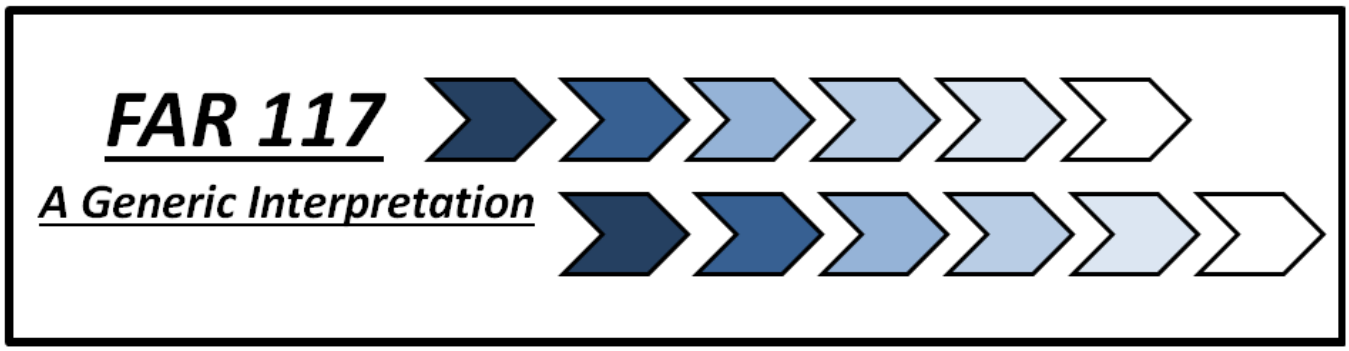
Understanding FAR Part 117

Acclimatization – Differences in Regulatory Schemes



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Abstract:

On January 4, 2012 the Federal Aviation Administration published the Final Notice of proposed rule making (FNPRM) for this regulation.

The purpose of this document is to provide an explanation of the methods and criteria for the application of FAR 117 as amended on 16-May-2012 and 05-Feb-2013 and clarified on 05-Mar-2013.

This document will allow the reader to understand the science concerning Time Zone Acclimatization, the processes for compliance with FAR 117, as well as comparisons with other regulatory schemes in force or being proposed in other jurisdictions.

Sleep Science

Jet lag is a temporary disorder among air travelers who rapidly travel across 3 or more time zones. Jet lag results from the slow adjustment of the body clock to the destination time, so that daily rhythms and the internal drive for sleep and wakefulness are out of synchronization with the new environment.

Time zone adaptation differs when traveling Eastbound or Westbound; Eastbound requires approximately 16 hours for each time zone, while westbound requires less time approximately 12 hours for each time zone.

Direction	Time Zone Difference											
	1	2	3	4	5	6	7	8	9	10	11	12
East	16:00	32:00	48:00	64:00	80:00	96:00	112:00	128:00	144:00	160:00	176:00	192:00
West	12:00	24:00	36:00	48:00	60:00	72:00	84:00	96:00	108:00	120:00	132:00	144:00
Days Required												
East	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00
West	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00

Adaptation may be delayed, provided an individual maintains a consistent wake/sleep cycle to a particular time zone, however, that cycle may not be maintained for a long time, possibly as much as 48 hours.

It may be inferred that when an individual returns to the location of present acclimatization within 28 hours, possibly 36 hours, the individual is acclimated upon return.

It may also be inferred that individuals may be able to maintain a relatively high level of alertness when the time zone difference is small, on the order of 2 hours or less, possibly as much as 4 hours.

The time required for adaptation may also be decreased, when an individual adjusts their wake/sleep cycle prior to entry to a new time zone, to be closer to the target time zone to become acclimated to.

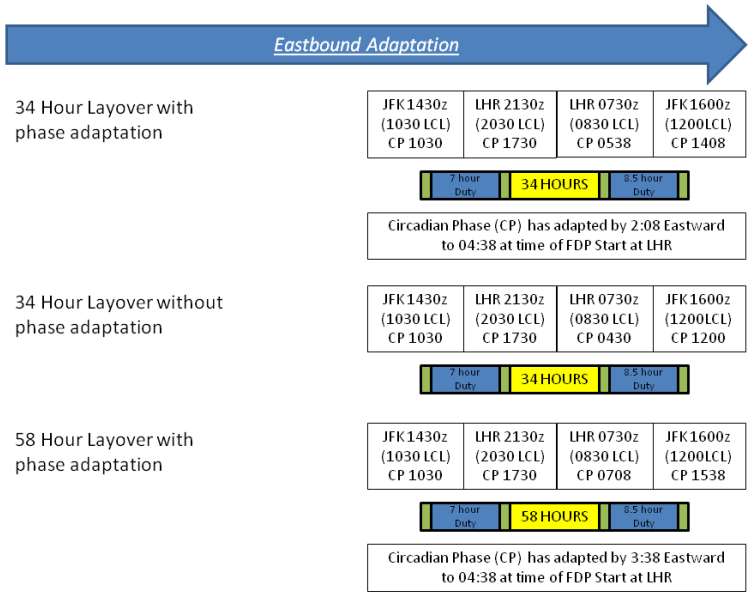
Travelers can minimize jet lag by doing the following before travel:

- Exercise, eat a healthful diet, and get plenty of rest.
- Begin to reset the body clock by shifting the timing of sleep to 1–2 hours later for a few days before traveling westward and shifting the timing of sleep to 1–2 hours earlier for a few days before traveling eastward.

Travelers should do the following on arrival at the destination:

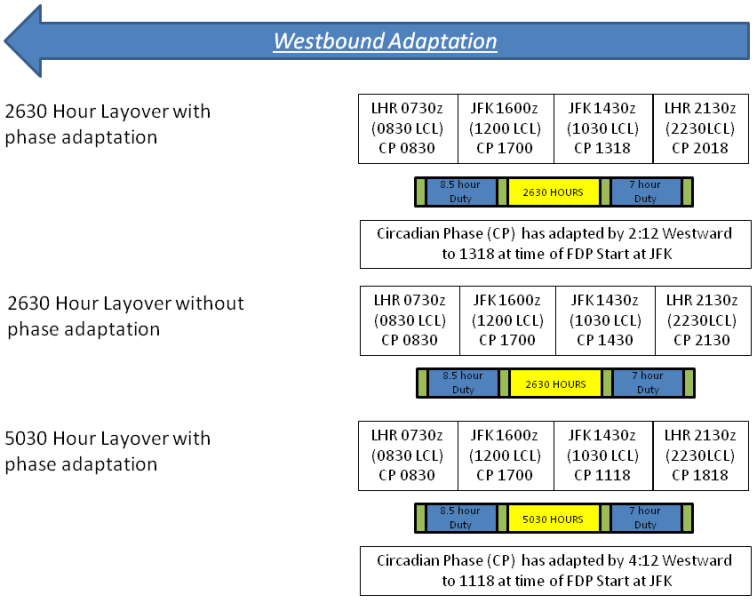
- Adapt to the local schedule as soon as possible.
- Optimize exposure to sunlight after arrival from either direction.
- Eat meals appropriate to the local time, drink plenty of water, and avoid excess caffeine or alcohol.
- Take short naps (20–30 minutes) to increase energy but not undermine nighttime sleep.

Examples:

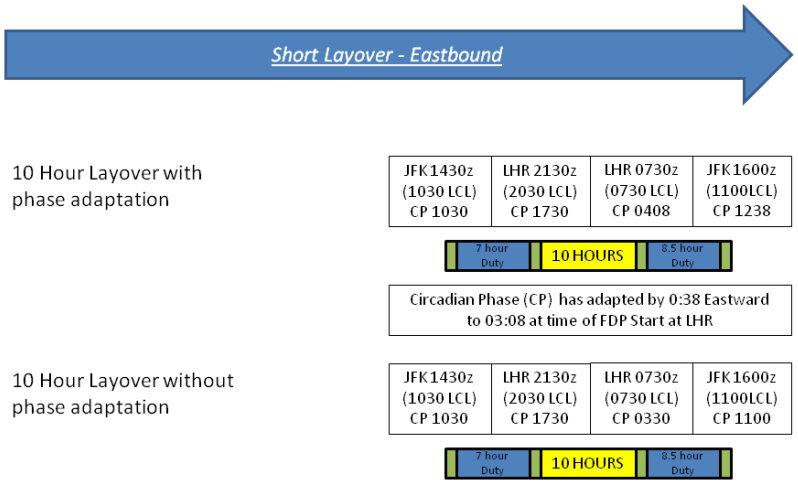


In looking at the examples presented, it is obvious that an individual will have adapted closer to the target time zone with increasing time in that zone (34 hours versus 58 hours) showing an increase 2:08 to 3:38 towards the target.

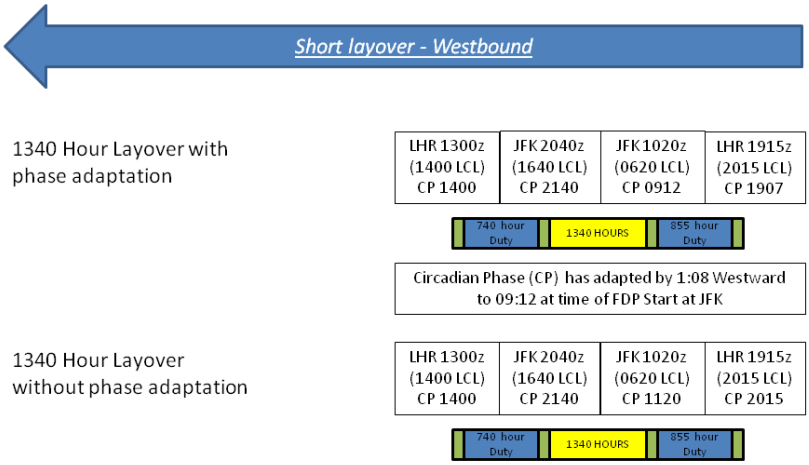
The adaptation process usually will not begin until an individual has actually entered into the external environment, not just when the aircraft has arrived. This allows for exposure to daylight, one of the driving factors used by humans for adaptation.



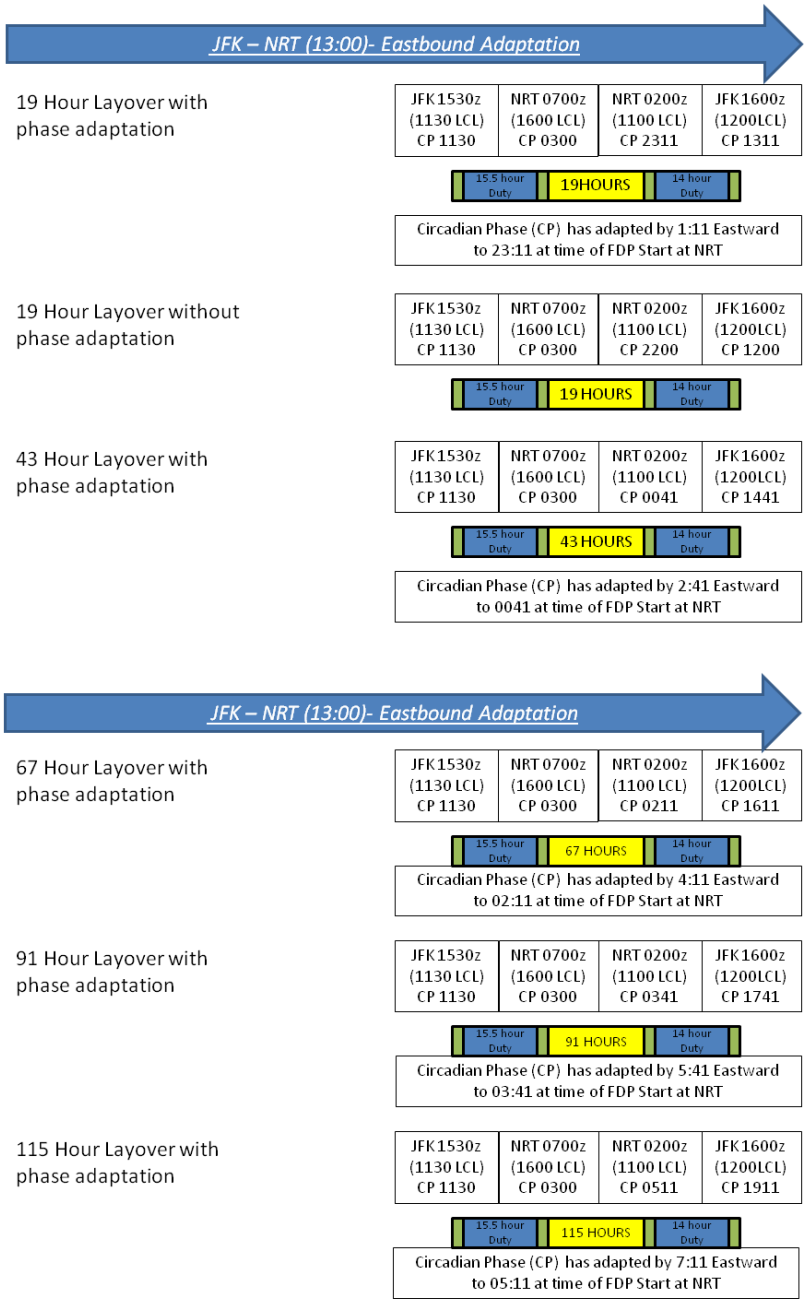
In looking at the examples presented, the Westward adaptation rate is faster than the previous examples depicting the Eastward adaptation., Like the Eastward depiction, the longer an individual spends in the time zone (26:30 versus 50:30), the greater amount of adaptation (2:12 versus 4:12)



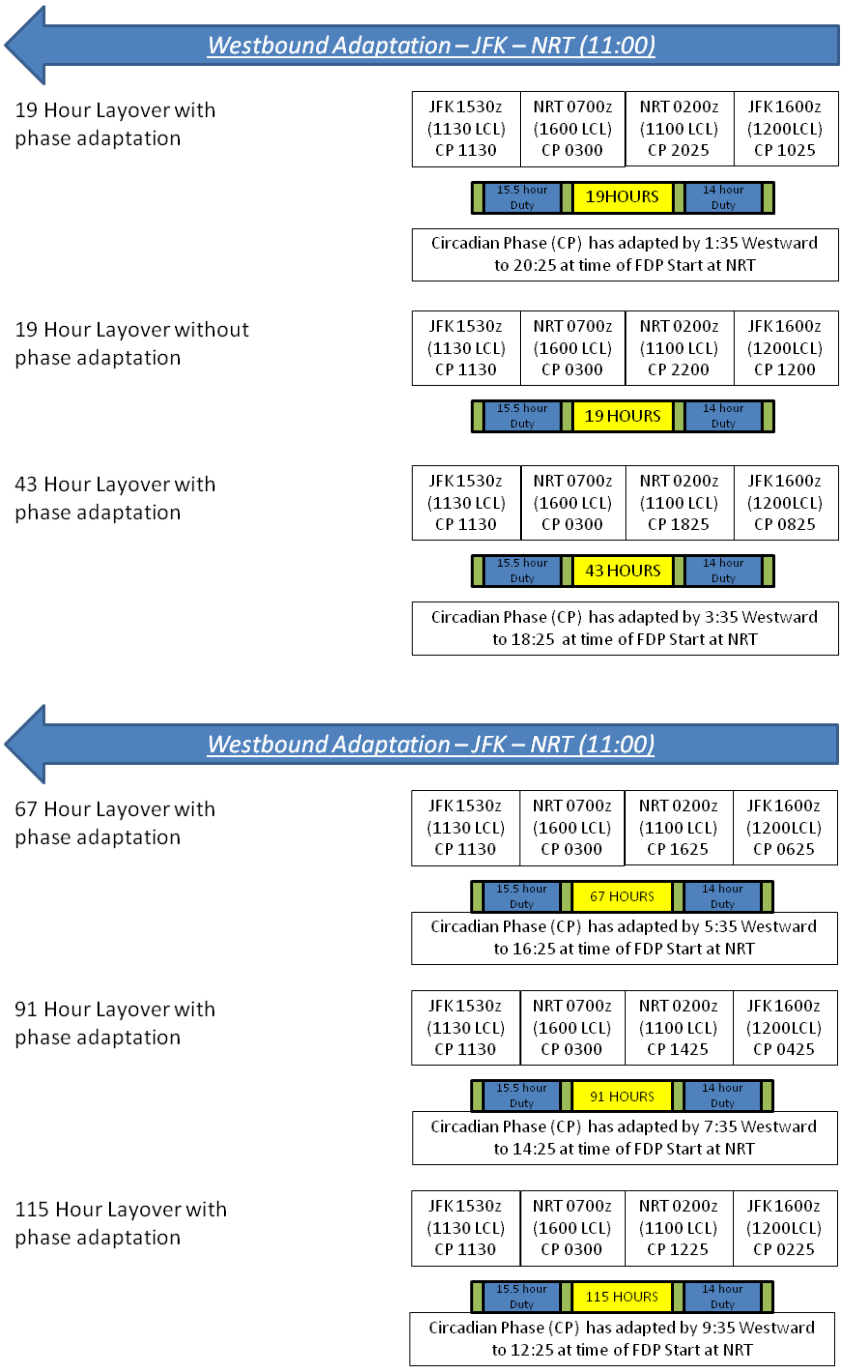
With very short layovers, the amount of adaptation is very small, only 0:38 for 10:00; it is conceivable that an individual could remain acclimated during this time to the previous time zone of acclimatization.



With Westward adaptation, despite the faster rates it is still possible that when the amount of adaptation is very small, only 1:08 for 13:40; it is conceivable that an individual could remain acclimated during this time to the previous time zone of acclimatization.



With very large differences in time zones it may take several days for an individual to adapt.



With very large differences in time zones, an individual may adapt using either an Eastward or Westward adaption.

References:

CDC 2012 – Jet Lag – Emad A. Yanni

An American Academy of Sleep Medicine Review – 2007 – Circadian Rhythm Sleep Disorders: Part I, Basic Principles, Shift Work and Jet Lag Disorders – Robert L Sack, MD

Overview of Different Regulatory Schemes.

	Conditions to become Un-Acclimated	**Conditions to become Acclimated**
FAR 117 (Approved)	FCM leaves a zone +- 60 degrees from the ref point.	FCM has been given 36 hours continuous rest or has spent 72 hours within a zone +- 60 degrees of the new ref point
CAP371 (Implemented)	FCM leaves a zone +- 2 hours from Ref time zone	3 local nights rest with a zone +- 1 hour wide of new time zone
EASA (Proposed)	FCM leaves a zone +- 2 hours from Ref time zone and has been away >= 48 hours from the ref time zone	FCM has spent at least the amount of time within a zone +-1 hour wide in accordance to EASA table.
CASA (Proposed)	FCM leaves a zone +- 2 hours from Ref time zone and has been away >= 36 hours from the ref time zone	FCM has spent at least the amount of time within a zone +-1 hour wide in accordance to CASA table.
CARAC (Proposed)	FCM leaves a zone +- 4 hours from Ref time zone	FCM has spent at least 96 hours within a zone +- 4 hour wide

FAR 117

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.

Theater

means a geographical area in which the distance between the flightcrew member's flight duty period departure point and arrival point differs by no more than 60 degrees longitude.

- *There are provisions for recovery rest upon return to base based upon acclimatization status.*
- *The schemes do not account for direction of travel with regards to acclimatization.*
- *The schemes do not account for a short time away from base/point of acclimatization.*
- *The schemes are based upon a zone 60 degrees wide from the reference point.*

FAA's official letter of interpretation:

The terms "theater" and "acclimated" are defined in 117.3.
A flight duty period departure point is the location at which a flightcrew member begins a series of flight duty periods (FDPs).
If a flightcrew member remains acclimated, a series of FDPs consists of FDPs that take place between the 30 hours of rest specified in 117.25(b).
However, if a flightcrew member becomes unacclimated, then (l) the first FDP that takes place in the new theater would commence a new series of FDPs subject to the non-acclimated provisions of 117.13(b) and 117.17(b); and (2) the first FDP that takes place after the flightcrew member reacclimates would also commence a new series of FDPs that would not be subject to 117.13(b) and 117.17(b).

A flight duty period arrival point is the location at which the flightcrew member ends a flight segment.
Thus, a flightcrew member does not change theaters unless the location at which the FDP series began is more than 60 degrees longitude away from the location at which a flight segment ends.
Under 117.3, a flightcrew member is acclimated upon being in a theater for 72 hours or being given at least 36 consecutive hours of rest in that theater.
While a theater can have multiple time zones, for purposes of determining acclimation, those time zones are irrelevant.
What matters is whether a flightcrew member has spent 72 hours in the theater or has had 36 consecutive hours of rest in the theater.
Otherwise, the flightcrew member remains acclimated to the last point of acclimation.
Once a flightcrew member has spent the requisite amount of time in the theater, the flightcrew member is acclimated to that theater - not to any specific time zone inside the theater.

If a flightcrew member is unacclimated, the applicable FDP limits are determined using the location at which the last-acclimated FDP series began.
If a flightcrew member is acclimated, then the FDP limits in Tables Band C are determined using the local time at the location where the FDP series begins.

However, if a flightcrew member is acclimated to a theater that encompasses the flightcrew member's home base, then the certificate holder can use home base time to determine the appropriate FDP limits.
Once this designation is made, then the flightcrew member's FDP limits for the entire FDP series are determined using home base time.
In addition" for purposes of determining a change in theaters, the flight duty period departure point is the location at which the FDP series actually begins, even when a certificate holder uses home base time to determine the appropriate FDP limits as described above.

We also note that, because acclimation is used to determine the appropriate departure time and because departure time cannot be changed once an FDP has started, a flightcrew member's acclimation status is locked in once the flightcrew member begins an FDP and remains unchanged until that FDP ends.
Thus, if an acclimated flightcrew member changes theaters in the middle of an FDP, that flightcrew member will remain acclimated to the original theater until the FDP ends.

A. Theater
1. Determining FDP Departure and Arrival Points
As discussed above, for purposes of determining whether a flightcrew member has changed theaters, the FDP departure point is the location at which an FDP series begins and the FDP arrival point is the location at which a flight segment ends.
Thus, a flightcrew member can change theaters during the course of an FDP as a result of intermediate stops.
In addition, because a flightcrew member's acclimation status is locked in once the FDP begins, a flightcrew member cannot become unacclimated until the FDP ends.

Time zones are also irrelevant for changing-theater purposes because a change in theater is analyzed by simply examining the distance between the FDP departure and arrival points.
The FAA notes that a flightcrew member does not need to be acclimated in order to change theaters.
For example, a flightcrew member could end an FDP in a new theater, which would render that flightcrew member unacclimated.
After receiving 10 hours of rest, that unacclimated flightcrew member could then be assigned to another FDP containing an FDP that ends more than 60 degrees longitude away from the location at which the FDP series began.
In this example, the flightcrew member would change theaters even though he was unacclimated at the beginning of his FDP.

2. Calculating 60 Degrees Longitude
As discussed above, a theater is determined by examining whether the location at which the FDP series begins is more than 60 degrees longitude away from the location at which a flight segment ends.

For the purposes of this analysis, it is irrelevant what the flightcrew member does during the FDP or in which direction(s) the flightcrew member flies - all that matters is the distance in longitude between the locations at which the FDP series begins and a flight segment ends.

B. Acclimation
1. Determining Arrival in Theater and Acclimation
As discussed above, an FDP arrival point is the end of a flight segment.
Accordingly, a flightcrew member arrives in a new theater at the end of a flight segment if that flight segment ends more than 60 degrees longitude away from the point at which the FDP series began.
The arrival in a new theater acts to set in motion the time clock for determining when a flightcrew member who stays in a new theater will become acclimated to that theater.

Under 117.3, a flightcrew member becomes acclimated to a new theater when that flightcrew member has either (1) spent 72 hours in the theater, or (2) has had 36 consecutive hours of rest in the new theater.
However, we emphasize that because acclimation status is locked in at the beginning of an FDP, a flightcrew member entering a new theater does not become unacclimated until the FDP that caused the change in theater ends.
A flightcrew member could also become unacclimated from the theater that encompasses the flightcrew member's home base.
Due to the conditions for acclimation specified in 117.3, a flightcrew member can only be acclimated to a single theater.
If the theater to which the flightcrew member is acclimated does not encompass that flightcrew member's home base, then the flightcrew member would be unacclimated upon return to the home base.
If the flightcrew member is unacclimated to the theater that encompasses the flightcrew member's home base, then that flightcrew member may not use the time at the home base to determine the appropriate FDP limits in Tables Band C.

2. Time Zones in a Theater
A flightcrew member is acclimated to a theater and not to a specific time zone within that theater.
If a flightcrew member is acclimated, FDP limits are calculated using either (1) the local time at the location where the FDP series begins; or (2) the local time at the flightcrew member's home base if the flightcrew member is acclimated to a theater that encompasses the home base.
If home base time is used to determine the pertinent FDP limit, then, for purposes of Tables Band C, the entire FDP series will be treated as if it commenced at home base.

For example, an acclimated flightcrew member beginning an FDP series in the Eastern time zone has 36 hours of rest in the Pacific time zone.
Because this flightcrew member would receive over 30 hours of rest, the next FDP, which would be out of the Pacific time zone, would commence a new FDP series.
Thus, this flightcrew member would enter Table B or C based on either Pacific time or home base time if the theater to which the flightcrew member is acclimated encompasses the home base.

Examples using the FAA's interpretation:

Determination of Theater

Conventions used are East Longitudes are Positive and West Longitudes are Negative.

The specific formula to apply is:

Longitudinal Difference (LD) = Absolute value of (Arrival Longitude – Reference Longitude)
If the Longitudinal Difference is greater than 180, then the value is 360 - Longitudinal Difference

The stations are across the International Date Line.
HNL is 157.9224 West, SYD is 151.1772 East
LD = 151.1772 – (-157.9224) = 309.0996
LD = 360 - 309.0996 = 50.8304
Since the longitudinal difference is less than 60, no change in theater has occurred.

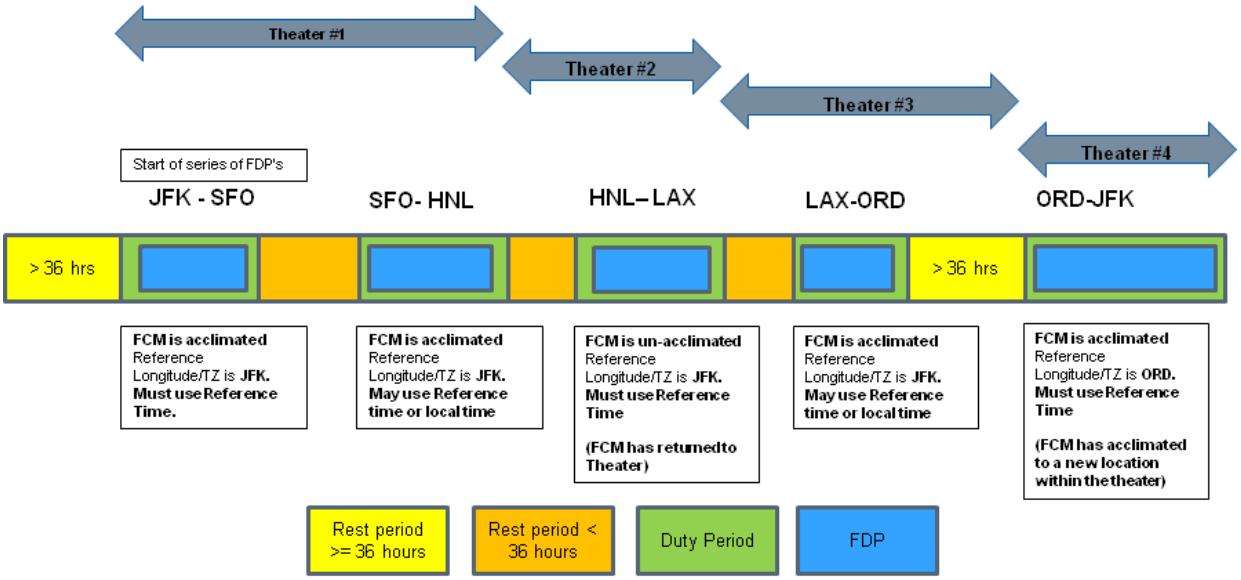
LAX is 118.4081 West, SYD is 151.1772 East
LD = 151.1772 – (-118.4081) = 269.5853
LD = 360 - 269.5853 = 90.4147
Since the longitudinal difference is greater than 60, a change in theater has occurred.

The stations are across the Prime Meridian.
JFK is 73.7789 West, CDG is 2.55 East
LD = 2.55 – (-73.7789) = 76.3289
Since the longitudinal difference is greater than 60, a change in theater has occurred.

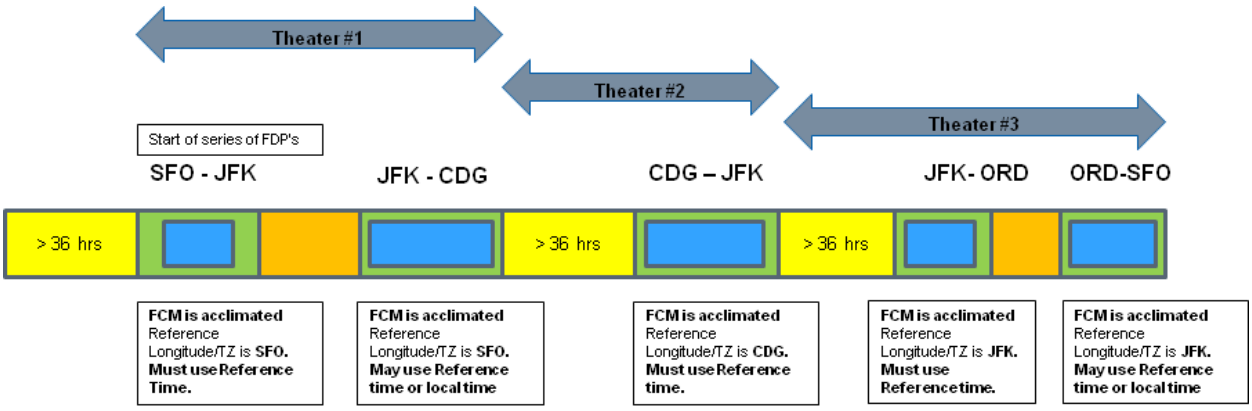
The stations are within the same Hemisphere.
JFK is 73.7789 West, HNL is 157.9224 West
LD = -157.9224 – (-73.7789) = 84.1435
Since the longitudinal difference is greater than 60, a change in theater has occurred.

Determination of Acclimatization Status

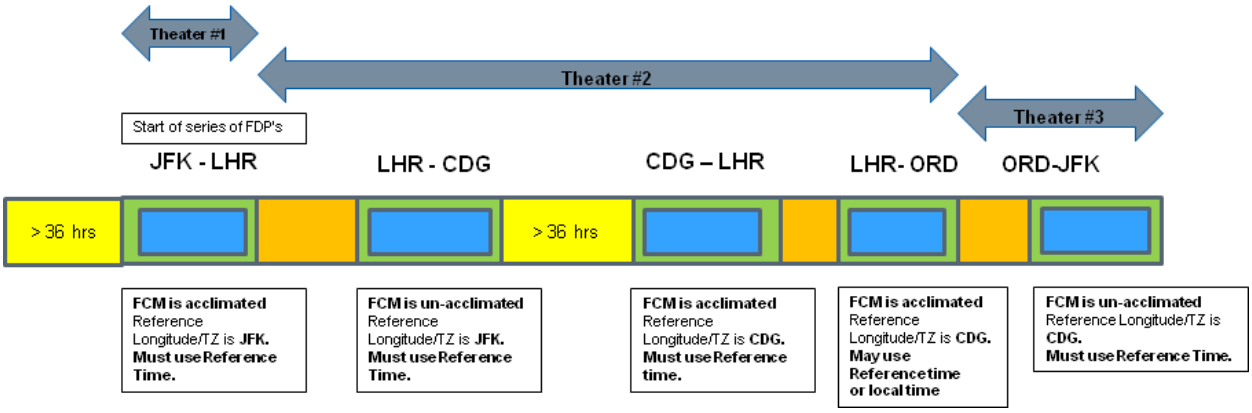
How a FCM may become un-acclimated without moving more than 60 degrees in a FDP.



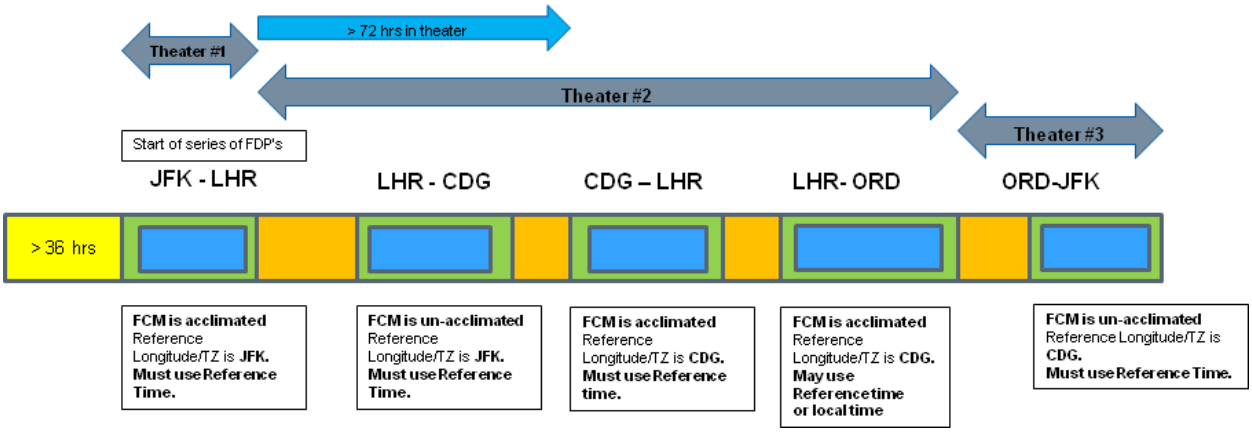
Application of Acclimatization process after entry into a theater.



Application of acclimatization process where the FCM remains in the theater after acclimatization.



Acclimatization process where a FCM remains in a theater for more than 72 hours.



CAP-371 – (United Kingdom)

'Acclimatized'

When a crew member has spent 3 consecutive local nights on the ground within a time zone, which is 2 hours wide, and is able to take uninterrupted night's sleep. The crew member will remain acclimatized thereafter until a duty period finishes at a place where local time differs by more than 2 hours from that at the point of departure.

- *Is the simplest scheme discussed.*
- *There are no provisions for recovery rest upon return to base based upon acclimatization status.*
- *The schemes do not account for direction of travel with regards to acclimatization.*
- *The schemes do not account for a short time away from base/point of acclimatization.*
- *The schemes are based upon a zone 2 time zones wide.*

EASA – (EU-OPS)

'**Acclimatized'**: means that a crew member is considered to be acclimatized to a 2-hour wide time zone surrounding the local time of his/her point of departure. When the local time of the place where a duty commences differs by more than 2 hours from that at the place where a duty ends, the crew member is considered to be acclimatized in accordance with the values in the table below for the calculation of the maximum daily FDP.

Time difference (h) between reference time and local time where the crew member starts the subsequent duty	**Time elapsed since reporting at reference time**				
	<48	**48–71:59**	**72–95:59**	**96–119:59**	**≥120**
< 4	B	D	D	D	D
≤6	B	X	D	D	D
≤9	B	X	X	D	D
≤12	B	X	X	X	D

'B' means acclimatized to the local time of the departure time zone,

'D' means acclimatized to the local time where the crew member starts his/her subsequent duty, and

'X' means that a crew member is in an unknown state of acclimatization.

The definition of 'acclimatized' maintains that a crew member remains acclimatized for 48 hours after departure as known from Subpart Q, but instead of making reference to the home base time, it makes reference to the newly defined term 'reference time'. The further state of acclimatization is described in a table acknowledging the fact that a crew member can either be still acclimatized to the local time of the departure time zone, acclimatized to the destination time zone or in an unknown state of acclimatization when the body clock is located somewhere in between the local time of the departure point and the local time of the destination.

- *There are no provisions for recovery rest upon return to base based upon acclimatization status.*
- *The schemes do not account for direction of travel with regards to acclimatization.*
- *The schemes account for a short time (48 hours) away from base/point of acclimatization.*
- *The schemes are based upon a zone 2 time zones wide.*

CASA – (Australia)

Acclimatized has the meaning given in subsection 7.

Acclimatized time means local time at the location where an FCM is acclimatized.

Adaptation period means a continuous off-duty period for an FCM to become acclimatized to a particular location.

7 Determination of acclimatization

- 7.1 At the commencement of an FDP or an off-duty period at a location, a FCM must be considered to be acclimatized to the location if:

(a) the location differs by less than 2 hours from the location where the FCM was last acclimatized; and
(b) the FCM has remained in an acclimatized state since he or she was last acclimatized.

Note AOC holders and FCMs should be aware that a determination of acclimatization under this definition may impact on an individual's body clock to a small degree. For guidance on acclimatization, AOC holders and FCMs should refer to CAAP 48-1.

- 7.2 At the commencement of an FDP or an off-duty period (a period) at a new location which differs in time by 2 hours or more from the location where the FCM was last acclimatized (the original location), the FCM is considered to remain acclimatized to the original location if the period at the new location commences less than 36 hours after the FCM commenced a duty period at the original location.
- 7.3 At the commencement of an FDP or an off-duty period (a period) at a new location which differs in local time by 2 hours or more from the location where the FCM was last acclimatized (the original location), the FCM is considered to be in an unknown state of acclimatization if the period at the new location commences 36 hours or more after the FCM commenced a duty period at the original location.
- 7.4 An FCM is considered to remain in his or her state of acclimatization (whether acclimatized to a particular location, or in an unknown state of acclimatization) until he or she has had:

(a) an adaptation period in a location (the *adaptation location*) in accordance with Table 7.1 in this subsection; or
(b) an adaptation period that is:
  (i) in a location other than home base; and
  (ii) in accordance with subparagraph (a); and
  (iii) reduced by 12 hours for each previous off-duty period that:
    (A) immediately preceded the adaptation period; and
    (B) was taken at an off-duty location which differs in local time by less than 2 hours from the adaptation location; and
    (C) included an off-duty location local night.

- 7.5 In applying Table 7.1 to arrive at an adaptation period for paragraph 7.4:

(a) determine the time zone displacement between:

(i) the location where the FCM was last acclimatized (the ***original location***); and

(ii) each location where an FDP or off-duty period was commenced since last acclimatized (***later locations***); and

(b) then choose the time zone displacement between the original location and whichever of the later locations gives the greatest time zone displacement; and

(c) then choose the time zone change in the Table that corresponds to the greatest time zone displacement; and

(d) then choose the direction (west or east) in which the FCM travelled and in which, therefore, the greatest time zone displacement occurred under subparagraph (b); and

(e) then choose the number of hours west or east (as the case requires) that corresponds to the time zone change chosen under subparagraph (c).

Table 7.1 Adaptation period to become acclimatized

Time zone change (measured in time zones)	Adaptation period to become acclimatized to new location (hours)	
Note See definition of time zone	**West**	**East**
2	24	30
3	36	45
4	48	60
5	48	60
6	48	60
7	72	90
8	72	90
9	72	90
10 or more	96	120

Note 1 ***Adaptation period*** means a continuous off-duty period for an FCM to become acclimatized to a particular location.

Note 2 An adaptation period under paragraph 7.4 may commence before the time when an FCM comes to be in an unknown state of acclimatization.

Note 3 For guidance in determining acclimatization, including examples of how an FCM becomes re-acclimatized in accordance with paragraph 7.4, AOC holders and FCMs should refer to CAAP 48-1.

- *Is one of the most advanced schemes.*
- *There are no provisions for recovery rest upon return to base based upon acclimatization status.*
- *The schemes do account for direction of travel with regards to acclimatization.*
- *The schemes account for a short time (36 hours) away from base/point of acclimatization.*
- *The schemes are based upon a zone 2 time zones wide.*

CARAC – (Canada)

Acclimatized means the physiological and mental state of a crew member whose bio-rhythms and bodily functions are considered aligned with local time.

Acclimatized time means the time at the location where the flight crew member is acclimatized.

26.0 Determining FDP Table Start Time

This section provides a method to account for the differences between the individual's acclimatized time and the time zone that the FDP begins in and to determine how long it takes an individual to acclimatize to a new time zone.

Recommendation: For an acclimatized flight crew member the maximum daily FDP is based on start time of the FDP using local time.

For a not acclimatized flight crew member the maximum daily FDP is based on start time of FDP using the last acclimatized local time.

Time Zone Differences and Time Required to Acclimatize

For the purpose of determining the FDP Table start time, Canada will be considered to encompass 5 time zones: Pacific, Mountain, Central, Eastern, and Atlantic. The Newfoundland Time zone is considered to be included in the Atlantic Time zone.

Time required to acclimatize:

- when the time zone difference between local time and last acclimatized time does not exceed 4 hours, a flight crew member is considered acclimatized to the new time zone when all rest periods within a 72 consecutive hour period have occurred in the same time zone; or,
- when the time zone difference between local time and last acclimatized time exceeds 4 hours, a flight crew member is considered acclimatized to the new time zone when all rest periods within a 96 consecutive hour period have occurred in the same time zone.

Science: On average an individual can adapt to time zone changes at a rate of 1 time zone (1 hour) per day. However, this varies among individuals. The working group members felt that creating a rule to account for each individual's body clock would be overly complicated and difficult to manage. A broader brush approach was chosen that is in line with both the EASA proposal and the FAA final rule – an operational application of the science.

Harmonization: Both the EASA CRD to NPA 2010-014 and the FAA Final Rule approach the acclimatization question in a similar fashion.

- *There are no provisions for recovery rest upon return to base based upon acclimatization status.*
- *The schemes do not account for direction of travel with regards to acclimatization.*
- *The schemes do not account for a short time away from base/point of acclimatization.*
- *The schemes are based upon a zone 4 time zones wide.*