours of 0100 and 0700 at the flightcrew member's home base, unless the individual has acclimated to a different theater. If the flightcrew member has acclimated to a different theater, 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 flightcrew member to report for an assignment.

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

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 or seat accommodation installed in an aircraft that provides a flightcrew member 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 flightcrew member 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 flightcrew members.

(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 flightcrew member is free from all restraint by the certificate holder, including freedom from present responsibility for work should the occasion arise.

Scheduled means to appoint, assign, or designate for a fixed time.

Short-call reserve means a period of time in which a flightcrew member is assigned to a reserve availability 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 and the ability to control light that provides a flightcrew member with the ability to sleep either in a bed, bunk or in a chair that allows for flat or near flat sleeping position. Suitable accommodation only applies to ground facilities and does not apply to aircraft onboard rest facilities.

Theater means a geographical area where local time at the flightcrew member's flight duty period departure point and arrival point differ by more than 60 degrees longitude.

Unforeseen operational circumstance means an unplanned event of insufficient duration to allow for adjustments to schedules, including unforecast weather, equipment malfunction, or air traffic delay that is not reasonably expected.

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.

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

(d) 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.

§ 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 safety 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.

§ 117.9 Fatigue education and awareness training program.

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

(b) The fatigue education and awareness training program must be designed to increase awareness of:

(1) Fatigue;

(2) The effects of fatigue on pilots; and

(3) Fatigue countermeasures

(c) (1) Each certificate holder must update its fatigue education and awareness training program every two years and submit the update to the Administrator for review and acceptance.

(2) Not later than 12 months after the date of submission of the fatigue education and awareness training program required by (c)(1) of this section, the Administrator shall review and accept or reject the update. If the Administrator rejects an update, the Administrator shall provide suggested modifications for resubmission of the update.

§ 117.11 Flight time limitation.

(a) 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:

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

(2) Will exceed 13 hours if the operation is conducted with a 3-pilot flightcrew.

(3) Will exceed 17 hours if the operation is conducted with a 4-pilot flightcrew.

(b) If unforeseen operational circumstances arise after takeoff that are beyond the certificate holder's control, a flightcrew member may exceed the maximum flight time specified in paragraph (a) of this section and the cumulative flight time limits in 117.23(b) to the extent necessary to safely land the aircraft at the next destination airport or alternate, as appropriate.

(c) Each certificate holder must report to the Administrator within 10 days any flight time that exceeded the maximum

flight time limits permitted by this section. The report must contain the following:

(1) A description of the extended flight time limitation and the circumstances surrounding the need for the extension; and

(2) If the circumstances giving rise to the extension were within the certificate holder's control, the corrective action(s) that the certificate holder intends to take to minimize the need for future extensions.

(d) Each certificate holder must implement the corrective action(s) reported in paragraph (c)(2) of this section within 30 days from the date of the extended flight time limitation.

§ 117.13 Flight duty period: Unaugmented operations.

(a) Except as provided for in § 117.15, 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 theater in which the flightcrew member was last acclimated.

§ 117.15 Flight duty period: Split duty.

For an unaugmented operation only, if a flightcrew member is provided with a rest opportunity (an opportunity to sleep) in a suitable accommodation during his or her flight duty period, the time that the flightcrew member spends in the suitable accommodation is not part of that flightcrew member's flight duty period if all of the following conditions are met:

(a) The rest opportunity is provided between the hours of 22:00 and 05:00 local time.

(b) The time spent in the suitable accommodation is at least 3 hours, measured from the time that the flightcrew member reaches the suitable accommodation.

(c) The rest opportunity is scheduled before the beginning of the flight duty period in which that rest opportunity is taken.

(d) The rest opportunity that the flightcrew member is actually provided may not be less than the rest opportunity that was scheduled.

(e) The rest opportunity is not provided until the first segment of the flight duty period has been completed.

(f) The combined time of the flight duty period and the rest opportunity provided in this section does not exceed 14 hours.

§ 117.17 Flight duty period: Augmented 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 theater in which the flightcrew member was last acclimated.

(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 in the second half of the flight duty period are available for in-flight rest for the pilot flying the aircraft during landing.

(2) Ninety consecutive minutes are available for in-flight rest for the pilot performing monitoring duties during landing.

(d) No certificate holder may assign and no flightcrew member may accept an assignment involving more than three flight segments under this section.

(e) At all times during flight, at least one flightcrew member qualified in accordance with § 121.543(b)(3)(i) of this chapter must be at the flight controls.

§ 117.19 Flight duty period extensions.

(a) For augmented and unaugmented operations, if unforeseen operational circumstances arise prior to takeoff:

(1) The pilot in command and the certificate holder may extend the maximum flight duty period permitted in Tables B or C of this part up to 2 hours.

(2) An extension in the flight duty period under paragraph (a)(1) of this section of more than 30 minutes may occur only once prior to receiving a rest period described in § 117.25(b).

(3) A flight duty period cannot be extended under paragraph (a)(1) of this section if it causes a flightcrew member to exceed the cumulative flight duty period limits specified in 117.23(c).

(4) Each certificate holder must report to the Administrator within 10 days any flight duty period that exceeded the maximum flight duty period permitted in Tables B or C of this part by more than 30 minutes. The report must contain the following:

(i) A description of the extended flight duty period and the circumstances surrounding the need for the extension; and

(ii) If the circumstances giving rise to the extension were within the certificate holder's control, the corrective action(s) that the certificate holder intends to take to minimize the need for future extensions.

(5) Each certificate holder must implement the corrective action(s) reported in paragraph (a)(4) of this section within 30 days from the date of the extended flight duty period.

(b) For augmented and unaugmented operations, if unforeseen operational circumstances arise after takeoff:

(1) The pilot in command and the certificate holder may extend maximum flight duty periods specified in Tables B or C of this part to the extent necessary to safely land the aircraft at the next destination airport or alternate airport, as appropriate.

(2) An extension of the flight duty period under paragraph (b)(1) of this section of more than 30 minutes may occur only once prior to receiving a rest period described in § 117.25(b).

(3) An extension taken under paragraph (b) of this section may exceed the cumulative flight duty period limits specified in 117.23(c).

(4) Each certificate holder must report to the Administrator within 10 days any flight duty period that exceeded the maximum flight duty period limits permitted by Tables B or C of this part. The report must contain a description of the circumstances surrounding the affected flight duty period.

§ 117.21 Reserve status.

(a) Unless specifically designated as airport/standby or short-call reserve by the certificate holder, all reserve is considered long-call reserve.

(b) Any reserve that meets the definition of airport/standby reserve must be designated as airport/standby reserve. 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) The reserve availability period may not exceed 14 hours.

(2) For a flightcrew member who has completed a reserve availability period, no certificate holder may schedule and no flightcrew member may accept an assignment of a reserve availability period unless the flightcrew member receives the required rest in § 117.25(e).

(3) For an unaugmented operation, the total number of hours a flightcrew member may spend in a flight duty period and a reserve availability period

may not exceed the lesser of the maximum applicable flight duty period in Table B of this part plus 4 hours, or 16 hours, as measured from the beginning of the reserve availability period.

(4) For an augmented operation, the total number of hours a flightcrew member may spend in a flight duty period and a reserve availability period may not exceed the flight duty period in Table C of this part plus 4 hours, as measured from the beginning of the reserve availability period.

(d) For long call reserve, 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 certificate holder.

(e) A certificate holder may shift a reserve flightcrew member's reserve status from long-call to short-call only if the flightcrew member receives a rest period as provided in § 117.25(e).

§ 117.23 Cumulative limitations.

(a) The limitations of this section include all flying by flightcrew members on behalf of any certificate holder or 91K Program Manager 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 672 consecutive hours 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.

§ 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.

(c) If a flightcrew member operating in a new theater has received 36 consecutive hours of rest, that flightcrew member is acclimated and the rest period meets the requirements of paragraph (b) of this section.

(d) If a flightcrew member travels more than 60° longitude during a flight duty period or a series of flight duty periods that require him or her to be away from home base for more than 168 consecutive hours, the flightcrew member must be given a minimum of 56 consecutive hours rest upon return to home base. This rest must encompass three physiological nights' rest based on local time.

(e) No certificate holder may schedule and no flightcrew member may accept an assignment for any reserve or flight duty period unless the flightcrew member is given a rest period of at least 10 consecutive hours immediately before beginning the reserve or flight duty period measured from the time the flightcrew member is released from duty. The 10 hour rest period must provide the flightcrew member with a minimum of 8 uninterrupted hours of sleep opportunity.

(f) If a flightcrew member determines that a rest period under paragraph (e) of this section will not provide eight uninterrupted hours of sleep opportunity, the flightcrew member must notify the certificate holder. The flightcrew member cannot report for the assigned flight duty period until he or she receives a rest period specified in paragraph (e) of this section.

(g) If a flightcrew member engaged in deadhead transportation exceeds the applicable flight duty period in Table B of this part, the flightcrew member must be given a rest period equal to the length of the deadhead transportation but not less than the required rest in paragraph (e) of this section before beginning a flight duty period.

§ 117.27 Consecutive nighttime operations.

A certificate holder may schedule and a flightcrew member may accept up to five consecutive flight duty periods that infringe on the window of circadian low if the certificate holder provides the flightcrew member with an opportunity to rest in a suitable accommodation during each of the consecutive nighttime flight duty periods. The rest opportunity must be at least 2 hours, measured from the time that the flightcrew member reaches the suitable accommodation, and must comply with the conditions specified in § 117.15(a), (c), (d), and (e). Otherwise, no certificate holder may schedule and no flightcrew member may accept more than three consecutive flight duty periods that infringe on the window of circadian low. For purposes of this section, any split duty rest that is provided in accordance with § 117.15 counts as part of a flight duty period.

§ 117.29 Emergency and government sponsored operations.

(a) This section applies to operations conducted pursuant to contracts with the U.S. Government and operations conducted pursuant to a deviation under § 119.57 of this chapter that cannot otherwise be conducted under this part because of 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) The pilot-in-command may determine that maximum applicable flight duty periods must be exceeded to the extent necessary to allow the flightcrew to fly to the closest 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) A flight duty period may not be extended for an operation conducted pursuant to a contract with the U.S. Government if it causes a flightcrew member to exceed the cumulative flight time limits in § 117.23(b) and the cumulative flight duty period limits in § 117.23(c).

(d) 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.

(e) Each certificate holder must report within 10 days:

(1) Any flight duty period that exceeded the maximum flight duty period permitted in Tables B or C of this part, as applicable, by more than 30 minutes; and

(2) Any flight time that exceeded the maximum flight time limits permitted in Table A of this part and § 117.11, as applicable.

(f) The report must contain the following:

(1) A description of the extended flight duty period and flight time limitation, and the circumstances surrounding the need for the extension; and

(2) If the circumstances giving rise to the extension(s) were within the certificate holder's control, the corrective action(s) that the certificate holder intends to take to minimize the need for future extensions.

(g) Each certificate holder must implement the corrective action(s) reported pursuant to paragraph (e)(2) of

this section within 30 days from the date of the extended flight duty period.

TABLE A TO PART 117—MAXIMUM FLIGHT TIME LIMITS FOR UNAUGMENTED OPERATIONS TABLE

Time of report (acclimated)	Maximum flight time (hours)
0000–0459	8
0500–1959	9

TABLE A TO PART 117—MAXIMUM FLIGHT TIME LIMITS FOR UNAUGMENTED OPERATIONS TABLE—Continued

Time of report (acclimated)	Maximum flight time (hours)
2000–2359	8

TABLE B TO PART 117—FLIGHT DUTY PERIOD: UNAUGMENTED OPERATIONS

Scheduled time of start (acclimated time)	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	10	10	9	9	9
0500–0559	12	12	12	12	11.5	11	10.5
0600–0659	13	13	12	12	11.5	11	10.5
0700–1159	14	14	13	13	12.5	12	11.5
1200–1259	13	13	13	13	12.5	12	11.5
1300–1659	12	12	12	12	11.5	11	10.5
1700–2159	12	12	11	11	10	9	9
2200–2259	11	11	10	10	9	9	9
2300–2359	10	10	10	9	9	9	9

TABLE C TO PART 117—FLIGHT DUTY PERIOD: AUGMENTED OPERATIONS

Scheduled time of start (acclimated 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	15	17	14	15.5	13	13.5
0600–0659	16	18.5	15	16.5	14	14.5
0700–1259	17	19	16.5	18	15	15.5
1300–1659	16	18.5	15	16.5	14	14.5
1700–2359	15	17	14	15.5	13	13.5

PART 119—CERTIFICATION: AIR CARRIERS AND COMMERCIAL OPERATORS

■ 2. The authority citation for part 119 continues to read as follows:

Authority: 49 U.S.C. 106(g), 1153, 40101, 40102, 40103, 40113, 44105, 44106, 44111, 44701–44717, 44722, 44901, 44903, 44904, 44906, 44912, 44914, 44936, 44938, 46103, 46105.

■ 3. In § 119.55, revise paragraph (a) to read as follows:

§ 119.55 Obtaining deviation authority to perform operations under a U.S. military contract.

(a) The Administrator may authorize a certificate holder that is authorized to conduct supplemental or on-demand operations to deviate from the applicable requirements of this part, part 117, part 121, or part 135 of this chapter in order to perform operations under a U.S. military contract.

* * * * *

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

■ 4. The authority section 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.

■ 5. In § 121.467, revise paragraphs (c) introductory text and (c) (1) to read as follows:

§ 121.467 Flight attendant duty period limitations and rest requirements: Domestic, flag, and supplemental operations.

* * * * *

(c) Notwithstanding paragraph (b) of this section, a certificate holder conducting domestic, flag, or supplemental operations may apply the flightcrew member flight time and duty limitations and requirements of part 117 of this chapter to flight attendants for all operations conducted under this part provided that—

(1) The flightcrew is subject to part 117;

* * * * *

Subpart Q [Amended]

■ 6. Revise § 121.470 to read as follows:

§ 121.470 Applicability.

This subpart prescribes flight time limitations and rest requirements for domestic all-cargo operations, except that:

(a) Certificate holders conducting operations with airplanes having a passenger seat configuration of 30 seats or fewer, excluding each crewmember seat, and a payload capacity of 7,500 pounds or less, may comply with the

applicable requirements of §§ 135.261 through 135.273 of this chapter.

(b) Certificate holders conducting scheduled operations entirely within the States of Alaska or Hawaii with airplanes having a passenger seat configuration of 30 seats or fewer, excluding each crewmember seat, and a payload capacity of 7,500 pounds or less, may comply with the applicable requirements of subpart R of this part for those operations.

(c) A certificate holder may apply the flightcrew member flight time and duty limitations and requirements of part 117 of this chapter. A certificate holder may choose to apply part 117 to its—

(1) Cargo operations conducted under contract to a U.S. government agency.

(2) All-cargo operations not conducted under contract to a U.S. Government agency,

(3) A certificate holder may elect to treat operations in paragraphs (c)(1) and (c)(2) of this section differently but, once having decided to conduct those operations under part 117, may not segregate those operations between this subpart and part 117.

■ 7. Add § 121.473 to read as follows:

§ 121.473 Fatigue risk management system.

(a) No certificate holder may exceed any provision of this subpart unless approved by the FAA under a Fatigue Risk Management System.

(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.

Subpart R—[Amended]

■ 8. Revise § 121.480 to read as follows:

§ 121.480 Applicability.

This subpart prescribes flight time limitations and rest requirements for flag all-cargo operations, except that:

(a) Certificate holders conducting operations with airplanes having a passenger seat configuration of 30 seats or fewer, excluding each crewmember seat, and a payload capacity of 7,500 pounds or less, may comply with the applicable requirements of §§ 135.261 through 135.273 of this chapter.

(b) A certificate holder may apply the flightcrew member flight time and duty limitations and requirements of part 117 of this chapter. A certificate holder may choose to apply part 117 to its—

(1) All-cargo operations conducted under contract to a U.S. government agency.

(2) All-cargo operations not conducted under contract to a U.S. Government agency,

(3) A certificate holder may elect to treat operations in paragraphs (b)(1) and (b) (2) of this section differently but, once having decided to conduct those operations under part 117, may not segregate those operations between this subpart and part 117.

■ 9. Add § 121.495 to read as follows:

§ 121.495 Fatigue risk management system.

(a) No certificate holder may exceed any provision of this subpart unless approved by the FAA under a Fatigue Risk Management System.

(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.

Subpart S—[Amended]

■ 10. Revise § 121.500, to read as follows:

§ 121.500 Applicability.

This subpart prescribes flight time limitations and rest requirements for supplemental all-cargo operations, except that:

(a) Certificate holders conducting operations with airplanes having a passenger seat configuration of 30 seats or fewer, excluding each crewmember seat, and a payload capacity of 7,500 pound or less, may comply with the applicable requirements of §§ 135.261 through 135.273 of this chapter.

(b) A certificate holder may apply the flightcrew member flight time and duty limitations and requirements of part 117 of this chapter. A certificate holder may choose to apply part 117 to its—

(1) All-cargo operations conducted under contract to a U.S. Government agency.

(2) All-cargo operations not conducted under contract to a U.S. Government agency,

(3) A certificate holder may elect to treat operations in paragraphs (b)(1) and (b)(2) of this section differently but, once having decided to conduct those operations under part 117, may not segregate those operations between this subpart and part 117.

■ 11. Add § 121.527 to read as follows:

§ 121.527 Fatigue risk management system.

(a) No certificate holder may exceed any provision of this subpart unless approved by the FAA under a Fatigue Risk Management System.

(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.

12. In § 121.583, revise paragraph (a) introductory text to read as follows:

§ 121.583—Carriage of persons without compliance with the passenger-carrying requirements of this part and part 117.

(a) When authorized by the certificate holder, the following persons, but no others, may be carried aboard an airplane without complying with the passenger-carrying airplane requirements in §§ 121.309(f), 121.310, 121.391, 121.571, and 121.587; the passenger-carrying operation requirements in part 117 and §§ 121.157(c) and 121.291; and the requirements pertaining to passengers in §§ 121.285, 121.313(f), 121.317, 121.547, and 121.573:

* * * * *

Issued in Washington, DC, on December 21, 2011.

Michael P. Huerta,

Acting Administrator.

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