



Australian Government

Civil Aviation Safety Authority

CIVIL AVIATION ADVISORY PUBLICATION

CAAP 48-01 **Fatigue management for flight crew** **members**

Civil Aviation Advisory Publications (CAAP) provide guidance, interpretation and explanation on complying with the *Civil Aviation Regulations 1988 (CAR 1988)* or a *Civil Aviation Order (CAO)*.

This CAAP provides advisory information to the aviation industry in support of a particular CAR 1988 or CAO. Ordinarily, the CAAP will provide additional 'how to' information not found in the source CAR 1988, or elsewhere.

Civil Aviation Advisory Publications should always be read in conjunction with the relevant regulations.

Audience

This Civil Aviation Advisory Publication (CAAP) applies to:

- all holders of an Air Operator's Certificate (AOC) or Part 141 certificate
- all holders of a flight crew licence.

Purpose

This CAAP has been produced in accordance with the Civil Aviation Safety Authority (CASA) safety-related functions under Subsection 9 (2) of the *Civil Aviation Act 1988 (the Act)*.

This CAAP provides guidance on meeting the AOC holder and flight crew member (FCM) obligations in relation to fatigue risk management, required under Civil Aviation Order (CAO) 48.1 *Instrument 2013*.

This CAAP does not cover operational aspects specific to ultra-long range operations, which are operations involving flight times greater than 16 hours or flight duty periods greater than 18 hours, and which require special considerations within a fatigue risk management system (FRMS).

For further information

For further information on this CAAP, contact CASA's Safety Systems Branch (telephone 131 757).

Status

This version of the CAAP is approved by the Manager, Safety Systems Branch.

| Version | Date | Details |
|---------|---------------|--|
| v2.0 | October 2016 | Reflects changes made to CAO 48.1 as a result of <i>Civil Aviation Order 48.1 Amendment Instrument 2016 (No 1)</i> and makes minor editorial changes. |
| (1.1) | January 2016 | Revised to take into account the new applicability date of Civil Aviation Order 48.1 Instrument 2013, being 1 May 2017. |
| (1) | February 2015 | Adds further guidance on the practical application of <i>CAO 48.1 Instrument 2013</i> (predominately contained in new Appendices A, B and C), and makes minor editorial changes. |
| (0) | August 2013 | This is the first CAAP on this subject and has been produced in accordance with the Civil Aviation Safety Authority (CASA) safety-related functions under Subsection 9 (2) of the <i>Civil Aviation Act 1988 (the Act)</i> . |

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1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this CAAP are listed in the table below.

| Acronym | Description |
|----------------|--|
| ALARP | as low as reasonably practicable |
| AOC | Air Operator's Certificate |
| CAAP | Civil Aviation Advisory Publication |
| CAO | Civil Aviation Order |
| CAR | Civil Aviation Regulations 1988 |
| CASA | Civil Aviation Safety Authority |
| CASR | Civil Aviation Safety Regulations 1998 |
| FCM | Flight Crew Member |
| FDP | Flight Duty Period |
| FRMS | Fatigue Risk Management System |
| FTL | Flight and Duty Time Limits |
| IATA | International Air Transport Association |
| ICAO | International Civil Aviation Organization |
| IFALPA | International Federation of Air Line Pilots' Association |
| LNO | Late night operation |
| ODP | Off-duty period |
| PIC | Pilot-in-Command |
| PVT | Psychomotor Vigilance Test |
| REM | Rapid Eye Movement |
| SMS | Safety Management System |
| SSAA | Safety Sensitive Aviation Activity |
| WOCL | Window of Circadian Low |

1.2 Definitions

Terms that have specific meaning within this CAAP are defined in the table below.

Where these definitions differ in wording from those in *Civil Aviation Order 48.1 Instrument 2013* the wording for this CAAP was chosen to simplify complex definitions. The wording in the Instrument takes precedence and was necessary for legal drafting purposes; however, the wording chosen for the CAAP was chosen to aid understanding.

| Term | Definition |
|--------------------------|---|
| Access | No restriction on, or impediment to, a flight crew member's (FCM's) immediate and actual use of a necessity. |
| Acclimatised time | The local time at the location where an FCM is acclimatised. |
| Adaptation period | A continuous off-duty period (ODP) for an FCM to become acclimatised to a particular location. |
| Adequate sustenance | Food and drink (including clean drinking water) in quantities sufficient to reasonably sustain a person in the person's circumstances. |
| Augmented crew operation | An aircraft operation in which one or more FCMs, additional to the minimum required number of FCMs, are engaged in a flight to allow one or more FCMs to be relieved of duty during flight time. |
| Call out | Being required by an AOC holder to commence a duty period during a standby. |
| Complex operation | An operation that involves 1 or more of the following: <ol style="list-style-type: none"> a. a flight duty period (FDP) with a displacement time of 2 hours or more b. an augmented crew operation c. an FDP that commences when the FCM is: <ol style="list-style-type: none"> i in an unknown state of acclimatisation, or ii acclimatised to a location other than the location where the FDP commences. |
| Consecutive | A continuous, unbroken, period of time for the duration of the hours or days mentioned. |

| Term | Definition |
|------------------------------|---|
| Crew rest facility | <p>One of the following defined classes of facility on board an aircraft that is available to an FCM, and fit for purpose for an FCM to obtain sleep:</p> <ul style="list-style-type: none"> a. Class 1 means a bunk or other surface that: <ul style="list-style-type: none"> i allows for a horizontal sleeping position ii is located separate from both the flight deck and passenger compartment in an area that: <ul style="list-style-type: none"> (a) is temperature-controlled (b) allows the FCM to control light (c) provides isolation from noise and disturbance b. Class 2 means a seat in an aircraft cabin that: <ul style="list-style-type: none"> i allows for a horizontal or near-horizontal sleeping position ii is separated from passengers by at least a curtain that provides darkness and some noise mitigation iii is reasonably free from disturbance by passengers or crew members c. Class 3 means a seat in an aircraft cabin or flight deck that: <ul style="list-style-type: none"> i reclines at least 40 degrees from the vertical plane ii provides leg and foot support in the reclined position. |
| Cruise | The period of a flight from not less than 30 minutes after take-off until not less than 60 minutes before the estimated time of landing. |
| Cumulative duty | The progressive sum of duty periods. |
| Cumulative flight time | The progressive total of flight time accrued by the FCM when acting as a crew member on board any aircraft, but excluding flight time accrued during recreational private operations. |
| Day | The period between local midnight at home base and the subsequent local midnight at home base. |
| Displacement time | <p>The difference in local time between:</p> <ul style="list-style-type: none"> a. the place where an FCM commenced an FDP b. the place where the FCM undertakes an off-duty period following the FDP. |
| Duty | Any task that a person who is employed as an FCM is required to carry out associated with the business of an AOC holder. |
| Duty period | A period of time that starts when an FCM is required by an AOC holder to report for duty, and ends when the FCM is free of all duties. A duty period includes any time spent by the FCM in positioning. |
| Emergency service operations | <p>An aircraft operation:</p> <ul style="list-style-type: none"> a. for the purpose of law enforcement, or saving or protecting life or property; and b. conducted by, or at the request of, an organisation recognised by an Australian governmental agency as having responsibility to conduct or request the operation as part of the organisation's functions. |

| Term | Definition |
|---------------------------------------|---|
| Fatigue | <p>A physiological state of reduced alertness or capability to perform mental or physical tasks, which:</p> <ul style="list-style-type: none"> a. may impair the ability of the FCM to safely operate an aircraft b. is caused by one or more of the following: <ul style="list-style-type: none"> i the FCM's lack of sleep ii the FCM's extended wakefulness iii the FCM's circadian phase at any relevant time iv the FCM's workload of mental activities, or physical activities at any relevant time. |
| Fatigue risk management system (FRMS) | <p>A comprehensive system for managing fatigue-related risks that:</p> <ul style="list-style-type: none"> a. includes all of the elements set out in Appendix 7 of the CAO 48.1 Instrument b. is approved for implementation by CASA. |
| Fit for purpose | <p>For a crew rest facility, or suitable sleeping accommodation, means that it has ergonomic characteristics that make it suitable for an FCM to obtain sleep.</p> |
| Flight duty period (FDP) | <p>A period of time that:</p> <ul style="list-style-type: none"> a. starts when a person is required, by an AOC holder, to report for a duty period in which they undertake one or more flights as part of an operating crew b. ends at the later of: <ul style="list-style-type: none"> i the person's completion of all duties associated with the flight, or the last of the flights; or ii 15 minutes after the end of the person's flight, or the last of the flights. |
| Flight time | <p>The time when an FCM is acting in the capacity as a crew member on board an aircraft that includes:</p> <ul style="list-style-type: none"> a. in the case of a heavier-than-air aircraft — the total time from the moment at which the aircraft first moves under its own power for the purpose of taking-off, until the moment at which it comes to rest after landing; and b. in the case of a lighter-than-air aircraft — the total time from the moment at which the aircraft first becomes airborne until it comes to rest on the ground, excluding any time during which the aircraft is moored. <p>Note: Recording flight time from 'push-back' or 'off blocks', rather than from the moment the aircraft first moves under its own power (as per the definition), is acceptable. Likewise, for rotorcraft, recording flight time from the moment the rotor blades start turning until they stop turning is also acceptable.</p> |
| Flight training | <p>For a flight crew licence, rating or endorsement, means the training mentioned in regulation 61.195 of the <i>Civil Aviation Safety Regulations 1998 (CASR)</i> for the licence, rating or endorsement.</p> |

| Term | Definition |
|---|--|
| Flight training associated with aerial work | <p>Flight training for the grant, under Part 61 of CASR, of a rating or endorsement mentioned in paragraph (a), (b), (c) or (d):</p> <ol style="list-style-type: none"> a. the following operational ratings: <ol style="list-style-type: none"> i low level rating; ii aerial application rating; iii night vision imaging system rating; b. endorsements for the following operational ratings: <ol style="list-style-type: none"> i low level rating; ii aerial application rating; iii night vision imaging system rating; c. the following endorsements on the flight instructor rating: <ol style="list-style-type: none"> i low level rating training; ii aerial application rating training – day training; iii aerial application rating training – night training; iv night vision imaging rating training endorsement; v sling operations training; vi winching and rappelling training; d. the following endorsements on the flight examiner rating: <ol style="list-style-type: none"> i low level rating training; ii aerial application rating training; iii night vision imaging system rating flight test endorsement. |
| Home base | The location, assigned by the AOC holder to the FCM, from where the FCM normally starts and ends a duty period or a series of duty periods. |
| Late night operation | An operation where an FDP includes more than 30 minutes between the hours of 2300 and 0530 (local time) at the location where the FCM is acclimatised. |
| Local night | A period of 8 consecutive hours that includes the hours between 2200 and 0500 (local time). |
| Local time | <p>For a location means:</p> <ol style="list-style-type: none"> a. local time in the time zone of the location; or b. local time in a time zone (the alternative local time): <ol style="list-style-type: none"> i that adjoins the time zone of the location; and ii whose nearest boundary is reasonably proximate to the location; iii provided the alternative local time is: <ol style="list-style-type: none"> (a) specified in the AOC holder’s operations manual; and (b) used consistently as local time for the location. |
| Medical personnel | A person with medical, paramedical or nursing qualifications, and has responsibilities directly related to the qualifications. |

| Term | Definition |
|--------------------------------|--|
| Medical transport operation | <p>An aircraft operation consisting of 1 or more flights for any of the following purposes:</p> <ul style="list-style-type: none"> a. delivery of urgent medical assistance to a person, when determined to be necessary by a medical transport tasker; b. transportation of any of the following, when determined to be necessary by a medical transport tasker: <ul style="list-style-type: none"> i an ill or injured person; ii another person directly involved with the ill or injured person (for example, a close relative or the police); iii medical personnel intended to be, or who are, directly involved with the ill or injured person mentioned; iv blood, tissue or an organ for transfusion, grafting or transplantation, including a person who has authorised custody of the item; c. the return of the aircraft to its base because an operation mentioned in subparagraph (a) or (b) is completed. |
| Medical transport tasker | <p>Medical personnel, or an organisation whose purpose is, or whose purposes include, medical transport tasking.</p> |
| Multi-pilot operation | <p>A multi-pilot operation is an operation conducted under multi-pilot procedures. However, this does not include flight training or checking unless the aircraft requires at least 2 pilots to operate (i.e. ab initio training is not a multi-pilot operation).</p> |
| Mustering operation | <p>An aircraft operation to herd or otherwise control livestock, and includes the following:</p> <ul style="list-style-type: none"> a. aerial mustering in accordance with the meaning found in of CAO 29.10; b. aerial livestock spotting; c. aerial livestock culling; d. flight training associated with aerial work for any of the activities mentioned in this definition. |
| Off-duty period (ODP) | <p>A period of time during which an FCM is free of all duties and standby associated with their employment.</p> |
| Operator | <p>Either an AOC holder or, in the case of a Part 141 flying training school, the certificate holder.</p> |
| Positioning | <p>Means being transported, as a passenger, to a location, by any mode of transportation, as required by the AOC holder; and:</p> <ul style="list-style-type: none"> a. does not include being transported to or from suitable accommodation after or before an FDP; and b. if undertaken immediately before duty that includes the person flying an aircraft as an FCM (flying duty) — must be considered part of their FDP; and c. if undertaken immediately after the person's flying duty and no other flying duty is to be conducted in the duty period — is not part of their FDP or off-duty period; and d. is duty and part of the duty period. |
| Recreational private operation | <p>Flying conducted by an FCM in a personal capacity, and at and for the FCM's leisure. A flight conducted by an FCM as a private operation is not a recreational private operation if it is conducted for, or on behalf of, an entity (regardless of whether or not the entity is an AOC holder).</p> |

| Term | Definition |
|--------------------------|---|
| Reporting time | The time assigned to an FCM to commence an FDP. |
| Roster | A list made available to an FCM by an AOC holder, setting out the times when the FCM is assigned to undertake duties or standby. |
| Sector | <p>The following meanings:</p> <ul style="list-style-type: none"> a. except for a rotorcraft—any flight consisting of a take-off and a landing, when conducted by a person in the capacity of a FCM; b. for a rotorcraft — the period: <ul style="list-style-type: none"> i from when the rotor blades start turning until they stop turning; and ii during which an FCM on the rotorcraft conducts 1 or more flights, each consisting of a take-off and a landing. c. each hour, or each part of an hour, of an FDP spent in a synthetic training device. |
| Single pilot operation | Any operation other than a multi-pilot operation. |
| Sleep opportunity | <p>A period of time during an ODP when an FCM:</p> <ul style="list-style-type: none"> a. is not meeting the reasonable requirements of bodily functioning, such as: <ul style="list-style-type: none"> i eating ii drinking iii toileting iv washing v dressing; and b. has access to suitable sleeping accommodation without, under normal circumstances, being interrupted by any requirement of the AOC holder. <p>Note: Normal circumstances refer to those situations where the operator wishes to preserve the prior sleep opportunity. Abnormal circumstances refer to the case where the operator needs to contact the FCM and it is understood that this will mean that the prior sleep opportunity has been interrupted.</p> |
| Split-duty rest period | <p>A predefined period of time during which an FCM:</p> <ul style="list-style-type: none"> a. has access to suitable resting accommodation or suitable sleeping accommodation; and b. is relieved of all duties associated with their employment by the AOC holder. <p>Note: For Appendix 4B and Appendix 5, the period of time may or may not be predefined.</p> |
| Standby | <p>A period of time during which an FCM:</p> <ul style="list-style-type: none"> a. is required by an AOC holder to hold themselves available for duties b. has access to suitable sleeping accommodation c. is free from all duties associated with their employment. |
| Standby-like arrangement | <p>A period of time during which an FCM:</p> <ul style="list-style-type: none"> a. is required by an AOC holder to hold themselves available for duties; and b. does not have access to suitable sleeping accommodation. |

| Term | Definition |
|-------------------------------------|--|
| Suitable resting accommodation | A comfortable resting area that: <ol style="list-style-type: none"> has a comfortable temperature and minimal noise levels contains at least a comfortable chair provides access to adequate sustenance at times appropriate to the duty requirements. |
| Suitable sleeping accommodation | Accommodation not within an aircraft that is fit for purpose for an FCM to obtain sleep, and that includes all of the following: <ol style="list-style-type: none"> a comfortable room, compartment or facility a single occupancy, at the discretion of the FCM access to clean, tidy and hygienic amenities, including a toilet and hand washing basin a bed that is comfortable, flat and horizontal, allowing the occupant to sleep on their stomach, back, and either side minimum noise levels, including low occurrence of random noise the means to control light, temperature and ventilation access to adequate sustenance. |
| Tier 1 | A very simple prescriptive system, with relatively restrictive flight and duty time limits. |
| Tier 2 | More flexible limits, but with additional operator obligations (such as hazard identification and continuous monitoring). |
| Time zone | A defined region of earth with a uniform local time that differs by one hour, or by part of one hour, from the uniform local time of an adjoining region of the earth. |
| Unforeseen operational circumstance | An unplanned exceptional event that becomes evident after the commencement of the FDP (i.e. un-forecast weather, equipment malfunction, or air traffic delay). |

1.3 References

Regulations

Regulations are available on the Federal Register of Legislation <https://www.legislation.gov.au/>

| Document | Title |
|----------|---|
| | <i>Civil Aviation Act 1988 (the Act)</i> |
| | <i>Civil Aviation Regulations 1988</i> |
| CAO 48.1 | <i>Civil Aviation Order 48.1 Instrument 2013</i> All reference in this CAAP to CAO 48.1 are references to this instrument and the unincorporated amendment <i>Civil Aviation Order 48.1 Amendment Instrument (No. 1) 2016</i> . A guidance document of the compiled CAO 48.1 is available on the CASA website. |

Advisory material

CASA's Civil Aviation Advisory Publications are available at <http://www.casa.gov.au/CAAP>

| Document | Title |
|---|--|
| CAAP 5.59-1(0) | Teaching and Assessing Single Pilot Human Factors and Threat and Error Management |
| CAAP 5.59a-1(0) | Competency Based Training and Assessment in the Aviation Environment |
| CAAP SMS-3(1) | Non-Technical Skills Training and Assessment for Regular Public Transport Operations |
| CASA Fatigue Management guidance | Available at www.casa.gov.au/fatigue/ |
| International Civil Aviation Organization (ICAO) guidance | Fatigue Management resources, available at http://www.icao.int/safety/fatiguemanagement/Pages/Resources.aspx |

2 Introduction

Civil Aviation Order (CAO) 48.1 outlines the requirements for fatigue management for flight crew members (FCMs). Within CAO 48.1, there are a number of obligations that air operator certificate (AOC) holders and Part 141 certificate holders ('operators') and flight crew licence holders (individuals) must meet. This CAAP provides guidance in meeting those obligations.

The rules for fatigue management provides operators with the choice of which tier within a three-tier regime best suits them, based on their requirements for flexibility and their capacity to manage fatigue-related risks resulting from that level of flexibility:

- Tier 1 (Appendix 1 of CAO 48.1) – sets prescriptive flight and duty time limitations without the need for risk management processes; however, these limitations are relatively restrictive.
- Tier 2 (Appendices 2 through to 6 of CAO 48.1) – allows greater flexibility with less restrictive flight and duty time limitations, but requires operators to have in place; risk management processes, continuous monitoring processes and a training program for FCMs.
- Tier 3 (Appendix 7 of CAO 48.1) – is the most comprehensive fatigue risk management approach, known as a Fatigue Risk Management System (FRMS). An FRMS is a data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience, that aims to ensure relevant personnel are performing at adequate levels of alertness.

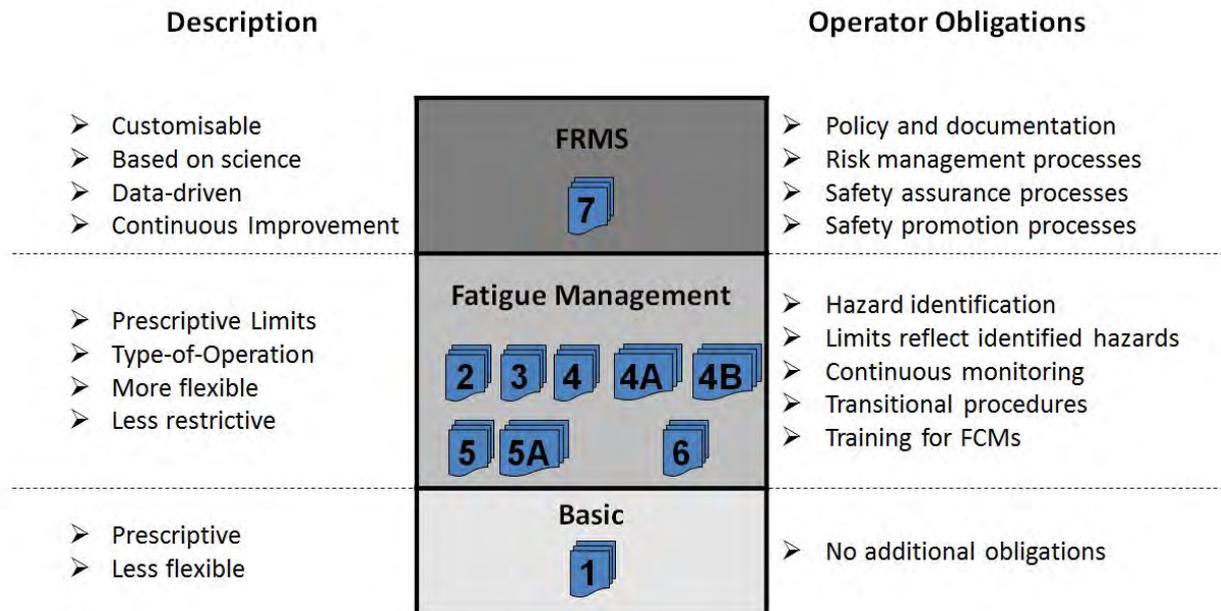


Figure 1: Three tiers of compliance

This CAAP is intended to provide guidance primarily for complying with Tier 1 and Tier 2 requirements. Some of this material is also likely to be relevant to an AOC holder wishing to apply for an FRMS or operating under an FRMS.

For operators choosing to develop and implement an FRMS under Tier 3, guidance on this is contained in joint publication *Fatigue Management Guide for Airline Operators* (see the ICAO Fatigue Management webpages). This publication was a collaboration between the following organisations:

- International Civil Aviation Organization (ICAO)
- International Air Transport Association (IATA)
- International Federation of Air Line Pilots' Association (IFALPA).

The information in this CAAP is relevant guidance to operators about generic fatigue management principles and, while the ICAO/IATA/IFALPA guidance sets the standards that CASA will apply when approving an FRMS, CASA strongly urges operators to consider applying the guidance in this CAAP to any FRMS they may produce.

Operators who are unable to develop and maintain an FRMS in accordance with the ICAO guidance will be required to operate to the relevant appendix in Tier 1 or Tier 2. ICAO intends to update its FRMS guidance as operational and scientific knowledge of FRMS advances. Operators should ensure their FRMS remains current with developments in the field of FRMS.

In order to provide readers with guidance relevant to their interests, the body of this CAAP is split into two main parts:

- AOC holder (operator) obligations
- flight crew licence holder (individual) obligations.

The appendices then cover more specific areas of guidance, such as how to interpret the limits and requirements of CAO 48.1.

2.1 Operator obligations

2.1.1 Under subsection 14 of CAO 48.1, all operators have a series of obligations.

2.1.2 Above all, an operator must not require an FCM to operate an aircraft if, considering the circumstances of the flight to be undertaken, the holder has reason to believe that the FCM is suffering from, or is likely to suffer from, fatigue that may so impair the FCM's performance that the safety of the operation may be affected.

2.1.3 The operator also has obligations in relation to:

- documenting flight and duty time limitations in their operations manual
- documenting the responsibilities of their employees in their operations manual
- providing opportunities for FCMs to consume meals
- record keeping and reporting
- determination of home bases for its FCMs (except for operations under Appendix 5 or 5A)
- publishing rosters.

2.1.4 Tier 2 operators have additional obligations. Under subsection 15, these operators must have the following documented within their operations manual:

- procedures for hazard identification
- procedures for determining limitations that take into account potential hazards

- procedures for the continuous monitoring and evaluation of policies, limitations and practices
 - transition procedures (when operations under multiple appendices are conducted).
- 2.1.5 Tier 2 operators are also required to have initial and recurrent fatigue training programs for their FCMs.
- 2.1.6 CASA has produced a number of Operations Manual Supplement Templates that are available to assist operators in implementing the procedures required. Refer to Annexes A-F.

2.2 Individual obligations

- 2.2.1 Under subsection 16 of CAO 48.1, it is a condition on each flight crew licence that the licence holder must not operate an aircraft if, considering the circumstances of the flight to be undertaken, a reasonable person in the FCM's position would consider that he or she is suffering from, or is likely to suffer from, fatigue which may so impair performance that the safety of the operation may be affected.
- 2.2.2 An FCM employed by an operator must, before any flight duty period (FDP), disclose to the operator any matter that a reasonable person in the FCM's position would consider likely to adversely affect his or her ability to meet the operator's fatigue risk management policies; or the limits and requirements of the appendix or appendices that the holder has chosen to apply to the FCM.

3 Operator obligations – fitness for duty

3.1 Selecting suitable sleeping accommodation for off-duty periods

- 3.1.1 Operators should be mindful of the requirement for FCMs to have prior sleep opportunity before undertaking an FDP or standby. This sleep opportunity must be at suitable sleeping accommodation. This may be at home or at another sleeping facility (e.g. a hotel).
- 3.1.2 Sleep quality (its restorative value) depends on going through unbroken sleep (non-rapid eye movement [non-REM]/REM) cycles. The more sleep is fragmented by waking up; the less restorative value sleep has in terms of how people feel and function when they wake up the next day. Operators should consider procedures that minimise interruptions to FCMs' sleep. Off-duty periods (ODPs) should include defined blocks of time (sleep opportunities), during which FCMs are not contacted. All relevant personnel (e.g. crew rostering personnel) should be aware of these protected sleep opportunities. Operators should also develop procedures to protect FCMs' sleep at layover facilities.
- 3.1.3 The physical ergonomics of sleeping and resting facilities should be taken into account, in order to ensure the staff can obtain suitable recovery (from fatigue) and be fit for the next duty. It is suggested that operators consider the work ergonomic factors, as well as the facilities available in the rest/sleep area, when managing fatigue in operations.

3.2 Location of sleeping accommodation

- 3.2.1 Operators should carefully consider and manage how the location of sleeping accommodation may affect sleep quality. When considering a location for suitability, operators should consider the following factors:
- travel distance to and from the facility
 - transport options
 - potential interruptions/disruptions
 - phone calls
 - cleaning
 - room service
 - maintenance work
 - temperature control
 - crew sharing options
 - lighting control
 - social cues (e.g. local meal times, arrival/departure times of other guests)
 - security at each location.
- 3.2.2 Operators should also consider how the resting/sleeping facility location may interact with time zones and time zone changes from where the last duty ended to where the next duty will commence. For example, having layover accommodation an hour away from the sign-on base could:
- place it in a different time zone
 - impact on social cues around meal times and sleep/awakening times

- require FCMs to adjust accordingly to the local time.

3.2.3 The difference between needing to wake at 0500 hours or 0600 hours may be the difference between the effects of the window of circadian low (WOCL) impacting on performance throughout the day or not.

3.3 Acclimatisation

3.3.1 ‘Acclimatisation’ is a complex issue. While CAO 48.1 defines acclimatisation, specifically when an FCM is considered to be in an unknown state of acclimatisation and the method to become reacclimatised, it is important that operators understand how the impact of crossing time zones and how time-zone adaptation can be individualised.

3.3.2 For the purpose of the rules pertaining to fatigue management for FCMs, ‘acclimatisation’ is a formal term applicable to operators complying with Appendix 2 of CAO 48.1. Whether an FCM is in a known state of acclimatisation, or an unknown state of acclimatisation, determines the maximum FDP and minimum ODPs for an FCM. While other appendices do not specifically address the impact of crossing time zones, the likely increase in fatigue risk from doing so must be adequately managed.

3.3.3 Generally, the responsibility for managing the effects of time zone changes and acclimatisation is shared between the operator and the FCM. The operator should provide adequate fatigue training, as well as tools for staff to use when assessing their own alertness.

Note: The operator must not require an FCM to commence a duty when they are not fit for that duty.

3.3.4 The FCM has an obligation to apply this training to their situation when deciding their fitness for duty. FCMs should report to their operator when they feel unfit for duty after crossing time zones. The operator can then use these reports to assess whether their limitations and fatigue policies are adequate. Even though the applicable limitations and policies may be in accordance with CAO 48.1, the operator must consider the particular operational characteristics in order to ensure, as far as possible, FCMs are fit for duty.

3.3.5 Appendix D to this CAAP provides various examples for determining an FCM’s state of acclimatisation for the purposes of CAO 48.1. These scenarios should be considered as guidance only, and may not guarantee that an FCM is actually acclimatised, or in an unknown state of acclimatisation, as described.

3.4 Augmented crew

3.4.1 Augmented crew refers to a flight crew comprising more than the minimum number of FCMs required to operate the aircraft as per the Flight Manual to allow 1 or more FCMs to be relieved of duties during flight time.

3.4.2 Augmenting the crew is a strategy operators can use to assist with managing crew alertness. With appropriate procedures in the operator’s operations manual, and appropriate on-board resting facilities, crew can rotate in-flight rest times and utilise facilities to manage their alertness, and mitigate against the effects of fatigue. When developing procedures operators should consider:

- designating a pilot responsible for making command decisions at all times when the pilot-in-command (PIC) is utilising in-flight rest

- a requirement for a comprehensive briefing prior to FCMs rotating through in-flight rest
 - direction to crew that the in-flight rest requirements do not take priority over the need to optimise the crew experience levels on the flight deck for managing unplanned operational threats.
- 3.4.3 Sleep inertia defines a period of transitory hypo-vigilance, confusion, disorientation of behaviour and impaired cognitive and sensory-motor performance that immediately follows awakening. There are various studies that have described the effects of sleep inertia on performance, particularly when awakening from deep sleep.¹ Operators and FCMs should be aware of, and manage, the effect of sleep inertia in flight operations.
- 3.4.4 It is important that operators are aware of, and consider, individual variability in alertness and circadian (time zone/body clock) adjustment when using augmented crews.
- 3.4.5 FCMs have different sleep needs and different performance effects from countermeasures (e.g. caffeine) each of which should be taken into consideration. Additional crew will still become fatigued even when they are not in an operational role. Operators need to ensure that FCMs receive training regarding the appropriate use of augmented crews and in-flight crew rest facilities.
- 3.4.6 Appendix 2 stipulates the minimum time an FCM requires the in-flight crew rest facility to be available; however, these times are only minimums and adequate alertness may require a substantially longer time be available to gain adequate in-flight rest/sleep. As a guide, the augmented crew FDP limits in Appendix 2 of CAO 48.1 assume that the majority of the FDP is flight time and the available rest/sleep time (cruise phase) is fully utilised and is reasonably evenly distributed amongst FCMs. The number of sectors is limited so that an augmented crew operation is only undertaken in FDPs containing sufficiently long sector lengths to allow adequate time for rest/sleep.
- 3.4.7 In-flight rest facilities need careful design and consideration in order to permit adequate rest and sleep for crew. Classes of in-flight crew rest facilities are defined in CAO 48.1. When determining appropriate rest facility specifications, the following factors should be taken into account:
- relief from postural constraints of the work (e.g. prolonged periods strapped to a flight seat)
 - noise
 - physical configurations
 - locations
 - privacy needs
 - lighting
 - vibration
 - micro-climate (air flow, ventilation, temperature, temperature gradient, humidity)
 - hygiene (avoidance of pathogens, shielding)

¹ Studies include: Ferrara, M & DeGennaro, L. 2000. The sleep inertia phenomenon during sleep-wake transition: Theoretical and operational issues. *Aviation, space and environment medicine*, 71(8), 843-848. Caldwell, J., Prazinko, B. & Caldwell, J. (2002). *Fatigue in aviation sustained operations, the utility of napping, and the problem of sleep inertia*. Paper presented at the Research and Technology Organisation Human Factors Medicine Lecture Series, Fort Tucker, Alabama.

- communications
- restraint mechanisms
- access
- evacuation procedures
- requirements for emergency equipment.

3.5 Fatigue occurrence reporting

3.5.1 The willingness of FCMs to participate in fatigue occurrence reporting will reflect their level of understanding of their roles and responsibilities in relation to fatigue risk management and their confidence that the purpose of the data collection is to improve safety. An effective fatigue reporting system requires an open and fair reporting culture. It needs to:

- use forms that are easy to access, complete and submit
- have clearly understood rules about confidentiality of reported information
- have clearly understandable voluntary reporting protections
- include regular analysis of the reports
- provide regular feedback to crew members about decisions or actions taken based on the reports and lessons learned.

3.5.2 A fatigue report form (either paper-based or electronic) should include information on:

- recent sleep
- duty history (the minimum should be the last three days)
- time of day of the event
- measurement of different aspects of fatigue-related impairment (for example, validated alertness or sleepiness scales).

3.5.3 The report should also provide space for written commentary so that the person reporting can explain the context of the event and give their view of why it happened. An example of a fatigue occurrence report form can be found in Appendix E to this CAAP.

3.5.4 Management should encourage crew members to complete and submit a fatigue occurrence report in the following instances:

- Through the voluntary reporting system when an FDP has not commenced or is not completed, due to fatigue (either entirely or in part). This includes when the FDP is completed but only after some mitigating action. For example:
 - o adding an extra crew member
 - o reducing the workload of the duty
 - o delaying the reporting time
 - o creating the opportunity for a nap
 - o increasing supervision/monitoring.
- Through the voluntary reporting system following an FDP, if the FCM believes (upon reflection) that the level of fatigue they, or other crew members, were suffering meant sufficient safety margins had not been maintained throughout the flight(s).

- Through the voluntary reporting system, when the FCM notices something in their operating environment that is likely to impact on their, or other crew members', alertness to such an extent that safety margins could be reduced to unsatisfactory levels.
- Through the occurrence reporting system, when an incident or event has occurred where fatigue may, or may not, have been a contributing safety factor. To enable this, it is preferable for there to be a fatigue reporting facility or prompt on the operator's occurrence reporting mechanism. In these instances it is advisable to provide a 72 hour sleep history.

4 Operator obligations

4.1 Setting limitations

- 4.1.1 An operator's operations manual needs to document the limitations applicable to all FCMs. These limitations must not exceed those contained in the relevant appendix or appendices with which the operator chooses to comply.
- 4.1.2 CASA will not accept an operations manual that simply refers to the limitations contained in CAO 48.1. The operations manual must explicitly specify the limitations applicable to the operator's FCMs; these become 'hard' limits. This requirement allows all FCMs to be aware of their limitations.
- 4.1.3 Fatigue risk may not be sufficiently managed by relying entirely on limiting the hours of duty and commensurately providing for minimum length ODPs. After the application of these limits, there may be further need for an operator to control fatigue risk due to such things as:
- individual variability
 - operational environment
 - workload (amongst other factors).
- 4.1.4 An operator choosing to operate in Tier 2 must have hazard identification processes in place that are then used to determine operator-specific limitations as well as any other controls. Refer to Section 9 of this CAAP for detailed guidance about setting limitations for Tier 2 operators.
- 4.1.5 For transparency, if an operator has no intention to conduct certain operations available under an applicable appendix, the operator should include a statement in their operations manual acknowledging this. For example, if an operator conducting operations under Appendix 2 does not have any intention to conduct augmented crew operations; this should be stated in their operations manual.

4.2 Record keeping

- 4.2.1 In accordance with the operator obligations in CAO 48.1, an operator must maintain records in relation to FCM rosters, actual duty times and flight times (including reports of instances where an FDP is extended under an 'extension' provision).
- 4.2.2 These records and reports must be retained for five years. Operators must maintain records of the duration of all duty periods performed by an FCM, such as any task that an FCM is required, by an operator, to carry out associated with the business of the operator (this includes desk duties).
- 4.2.3 Where an extension provision is used that exceeds a 'hard' limit contained in the operator's operations manual, a report must be completed by the operator (refer to Appendix E to this CAAP for an example of a fatigue occurrence report). The purpose of these reports is to facilitate identification of fatigue hazards and the improvement in an operator's fatigue management policies (i.e. limitations). There must be sufficient detail in the report to enable it to be used effectively for this purpose.

- 4.2.4 The reports must be provided to CASA upon request. CASA inspectors will review these reports and may follow up on how these are being used to provide for continuous improvement of the operator's fatigue management policies.

4.3 Extensions due to unforeseen operational circumstances

- 4.3.1 For all operations (excluding Appendix 5 or 5A, and in some circumstances Appendix 4B of CAO 48.1), extensions beyond FDP limits may only be made in unforeseen operational circumstances, and should not be made on a regular basis. The intention behind the use of the term 'unforeseen circumstances' is to prevent operators continually rostering flight and duty times to their maximum limits and regularly relying on extensions to achieve their operational goals. As well as operational experience, hazard identification and risk assessments can be utilised to foresee potential disruptions or delays, for example:
- weather
 - air traffic control instructions
 - peak traffic during departure/landing times
 - sickness of crew members during a duty.
- 4.3.2 Extensions should only occur in less than 5 % in any sample of similar FDPs or similar operations. The sample of FDPs should be based on capturing a common root cause for the extension. For example, if an airport turn-around time is programmed for 45 minutes, however, it takes 1 hour and 15 minutes in one third of cases, relying on a 45 minute turnaround when rostering an FCM for a FDP that is at or close to the maximum is not appropriate.
- 4.3.3 Where an operator experiences extensions in more than 5% of the sample, the operator should consider revising its rostering practices by creating or amending documented rostering rules both for developing a roster and for day-of-operations management that provide greater assurance that the flight and duty time limits prescribed in the operator's operations manual will reliably not be exceeded.
- 4.3.4 For a Tier 2 operator to meet their obligations, the reports on extensions should be fed into their hazard identification and continuous monitoring processes (refer to section 9 of this CAAP, for further guidance).

4.4 Determination of home base

- 4.4.1 An operator is required to determine and notify each of its FCMs of their 'home base', unless the FCM only conducts operations under Appendix 5 or 5A of CAO 48.1.
- 4.4.2 Details of the process for making these home base determinations must be set out in the operator's operations manual. This allows FCMs to understand the procedures associated with these determinations (i.e. time available to move locations, if necessary).
- 4.4.3 Operators must ensure that changes in home base will not adversely affect aviation safety. Careful consideration of what an FCM may need to do as a result of a change in home base and subsequent recovery is necessary.

- 4.4.4 Determinations of home base should be assigned with a degree of permanence so as to not disrupt an FCM's fatigue recovery routines between duties.

4.5 Meals

- 4.5.1 Operators are required to provide an opportunity for FCMs to consume meals throughout an FDP at intervals of not more than 5 hours. Opportunities to consume a meal—food and drink—are required in order to avoid any detriment to an FCM's performance.
- 4.5.2 An operator should attempt to schedule meals alongside a break during the FDP. Evidence suggests that a break of 30 minutes during a duty period (during which a meal can be consumed) has a significant positive effect on an FCM's cognitive performance for an extended period following the break.
- 4.5.3 During long sectors, it is reasonable for the FCMs to consume a meal during the cruise. Operators should consider procedures that ensure that the safety of flight is not compromised if meals are consumed during flight.

4.6 Publishing of rosters

- 4.6.1 Publishing duty rosters allows FCMs to plan adequate rest before their next assigned duty. Operators should be aware that their FCMs will require some degree of certainty in organising their work/life balance and, more importantly from a fatigue management point-of-view, organising sleep.
- 4.6.2 It is important that operators publish the roster sufficiently in advance of the flights covered by the roster to allow the FCMs to organise their work/life balance, adequate sleep, and other aspects of personal life. Rosters should also be published with a consistent lead time that is communicated to all FCMs.
- 4.6.3 As a guide, the minimum notification period should be between 14 and 30 days when an FCM is rostered for FDPs that:
- involve augmented crew operations;
 - cross two or more time zones;
 - include two or more late night operations; or
 - include split-duty rest periods.
- 4.6.4 For *ad hoc* operations, particularly those where FCMs are employed on a casual basis, there may be little opportunity to provide notice of an upcoming FDP. Unless the FDP is going to be quite short, an operator should have in place procedures that involve offering an available FDP to a casual FCM at least the day before it is to take place. These procedures should therefore allow the casual FCM, prior to accepting the FDP, to consider their fitness for duty and whether or not they will be able to ensure adequate rest prior to it. As a guide, for an FDP to be considered quite short it would not exceed 50% of the FDP limit for the applicable start time. In addition, if there is any increase to the FDP limit via the use of augmented crew or a split-duty rest period then the notification period need to be increased appropriately.
- 4.6.5 Whilst late changes to rosters are understandable, it is important that these changes are kept to a minimum. It is necessary to have procedures in place so that any fatigue

risk resulting from the effects of late roster changes is managed. This is particularly important for augmented crew operations and the subsequent in-flight rest planning.

4.7 Delayed reporting time

- 4.7.1 There are various provisions in CAO 48.1 that provide for delaying an FCM's reporting time. Delaying a reporting time can result in extended periods of wakefulness and, if not managed properly, has the potential to impact on fatigue risk. If the operator becomes aware of circumstances that necessitate a delay to the FCM's reporting time for a FDP in the time preceding the commencement of a rostered FDP, then it is reasonable that the FDP be delayed.
- 4.7.2 Depending on the length of the delay, there can be an increase in fatigue risk that may impact on the safety of a flight following that delay. Operators must have procedures that address this potential for increased fatigue risk and ensure safeguards are in place to mitigate any increased risk.
- 4.7.3 The delayed reporting time provisions divide the possible delays into three main brackets:
- less than 4 hours
 - 4 hours or more, but less than 10 hours
 - 10 hours or more.
- Specific guidance on application of the delayed reporting requirements can be found in section C5 to Appendix C of this CAAP.
- 4.7.4 For delays less than 4 hours, the assumption is that the FCM may be able to rest; however, it is unlikely they will be able to return to sleep. The maximum FDP limit that the FCM cannot exceed remains the one determined for the original reporting time, and it is not permitted for the maximum FDP limit to be increased as a result of the delay. The reasoning behind this is that the FCM did not have an opportunity to organise their awakening time to suit the later reporting time and they will likely remain awake during the period of the delay.
- 4.7.5 In contrast, if the delayed reporting time results in a lower maximum FDP limit, this becomes the limiting maximum FDP limit, as this means the delay has resulted in a start time for which the maximum FDP is beginning to encroach on the WOCL.
- 4.7.6 For delays between 4 and 10 hours, there is an additional requirement that the maximum FDP determined for the 4 hour mark is then reduced by the amount of time that the resulting total delayed reporting time exceeds 4 hours. This linear reduction reflects the expectation that the FCM has already completed 8 hours of sleep and will not be able to return to sleep during the delay, and the FCM will therefore be awake for a significant period before they commence the delayed FDP.
- 4.7.7 For delays greater than 10 hours, it is considered that the FCM will have an opportunity to rest and sleep (where possible) throughout this period, and so adequately prepare for the resulting FDP commencing at the delayed reporting time. As it is possible that a delay of 10 hours or more may lead to significant circadian disruption for some FCMs, it is advised that operations manual procedures require both operators and FCMs to carefully assess the fatigue risks associated with the new FDP.

- 4.7.8 For an operator to implement delays of less than 10 hours, it is necessary for the operations manual procedures to address the requirements. These required procedures must be familiar to FCMs and be capable of providing a consistent application of delayed reporting procedures that meet the prescriptive limits. In developing operations manual procedures, an operator should consider matters such as contact/delay notification protocols at home base and away from home base, and paying particular attention to protecting and not interrupting a FCMs' sleep opportunity.

5 Additional obligations relating to FCMs under Appendices 2-6

5.1 Tier 2 operators

5.1.1 Operators who choose to operate under Tier 2 are subject to additional obligations. These include:

- hazard identification procedures
- procedures for the establishment of limitations (taking into account hazards)
- procedures which provide for continuous monitoring and evaluation, with a view to improving the operator's limitations, policies and practices (refer to Appendix F to this CAAP for an example of how continuous monitoring procedures can be used in practice to satisfy the obligations)
- training for FCMs.

5.1.2 Operators with an effective Safety Management System (SMS) will be familiar with these processes, and an SMS will most likely enable compliance with the hazard identification and continuous monitoring obligations.

5.2 Hazard identification (including use of biomathematical models)

5.2.1 As with all risk management, hazards related to human fatigue and alertness need to be identified, safety risks need to be assessed and risks need to be managed (e.g. putting in place controls and mitigation strategies). This is consistent with International Organization for Standardization (ISO) 31000:2009 – Risk management – Principles and guidelines.

5.2.2 Hazard identification needs to be done with formalised processes, which may include:

- hazard identification workshops (i.e. group brainstorming)
- risk assessments (i.e. formal risk assessments can uncover new hazards)
- hazard reporting
- hazard logging in registers (e.g. through electronic systems).

5.2.3 Hazards can combine in unforeseeable ways, so that even apparently trivial hazards can result in undesirable outcomes, which may combine with other hazards to result in a catastrophe.

5.2.4 The methods for hazard identification should be commensurate with the proposed extent of the limits in the applicable appendices. If the proposed limits in the operations manual are at or near the limits in the applicable appendices, CASA expects that the operator would have reactive, proactive, and even predictive hazard identification processes in place to ensure fatigue risk is managed properly.

5.2.5 Hazards can be identified from a range of sources including, but not limited to:

- brain-storming using experienced operational personnel
- development of risk scenarios
- trend analysis
- fatigue reports

- feedback from training
- safety surveys and operational oversight safety audits
- monitoring of normal operations
- use of appropriately validated biomathematical models
- State investigation of accidents and serious incidents
- information exchange systems (similar operators, regulators etc.).

5.2.6 Over time, the database of reported hazards enables the organisation to:

- identify ‘hot spots’ of fatigue risk that need particular attention
- conduct trend analysis that can provide the basis for improvement of hazard identification.

5.2.7 FCMs have an obligation to disclose, to their operator(s), anything affecting the FCM or connected with the FDP, which they have reason to believe, may affect their ability to meet the operator’s fatigue risk management policies or limitations. Examples of such factors include:

- their living arrangements
- external employment
- private flying any other factor which may compromise their alertness during duty.

5.2.8 These factors should be considered in the same light as general operational-specific hazards. For example, where certain FCMs disclose that they live a long distance away from their home base, the additional time spent commuting to work is a hazard that could adversely affect their alertness towards the end of their duty, due to their increased hours of sustained wakefulness.

5.2.9 Hazards like this need to be dealt with in two main ways:

- when determining flight and duty time limitations
- provide for continuous improvement of policies and practices.

5.2.10 Biomathematical models of fatigue can assist operators in providing predictions of human fatigue and/or sleep opportunity factors that can be utilised as one, non-essential component of a fatigue management regime. A primary role of many models is to provide a strategic rostering support tool aimed at providing an initial validation for newly developed or modified rosters.

5.2.11 While not a necessary component, biomathematical models of fatigue can incorporate aspects of fatigue science into rostering practices through providing predictions of fatigue risk levels, performance levels, and/or optimum sleep times/opportunities. Biomathematical fatigue models have limitations that must be considered. Some limitations include:

- predicting risk probabilities for a population average rather than fatigue levels of a specific individual
- not taking into account the impact of workload or personal and work-related stressors that may affect fatigue levels
- incomplete description of all fatigue physiology factors
- limited testing (validation) against aviation specific data.

- 5.2.12 Because each model has different strengths and limitations, CASA’s recommended approach is to consider a range of predictive processes (including biomathematical models) to identify fatigue hazards. When using a biomathematical model, CASA suggests the operator take a cautionary approach, which takes into account the model’s limitations and validity in that particular operational context (i.e. whether it has been validated against fatigue data from operations similar to those the operator is interested in). When making decisions about roster design, model predictions should not be used without reference to operational experience.
- 5.2.13 For further details about comparing the properties, strengths and limitations of various fatigue models, refer to the Biomathematical Fatigue Models Guidance Document available on the CASA website. It is important to be cognisant that a fatigue management regime should be designed as a comprehensive, multi-layered system, in which biomathematical models provide an optional supportive role.

5.3 Setting limitations taking into account hazards

- 5.3.1 When determining flight and duty time limits, operators need to consider the unique needs of their operational environment and tailor the regulatory promulgated limitations accordingly. It is also important for operators to consider that their environment is likely to change over time. Consequently, any changes need to be appropriately risk assessed. The operator also needs to continually revisit, update and modify flight time and duty limits to ensure the relevancy to operations at the current time.
- 5.3.2 Operators should consider the consequences of organisational or operational changes on fatigue and crew performance. Where fatigue-related issues arise associated with changing operations (e.g. different routes); or introducing new operations, operators should consider further mitigations to manage fatigue and crew performance. To assess the risk of any change, a persuasive risk assessment should be conducted, which includes looking at the likelihood and consequences of fatigue risks associated with that change.
- 5.3.3 Documented risk assessments will be required by CASA during surveillance activities, to demonstrate that changes have been properly considered.
- 5.3.4 The limits which are determined under this obligation become new ‘hard’ limits for the operator. This means that any exceedance of these limits must be in accordance with the extension provisions and only in unforeseen operational circumstances. Reports of these extensions must be made and provided to CASA upon request.
- 5.3.5 Operators should take into account the impact on fatigue levels of training and checking requirements when designing and setting limits. Participating in a training exercise or training other individuals can contribute to a person’s fatigue levels over and above what might otherwise be expected for other duties. This needs to be taken into account.
- 5.3.6 Training might be delivered in any of the following ways:
- classroom-based
 - on-line
 - during flight operations (line training)
 - at a training facility

or

- in a flight simulator.

5.3.7 All types of training (in an aircraft, class-room or elsewhere) could potentially affect the alertness of FCMs and their subsequent operational performance. From a workload perspective, it is also possible that monitoring or training another FCM could be more fatiguing than regular operations. It is highly recommended that operators make an appropriate reduction to maximum FDP limits when the FDP includes a period of training.

5.3.8 Training flights in a simulator are considered duty, and must be included in an FDP if they are conducted prior to a flight and are not separated from that flight by a prior sleep opportunity. If the simulator training is conducted after the last flight in a duty period, it does not need to be included in the FDP. When planning any FCM training, the impact of the level of FCM fatigue on the quality of training should be considered and managed accordingly.

5.4 Continuous improvement of policies and practices

5.4.1 Operators need to monitor and evaluate the effectiveness of their fatigue management controls (such as policies and practices). Where controls are found to be inadequate or ineffective, the operator must address this as part of their continuous improvement requirements.

5.4.2 Policies and practices to consider include:

- scheduling and rostering practices
- layover accommodation conditions
- augmented crew procedures
- training syllabi
- use of alertness and vigilance tools (i.e. a psychomotor vigilance test [PVT] prior to commencing duty).

5.4.3 Smaller operator example – an operator, operating mostly during the very early morning, should consider their operational needs when considering policies, potentially including a means for systematically shifting subsequent start times an hour later each day in order to ensure FCMs whose awakening time infringes on their morning WOCL period can recover from the lower quality of sleep as the week progresses.

5.4.4 Larger operator example – a larger operator running long-haul routes across time zones internationally should have established policies for taking into account their operational needs when selecting and booking accommodation for FCMs. These accommodation venues should be able to meet policies addressing:

- noise management
- temperature control
- light-blocking facilities.

5.4.5 Where available, an operator should make use of their SMS for this process. For operators without an SMS, Appendix F to this CAAP provides further examples of the types of hazards that may need to be addressed.

- 5.4.6 An operator's policies and practices should be reassessed for adequacy when there are adjustments of flight and duty time limitations.

5.5 Transition between appendices

- 5.5.1 Depending on the operational characteristics, operators may need to operate to multiple CAO 48.1 appendices and need to transition their FCMs between these appendices. Transitioning FCMs between different appendices may produce inconsistencies in duty/flight/standby/off-duty requirements. Procedures are required to ensure the FCM is always in compliance when making these transitions. There must also be an assessment of the fatigue risks resulting from transitioning between appendices in the operator's particular operating context and environment. The operator must address any risks identified with procedures and/or adjustment of their limits.
- 5.5.2 To ensure compliance, particular consideration must be given by operators transitioning from Appendix 4B, 5 or 5A to CAO 48.1 (medical transport and emergency service operations, and aerial work operations) to the other appendices. This is because concepts, such as standby, are dealt with differently in these appendices (to provide more flexible standby arrangements) and, therefore, may conflict with the requirements and limits in other appendices. Subsection 13A of CAO 48.1 sets out specified days off when transitioning from Appendix 4B, 5 or 5A to another appendix. Further guidance about operating under multiple appendices is contained in Appendix B to this CAAP.

5.6 Fatigue Training

- 5.6.1 Operators need to conduct fatigue training and assessment. To meet their obligations, operators should:
- allocate adequate resources for fatigue training (including trainers, materials and time)
 - accept that the benefits of fatigue training will not be realised without ongoing investment and effort.
- 5.6.2 There are three main subject areas which form the substance of a typical fatigue training program (fatigue, sleep and countermeasures). The following is a list of topics that could be included in these subject areas:
- Fatigue:
 - o types of fatigue
 - o contributors to fatigue
 - o consequences of fatigue on safety
 - o fatigue in accidents
 - o high risk situations
 - Sleep:
 - o sleep physiology
 - o circadian body clock
 - o the sleep process
 - o amount of sleep required
 - o sleep debt and recovery
 - o quality of sleep

- o sleep disorders and individual differences
 - o shift work
 - o jet lag
 - Countermeasures:
 - o managing sleep habits
 - o tailoring the sleep environment
 - o napping
 - o exercise
 - o nutrition and hydration
 - o caffeine
 - o avoidance of alcohol before bed
 - o use of sleep aids
 - o avoidance of nicotine
 - o keeping a sleep log.
- 5.6.3 In addition to these generic fatigue management topics, operators should tailor their training programs to include relevant topics for their own operation. For example, during training, FCMs should be made aware of the operator’s operations manual procedures, limits and operator and individual obligations.
- 5.6.4 Training must be conducted on an initial and recurrent basis. The interval between training should be determined by the operator, given their operational characteristics and training needs analysis. A training interval of not more than three years is recommended; however, where an operator identifies a need for training at closer intervals, this should be acted on.
- 5.6.5 The training required by CAO 48.1 may be integrated with other training conducted by an operator (i.e. human factors/non-technical skills training).
- 5.6.6 Fatigue training must be assessed with the level of training determining the level of assessment required.
- 5.6.7 A primary goal of assessment is to determine to what extent those participating in the training program are learning. Different phases of training (awareness, knowledge and skills) will entail different forms of assessment. Assessment techniques for awareness and knowledge phases of training programs are well founded.
- 5.6.8 Another goal of assessment is to act as a feedback mechanism to permit adaptive changes to training content and methods of instruction. The diagnostic use of assessment to provide feedback to instructors and students during a program of instruction is known as formative assessment.
- 5.6.9 The other main form of assessment (referred to as summative assessment) traditionally uses a behavioural test or written paper after a specified period of training to enable judgements about what level of learning has occurred.
- 5.6.10 Both formative and summative assessment can be used to make adjustments to the practise and design of training (i.e. reteaching, implementing alternative instructional approaches, and adding extra opportunities for practice).
- 5.6.11 Assessment criteria should be drawn from the initial training needs analysis. Training personnel are encouraged to use their experience to develop assessment criteria tailored to their particular operation. CASA has published a Fatigue Management

Toolkit on its website that includes material that may be useful in developing and facilitating a fatigue management training course. (Refer to the list of references in section 1.3 of this CAAP).

6 Individual obligations – fitness for duty – individual cognitive and physical fitness

6.1 Individual alertness measurement

- 6.1.1 Determining fitness for duty has always been a complex and challenging task, both for operators who should provide training to employees in understanding how to meet their responsibilities, and for the employees themselves.
- 6.1.2 A multi-method approach proves particularly useful, given that substantial fatigue research has demonstrated that humans are quite poor at determining how fatigued they actually are. The most ideal approach to measure an individual's true alertness level is to combine information from a range of sources. While no one tool or method may be free of limitations in measurement, obtaining information from a variety of sources is more likely to provide the individual with more accurate picture upon which to make their decisions regarding alertness. For example, instead of relying only on their subjective assessment of how fatigued they feel, they could support this assessment by using a scale, such as the Samn-Perelli scale, and additionally, improve the accuracy of this assessment of their alertness by considering one or more of the following potential sources of information:
- their sleep history, particularly if they have kept a personal sleep diary
 - monitoring behavioural/cognitive/emotional indicators (e.g. drooping eyelids, slower information processing time, negative mood)
 - considering their responses to important factors relevant to fatigue (e.g. sleep length, sleep quality, sleep environment, time zones crossed)
 - completing a short handheld psychomotor vigilance test (PVT)
 - examining scores from sleep monitoring tools.
- 6.1.3 Using a range of measures of varying types (i.e. both objective and subjective data) to determine an overall alertness 'picture' will assist the FCM in making informed and accurate decisions about managing their fatigue and whether they are operationally fit for work.
- 6.1.4 It is also important to recognise that FCMs who are fatigued will have impaired decision-making (e.g. about their alertness scores) and they will have poorer judgment in terms of how fatigued they are and whether they are actually fit for duty. This is because problem-solving and decision-making capability is reduced when suffering from fatigue. Operationally, this may mean that fatigued FCMs making an assessment about their fitness for duty may misread test scores or administer measurement tools incorrectly.
- 6.1.5 Communication about the extent of their fatigue impairment may also not be effective when trying to manage the situation. As creativity (along with problem-solving) is also reduced when suffering from fatigue, an FCM will also be less likely to:
- determine effective ways of managing their fatigue
 - address alertness issues in general
 - be able to identify potential risks and hazards.

- 6.1.6 To manage poorer judgment and decision-making, CASA recommends involving a non-fatigued individual along with multiple methods of measuring alertness to assist the FCM in assessing fitness for flight.
- 6.1.7 Important factors that provide information when determining fitness for duty are the measurement of:
- sleep history
 - changes to circadian rhythms
 - operational risk
 - the time of proposed operation.
- 6.1.8 Appendix G to this CAAP provides an example of a useful method to tool for an individual to consider factors affecting their fitness for duty. The intention of this particular example tool is that it is used in a proactive manner to assist an FCM who thinks they present a fatigue risk, but are unsure if they should start duty, or are unsure for how long a period of reasonable alertness will likely continue for them. The tool in Appendix G to this CAAP has been developed to support them when making decisions of fitness for flight.
- 6.1.9 It is important for operators and employees to understand that the tool in Appendix G is not meant to provide a 'go or no-go' outcome. There will also be situations when FCMs need to commence operations and manage their fatigue risk through the use of other countermeasures (i.e. task rotation or napping).
- 6.1.10 It is important to understand that this tool is only one example of a decision-making aid when determining fitness for duty. Operators or FCMs themselves may utilise other methods/tools for determining fitness for duty; however, the most optimal methods will have established validity and be usable in operations. Managing fatigue needs to be specific to the operational risk context.

6.2 Fatigue occurrence reporting

- 6.2.1 Operators' hazard identification obligations are reliant on FCMs reporting when they believe fatigue led to a reduction in safety margins, or would have led to a reduction in safety margins had some mitigating action not been taken. It should be stressed that operators must make every effort through fatigue training to highlight the importance of accurate voluntary reporting. Broadly speaking, there are four instances when fatigue reporting is essential for effective hazard identification (refer to Appendix E to this CAAP for an example of a fatigue occurrence report):
- Through the operator's fatigue reporting system, when an FDP has not commenced or is not completed due to fatigue (entirely or in part). This includes when the FDP is completed, but only after some mitigating action, for example:
 - o adding an extra crew member
 - o reducing the workload of the duty
 - o delaying the reporting time
 - o creating the opportunity for a nap
 - o increasing supervision/monitoring.
 - Through the operator's fatigue reporting system, following an FDP if the FCM believes, on reflection, that the level of fatigue they or other crew members were

suffering meant sufficient safety margins had not been maintained throughout the flight(s).

- Through the operator's fatigue reporting system, when the FCM notices something in their operating environment that is likely to impact on their, or other crew members', alertness to such an extent that safety margins could be reduced to unsatisfactory levels.
- Through the operator's occurrence reporting system (if they have an SMS), when an incident or event has occurred where fatigue may, or may not, have been a contributing safety factor. To enable this, it is preferable for there to be a fatigue reporting facility or prompt on the operator's occurrence reporting mechanism. In these instances it is advisable to provide a 72 hour sleep history.

6.3 Health and well-being

6.3.1 The FCM should monitor and seek appropriate treatment for their health and general well-being, as physical health can impact on fatigue. Health and well-being includes:

- short-term (acute) and chronic health conditions
- genetic predispositions
- nutrition
- hydration
- sleep difficulties (a wide range of sleep difficulties can affect fatigue, circadian functions, sleep quantity and sleep quality).²

6.3.2 Sleep disorders range in severity from occasional and inconvenient (e.g. jet lag when on holiday) to chronic and potentially life-threatening (e.g. obstructive sleep apnoea syndrome). When managing fatigue, employees have a duty of care to monitor and manage any health concerns that may impact on their fitness for duty, which may include contacting a medical specialist. FCMs should be cognisant that sleep difficulties may exist or may develop in the future and that these should be treated accordingly, so they do not impact upon the safety of aviation operations.

6.4 Workload

6.4.1 One of the major topics when considering human factors and human performance in aviation systems is workload management. While various conceptualisations of workload exist, mental workload can be defined as a function of the environmental demands placed on the FCM and the capabilities of the FCM to meet those demands.

6.4.2 Workload management for the FCM requires consideration of:

- demands on attention
- processing capacity
- dual-tasks (multitasking)
- how mental resources are being allocated.

² There are a diversity of sleep disorders from a psychological perspective, which are listed in the current Diagnostic and Statistical Manual of Mental Disorders (5th edition). In addition to this, there is the International Classification of Sleep Disorders diagnostic and coding manual where new categories are continually being added.

- 6.4.3 While workload management itself is important when minimising the risk of human error, it is also likely that workload and the nature of the tasks performed affect how fatigued the FCM will become. To date, few studies have considered how workload influences alertness (or vice versa); however, their interaction is likely to require consideration and management.
- 6.4.4 Typical techniques for managing workload while on duty include:
- task shedding
 - prioritisation of tasks
 - task delegation
 - task rotation
 - personnel rotation.
- 6.4.5 It is also important to be cognisant of a person’s optimal level of stress or arousal necessary for optimal performance to:
- acknowledge the advantages of stress and engagement in a task
 - have realistic attitudes towards stress – understanding that different people react differently to stressful situations (e.g. emergencies)
 - use effective communication with colleagues
 - monitor and observe any behaviours that may indicate a change to a person’s workload level (e.g. gripping the controls tightly, fixation on the artificial horizon, tunnel focusing on a display screen).
- 6.4.6 Workload is also an increasingly important factor for biomathematical models of performance prediction. Although determining the degree to which this factor (the variance) might impact on alertness (in addition to factors such as shift length, timing or pattern) requires further research. Several fatigue biomathematical models on the market are currently investigating and incorporating the effects of workload on alertness in their suite of predictive variables.
- 6.4.7 Overall, existing data suggests that the relationships between workload, performance and subjective fatigue are likely to be complex and that further research is desirable. For aviation personnel, it is important to consider and manage the effects of workload and fatigue individually when managing risk, as well as the interacting relationship that may be present between them.

6.5 Fatigue mitigating strategies

- 6.5.1 An FCM can manage fatigue before, during and after work shifts by employing a range of fatigue mitigation strategies that work for their personal sleep needs. It is helpful to establish effective sleep habits, such as:
- scheduling sleep
 - trying a quiet activity before bed
 - establishing a bedtime routine
 - not eating or drinking too much
 - getting out of bed if they cannot sleep
 - using relaxation techniques
 - having a comfortable bed

- it is also important that the sleep environment is conducive to rest, specifically that it has a cool temperature, is dark and quiet.
- 6.5.2 One of the most effective fatigue countermeasures is napping; however, it is important to remember that napping should not be considered as an alternative to a regular night's sleep. Napping can be useful when supplementing too little or poor quality sleep and just 15-20 minutes can increase performance and alertness temporarily. Care should be taken when planning napping, as napping for greater than periods of approximately 45 minutes can result in greater sleep inertia.
- 6.5.3 Exercise is also a beneficial fatigue risk mitigator, as it improves energy and stamina, improves mood, relieves stress and results in longer and more restful sleep.
- 6.5.4 Adequate nutrition and hydration is also important for managing and preventing fatigue. Ideally, the FCM should:
- have a balanced diet
 - eat regularly
 - have healthy snacks
 - eat breakfast
 - plan meals
 - drink water regularly
 - avoid late night meals (which result in slower digestion).
- 6.5.5 Another popular fatigue countermeasure is the use of caffeine as a stimulant. Caffeine can improve alertness temporarily, takes 15-30 minutes to take effect and can last for 5 hours; however, it is important to consider that there are individual differences in terms of the effects of caffeine, that tolerance and withdrawal can develop, and that use should be avoided before bedtime. Caffeine should be used when its affect will have the most impact (i.e. prior to flying the descent and landing).
- 6.5.6 In order to increase sleep quality, alcohol should be avoided before bedtime. Sleep aids and medications should be treated with caution and used in consultation with a physician, as they can lead to drowsiness, confusion and forgetfulness. Nicotine should also be avoided, as it is a stimulant that can interfere with getting to (and remaining) asleep.
- 6.5.7 An ideal way for FCMs to keep track of their sleep quality or the effectiveness of used fatigue countermeasures, is to keep a sleep log or sleep diary. Research suggests that people (including pilots) tend to overestimate the amount of sleep they are getting, so a daily log can assist with accurate recall. An example log/sleep diary could incorporate:
- time in bed
 - time getting to sleep
 - time of awakening
 - mood upon awakening
 - nutrition/alcohol consumption from the previous day
 - sleep quality (e.g. number of awakenings during the night)
 - the sleep environment (e.g. a comfortable bed, ventilation, lighting).

6.6 Sleep

- 6.6.1 An FCM should utilise ODPs to ensure fitness for their next rostered duty period or standby time. This is both for recovery from time awake/fatigue and to ensure they are sufficiently rested for any future duty periods. If adequate sleep cannot be obtained, the FCM would need to report this to the operator before any duty periods commence.
- 6.6.2 It is likely that to meet their obligations, an FCM would be required to have suitable sleeping accommodation/conditions at home and also have access to suitable sleeping accommodation/conditions when they are away from home, due to duty requirements. CAO 48.1 also recommends sleep opportunity and the availability of suitable sleeping accommodation, at these times.
- 6.6.3 The sleep environment should allow for an adequate sleep period with defined blocks of time during which FCMs are not interrupted. The ergonomics of rest areas should be considered, as they can have a large influence on fatigue while working, and the quality and quantity of restorative rest. This includes an environment that is cool, dark and quiet and provides relief from postural constraints of the work (e.g. prolonged periods strapped to a flight seat), noise and other environmental factors.
- 6.6.4 Appropriate accommodation should consider the following factors:
- noise
 - physical configurations
 - locations
 - privacy needs
 - lighting
 - vibration
 - micro-climate (air flow, ventilation, temperature, temperature gradient, humidity)
 - hygiene.
- 6.6.5 It is also suggested that FCMs consider their personal ergonomic and environmental needs/requirements when determining suitable sleeping accommodation/conditions at home.

6.7 Time zones and acclimatisation

- 6.7.1 The responsibility for managing the effects of time zone changes and acclimatisation is shared between the operator and the FCM. The operator should provide adequate fatigue training, as well as tools for staff to use when assessing their own alertness.
- 6.7.2 The FCM has an obligation to then apply this to their situation when deciding their fitness for duty. FCMs should be cognisant of their personal time zone adaptation requirements. These may differ from what CAO 48.1 specifies. Where an FCM feels that they are not fit for duty following an off-duty period after crossing time zones, this should be reported to the operator so that the operator can determine whether their limitations and fatigue policies are adequate.

6.8 Augmented crew

- 6.8.1 With appropriate in-flight resting facilities, crew can rotate rest times and share facilities to manage their fatigue. It is important that crews consider that with an augmented crew, there will be variability in terms of alertness and circadian (i.e. time zone/body clock) adjustment among FCMs. Additionally, they will all have different sleep needs and different performance effects from countermeasures (e.g. caffeine). When utilising in-flight rest facilities, an FCM should do so intelligently, rather than doing something potentially stressful (e.g. a university assignment), the FCM should make use of the time to relax and attempt to sleep.
- 6.8.2 There are various studies which look at the effects of sleep inertia on performance, particularly when awakening from deep sleep. Operators and FCMs should be aware of and manage the effect of sleep inertia in flight operations.

7 Individual obligations – disclosure to an operator

7.1 Living arrangements – distance from base

7.1.1 FCMs should consider how their living arrangements and travel time to work may affect their fatigue levels. Any potentially problematic conditions need to be disclosed to the operator if it is having, or is likely to have, an impact on operational performance.

7.1.2 As an FCM's living arrangements change throughout their lifespan, these changes should also be considered in the context of whether it may have an impact on fatigue levels and subsequent operational performance. For example, living situations that may have a resulting impact on a person's fatigue levels include:

- having shared or alternating living locations
- long and variable commute times (e.g. due to distance and traffic congestion)
- personal and work-related relocation decisions
- noisy living environments/disruptions to home resting areas (e.g. council/road works, neighbourhood construction/renovations, care requirements for babies/children, traffic noise, non-soundproof walls)
- overly well-lit living environments/resting areas (e.g. bright city lighting, inadequate light coverings during allocated daytime rest periods).

7.1.3 FCMs may find that certain unique living situations can improve alertness and minimise the risk of fatigue. In some instances, it may be beneficial to live further away from a departure base, rather than closer. An example is where the departure base is continually noisy or overly lit during sleep/rest periods or night time. FCMs should give sufficient contextual consideration to their living arrangements and changes to their living arrangements in relation to any impact it may have on fatigue. If potentially problematic situations arise, this needs to be disclosed to the operator.

7.2 External employment and other tasks

7.2.1 FCMs have an obligation to manage any external employment activities to ensure that they do not impact on their fatigue levels during operations. External activities such as:

- home duties
- leisure duties
- family duties
- volunteering work conducted outside of work hours.

7.2.2 With external employment and other tasks, the employee should consider any potentially adverse effects on operational safety from a fatigue perspective and disclose any potentially problematic situations to the operator. Examples of external tasks which may affect fatigue levels include:

- night flying work
- shift work
- running a business
- child minding responsibilities
- physically labouring tasks

- study/education
- driving.

7.3 Private flying

7.3.1 An FCM, who undertakes private flying and acts as an FCM for an operator, may have an obligation to declare private flights. Private flying operations cover a wide range of activities. For the purposes of fatigue management these activities can be divided into two broad areas:

- recreational private operations
- non-recreational private operations.

7.3.2 A recreational private operation can be conducted by an FCM and there are no current limits (beyond personal limits) that may apply. In the normal course of events where an FCM does some recreational private flying on a day off, there may be no need for the FCM to disclose this; however, the FCM must be mindful of operators' policies to fatigue and recreational flying.

7.3.3 There are individuals who undertake private flying that is not considered recreational (i.e. paid work, ferry flights, flight testing and conversion training).

7.3.4 These operations are seen as more difficult to cancel or reschedule and generally involve more planning and operational complexity than traditional recreational flight. They may have an effect on a subsequent FDP for the pilot who is also employed by an operator. There are no limits, except personal ones that apply; however, once the FCM is rostered by an operator, these activities should be declared, as they will form part of cumulative flight time limits.

7.4 Open and fair reporting culture

7.4.1 In accordance with maintaining an open and fair reporting culture, FCMs need to disclose any situations, which are affecting, or may in the future affect, their alertness and compliance with CAO 48.1. Disclosure is also consistent with upholding best practice safety and risk management principles. FCMs have an obligation to contribute to this healthy safety culture and to maintain a strong reporting culture, which in turn enables the operator to manage risk predictively and proactively. Employees need to be able to disclose information and discuss factors with the operator that may affect fatigue and alertness in an open, communicative and confidential environment, without experiencing fear of penalty.

Appendix A

Development of operations manual limits and procedures

A.1 Development sequence

A.1.1 The following development sequence is just one approach of many that an operator could take to develop limits and procedures for their operations manual.

A.1.2 The major development tasks, in the suggested order, are:

- a. Determine allowable appendices (see section A.2 of this Appendix)—Confirm what operations the operator is authorised to conduct and therefore the available appendices.
- b. Determine limits (see Appendix C to this CAAP)—Determine limits that must not exceed the limits in the allowable appendix or appendices. The chosen limits cannot be more than any maximum stipulated in an applicable appendix and cannot be less than any minimum stipulated in an applicable appendix.
- c. Develop procedures to meet requirements contained in appendices (see Appendix C to this CAAP)—These procedures must provide for compliance and fulfilment of requirements as set out in the applicable appendix or appendices (i.e. sleep opportunity provisions and delayed reporting time procedures).
- d. Develop procedures to meet requirements for operations under multiple appendices (see Appendix B to this CAAP)—If operations under more than one appendix are to be undertaken, these procedures must manage FCM transitions between appendices. The procedures must meet the requirements of subsections 13 and 13A, and subparagraph 15.2 (d) of CAO 48.1.
- e. Develop procedures to meet requirements for fatigue risk management (see section 5 of this CAAP)—If operations under one or more of Appendices 2-6 of CAO 48.1 are to be undertaken, these fatigue risk management procedures must meet the matters required by paragraph 15.2 of CAO 48.1.
- f. Develop fatigue training (see section 5.6 of this CAAP)—If operations under one or more of Appendices 2-6 are to be undertaken, as required by paragraphs 15.3 to 15.9 of CAO 48.1. Develop an appropriate initial and recurrent fatigue training and assessment program, taking into account the nature of the operations undertaken, the operational context and environment, and the limits that have been chosen to apply. A description of the training resources must be documented in the operations manual.
- g. Develop other procedures (see sections 4 of this CAAP)—The various procedures required by subsection 14 of CAO 48.1 (i.e. rostering systems, provision for meals, etc.).

Note: All procedures and limits must be documented in the operator's operations manual. CASA must be satisfied that the limits and procedures in the operations manual are sufficient to reasonably ensure that FCMs will not exceed safe levels of fatigue while operating an aircraft.

A.2 Availability of the Appendices of CAO 48.1

A.2.1 Which appendix or appendices of CAO 48.1 are available to an operator will depend on what type of operations the operator conducts. There may be multiple appendices available for the same type of operation, and it is up to an operator to determine which appendix is suitable for them.

A.2.2 Appendix 1 - Basic limits

A.2.2.1 Appendix 1 is available to all operators conducting any type of operation. However, the window within which an FDP may be undertaken does not permit operations in the early hours of the morning (between 1am and morning civil twilight/7am, whichever is earlier).

A.2.3 Appendix 2 - Multi-pilot operations except flight training

A.2.3.1 Appendix 2 is available to operators that conduct operations with multi-pilot procedures. As well operations that involve multi-pilot certified aircraft, the appendix is also available to operators who conduct operations with 2 or more pilots in a single-pilot certified aircraft.

A.2.3.2 While operations that involve contracted checking or contracted recurrent training conducted as a multi-pilot operation are permitted under Appendix 2, flight training for the grant of a licence, rating or endorsement must not be conducted under this appendix.

A.2.4 Appendix 3 - Multi-pilot operations except complex operations and flight training

A.2.4.1 Appendix 3 is available to multi-pilot operations as per Appendix 2, but excludes 'complex operations'. A complex operation is one that involves augmented crew operations (carrying more than the minimum number of FCMs for the purpose of relieving one or more FCMs of duty during flight time), operations that involve a displacement time of 2 hours or more (where a time zone change from the beginning to the end of the duty period is 2 hours or more), or operations where an FCM is not acclimatised to the location where they commence an FDP.

A.2.4.2 Simple multi-pilot operations that do not cross time zones may find Appendix 3 more suitable than Appendix 2. Appendix 2 is available to these operators and the resulting limitations would be the same; however, Appendix 3 does not have the complexity of Appendix 2.

A.2.5 Appendix 4 - Single-pilot operations

A.2.5.1 Appendix 4 is available to single-pilot operations (i.e. operations that are not conducted under multi-pilot procedures).

A.2.5.2 A flight training flight consisting of a student and an instructor is considered a single-pilot operation, unless it is in an aircraft requiring more than one FCM to operate. Therefore, this appendix would be suitable for most operators that conduct both charter and flight training with the condition that any flight training is completed within 7 hours flight time and any FDP that includes flight training must be followed by an ODP of at least 12 hours.

A.2.6 Appendix 4A - Balloon operations

- A.2.6.1 Appendix 4A is available to operators that operate balloons. It is tailored specifically to these operations.
- A.2.6.2 However, nothing prevents a balloon operator to choose either Appendix 1, 4 or 7 instead of this appendix if they prefer.

A.2.7 Appendix 4B - Medical transport operations and emergency service operations

- A.2.7.1 For an operator to conduct an operation under Appendix 4B, the operation must be a medical transport operation or emergency service operation. These terms have specific meanings in CAO 48.1. The appendix is tailored around the operating characteristics of this segment of the industry.

A medical transport operation means an aircraft operation consisting of 1 or more flights for any of the following purposes:

- a. delivery of urgent medical assistance to a person, when determined to be necessary by a medical transport tasker;
- b. transportation of any of the following, when determined to be necessary by a medical transport tasker:
 - i. an ill or injured person;
 - ii. another person directly involved with the person mentioned in sub-subparagraph (i), for example, a close relative or the police.
 - iii. medical personnel intended to be, or who are, directly involved with the person mentioned in sub-subparagraph (i);
 - iv. blood, tissue or an organ for transfusion, grafting or transplantation (an item), including a person who has authorised custody of the item;
- c. the return of the aircraft to its base because an operation mentioned in subparagraph (a) or (b) is completed.

An emergency service operation means an operation involving an aircraft:

- a. for the purpose of law enforcement, or saving or protecting life or property; and
- b. conducted by, or at the request of, an organisation recognised by an Australian governmental agency as having responsibility to conduct or request the operation as part of the organisation's functions.

- A.2.7.2 For an operation to be classified as a medical transport operation, there must be procedures in place that sets out the means and considerations by which the medical transport tasker (medical personnel or an organisation whose purpose is, or whose purposes include, medical transport tasking) determines that a flight is medically necessary. Such matters should include, at a minimum, a risk assessment considering the nature of the flight(s).

- A.2.7.3 If an operator does not have procedures that allow an operation to be classified as a medical transport operation or emergency service operation, Appendix 4B is not available to them and a different appendix of CAO 48.1 must be complied with.
- A.2.7.4 If an operator also conducts charter operations, another appendix, such as Appendix 4, would need to be complied with when conducting such operations. Special provisions apply for transitioning from Appendix 4B to another appendix (refer to section B.2.2 of Appendix B to this CAAP).

A.2.8 Appendix 5 - Aerial work operations and flight training associated with aerial work

- A.2.8.1 Appendix 5 is available to all operations that are classified as aerial work under the *Civil Aviation Regulations 1988 (CAR)*. Flight training associated with aerial work (i.e. training for the grant of certain ratings and endorsements that permit typical aerial work-type operations) may also be permitted under Appendix 5.
- A.2.8.2 Operators who conduct non-aerial work operations such as charter operations will need to consider a different appendix, such as Appendix 4, when conducting such operations. Special provisions apply for transitioning from Appendix 5 to another appendix (refer to section B.2.2 of Appendix B to this CAAP).

A.2.9 Appendix 5A - Daylight aerial work operations and flight training associated with aerial work

- A.2.9.1 Like Appendix 5, Appendix 5A is available to all operations that are classified as aerial work under CAR, but it is restricted to operations that are conducted during daylight hours, for example, helicopter mustering operations. Flight training associated with aerial work (i.e. training for the grant of certain ratings and endorsements that permit typical aerial work-type operations) may also be permitted under Appendix 5A.
- A.2.9.2 Operators who conduct non-aerial work operations such as charter operations will need to consider a different appendix, such as Appendix 4, when conducting such operations. Special provisions apply for transitioning from Appendix 5A to another appendix (refer to section B.2.2 of Appendix B to this CAAP).

A.2.10 Appendix 6 - Flight training

- A.2.10.1 Appendix 6 is available and suitable to operator who solely conduct flight training (training for the grant of a licence, rating or endorsement under Part 61 of the *Civil Aviation Safety Regulations 1998 [CASR]*), or conduct multi-pilot flight training.
- A.2.10.2 If an operator conducts single-pilot flight training as well as other single-pilot operations, the limitations in Appendix 4 could be chosen instead of Appendix 6, therefore keeping all operations under the one appendix.

A.2.11 Appendix 7 - Fatigue risk management system

- A.2.11.1 Appendix 7, which allows an operator to manage FCM fatigue risk under an FRMS, is available to all operators. This permits an operator to develop and implement their own unique set of limitations which, subject to CASA approval, may differ from the prescriptive limitations.

A.2.11.2 An operator contemplating an FRMS should consider the guidance material available on the CASA website.

Appendix B

Operations under multiple appendices

B.1 General

- B.1.1 Operating under multiple appendices means either, or both, of:
- combining multiple appendices within a single FDP
 - switching from one appendix to another on consecutive FDPs.
- B.1.2 Operating under multiple appendices requires a two-step process. The first step is to ensure the FCM is within the limits of the new appendix prior to transitioning. Then, if the FCM will be operating to more than one appendix in an FDP, the second step is to determine the limits that will apply to the proposed FDP.
- B.1.3 Within CAO 48.1 the following sections need to be considered when developing procedures for operating under multiple appendices; and in particular, managing fatigue risk through transitions from one appendix to another:
- subsection 10
 - subsection 13
 - subsection 13A, if operating under Appendix 4B, 5 or 5A
 - paragraph 15.2 (d).
- B.1.4 Subsection 10 of CAO 48.1 requires that:
- each operator comply with limits and requirements mentioned in the applicable appendices
 - each FCM, employed by the operator, must comply with the limits in the appendices the operator has chosen to comply with.
- B.1.5 In some circumstances, meeting all the requirements of an appendix prior to operating under that appendix could potentially be more restrictive than is necessary to manage potential fatigue risk associated with transitioning.
- B.1.6 The requirements for combining multiple appendices within a single FDP have specific requirements that are addressed within subsection 13 of CAO 48.1 and operators must have procedures that comply with these requirements.
- B.1.7 If transitioning from Appendix 4B, 5 or 5A to another appendix, subsection 13A of CAO 48.1 sets a number of off-duty days that must be had prior to commencing an FDP under an appendix other than Appendix 4B, 5 or 5A.

B.2 What to do before changing from one appendix to another

- B.2.1 An operator must identify the hazards associated with their FCMs transitioning between appendices, and manage the risks through the application of limits and transition procedures, in accordance with subparagraph 15.2 (d) of CAO 48.1. This is to ensure that transitions do not result in an increase in risk to aviation safety.

B.2.2 Transitions from Appendix 4B, 5 and 5A to other appendices

- B.2.2.1 Appendices 4B, 5 and 5A have no requirement for a specific number of off-duty days to be completed across an 84 day period. This may result in an FCM having considerably less off-duty days than the minimum required to commence an FDP under Appendix 4 or 6. Requiring an extended number of consecutive days off duty (i.e. greater than seven), prior to operating under a different appendix is not reasonable. Rather than

require the FCMs to complete an extended number of consecutive days off-duty before they can transition from Appendix 4B, 5 or 5A to another appendix, subsection 13A of CAO 48.1 sets out an alternative way of complying with the limits and managing the minimum number of days off-duty.

- B.2.2.2 If an operator wanted to transition an FCM from Appendix 4B, 5 or 5A operations to charter work under Appendix 4, the FCM must first meet all the requirements of the new appendix other than the requirement for 24 off-duty days in 84 consecutive days. This requirement is then met by the prescribed number of days off specified in subsection 13A of CAO 48.1.
- B.2.2.3 Under subsection 13A of CAO 48.1, before transferring from Appendix 4B, 5 or 5A to any other appendix, the following requirements apply:
- a. The FCM must have had at least 7 days off-duty in the 28 consecutive days before commencing the FDP or standby; and
 - h. the FCM must have had either:
 - i. at least 24 days off-duty in the 84 consecutive days before commencing the FDP or standby; or
 - ii. The minimum number of off-duty days equal to half as many days as would otherwise be required for that FCM to meet the requirement for 24 off-duty days in the preceding 84 days (rounded up to the nearest whole number).
- B.2.2.4 If the FCM then commences operating in the new appendix with less than 24 off-duty days within 84 days, they have 28 days from the commencement of operating under the new appendix in which to achieve sufficient off-duty-days to then meet this requirement. At all times they are conducting the charter operation they must meet the requirement for 7 off-duty days in 28 days. If the FCM subsequently transitions back to Appendix 4B, 5 or 5A, then the whole procedure may be reset and commence again when they again transition out of Appendix 4B, 5 or 5A to another appendix.

Example 1: If the FCM had 5 off-duty days in the preceding 28 days and 16 off-duty days in the preceding 84 days then they would need to complete a period of 4 consecutive off-duty days (i.e. $24 - 16 = 8$; half of 8 equals 4 off-duty days). In this case, completing the 4 off-duty days means that the FCM then also meets the requirement for 7 off-duty days in a 28 day period and is clear to transition.

| Days | | |
|---|----------|----------|
| Requirement period | 28 | 84 |
| Required off-duty days | 7 | 24 |
| Actual off-duty days | 5 | 16 |
| Deficit (days) | 2 | 8 |
| Half 84 day requirement (rounded up) | | 4 |
| Off-duty days required to transition | | 4 |

Example 2: If the FCM had 2 off-duty days in the preceding 28 days and 16 off-duty days in the preceding 84 days then they would need to complete a period of 4 consecutive off-duty days (i.e. $24 - 16 = 8$; half of 8 equals 4 off-duty days). In this case, completing the 4 off-duty days means that the FCM then still requires an additional day to meet the requirement for 7 off-duty days in a 28 day period and is clear to transition once all 5 days off-duty are completed.

| Days | | |
|---|----------|----------|
| Requirement period | 28 | 84 |
| Required off-duty days | 7 | 24 |
| Actual off-duty days | 2 | 17 |
| Deficit (days) | 5 | 7 |
| Half 84 day requirement (rounded up) | | 4 |
| Off-duty days required to transition | | 5 |

B.2.2.5 Notwithstanding these specified days off, the requirements of subparagraph 15.2 (d) of CAO 48.1 apply with respect to these transitions, including that they do not adversely affect aviation safety. If there is any question regarding the suitability of this minimum period when employed in the operator's context, the operator should monitor the fatigue levels of FCMs and increase this minimum period if required. An example of a way an operator could monitor this is via surveys or regular meetings to discuss fatigue with the FCMs involved (the effectiveness of this approach would depend on the safety culture evident in the organisation at the time).

B.3 Operating under two or more appendices in a single FDP

B.3.1 If the operator intends to undertake operations where two or more appendices apply to a single FDP, the operations manual must contain procedures that ensure that:

- the maximum FDP is the FDP limit that applies to that particular activity that is being conducted at the time. The maximum FDP for the activity that is being conducted at any one time is always based on the start time of the entire FDP, not the point in time when the FCM switched to that activity.³
- the maximum flight time that an operator and an FCM must comply with is the flight time limit contained in the appendix under which the operation is being conducted at that particular time (based on the assumption that the entire FDP was conducted under that appendix). It must be based on the original start time of the FDP, and not on the start time of operations under each appendix.
- the ODP that must be applied following the FDP is the greater of the minimum ODPs (refer to Figure 2). This is calculated by assuming the entire FDP was conducted under each appendix. For example, the procedure should require that:
 - o the operator works out the minimum ODPs required (if the entire FDP was conducted under each appendix)
 - o the longest minimum ODP that was calculated is then the minimum ODP, which must be completed before the FCM can commence another FDP under any appendix.

³ For example, if the operator rosters the FCM for an aerial work flight under Appendix 5 prior to a non-aerial work flight (e.g. charter under Appendix 4), then before the FCM transitions to the charter flight, the FCM must be able to conduct the planned charter flight within the maximum FDP limit worked out under the charter limits. This means the charter flight/s must end within the maximum FDP limit worked out under the charter limits based on the start time of the duties associated with the aerial work flight as if the FCM had been conducting charter since that start time. (Refer to Figure 2).

Operating under two or more appendices in a single FDP – Maximum FDP

Procedure:

- Determine the maximum FDP limit for Charter (Appendix 4) from the Aerial Work start time
- In this example it is 10 hours (from Appendix 4) however it should be the limit in the operations manual
- The charter flight must end at least 15 minutes before 1700 (0700 + 10 hours)

Note: If the order of flights were reversed with aerial work second, the FDP could run until 1900

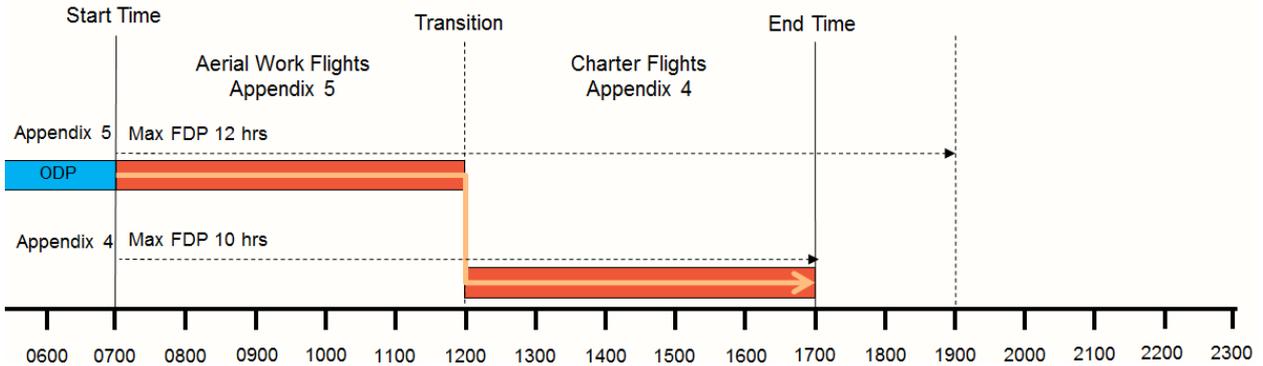


Figure 2: Operating under two or more appendices in a single FDP - Maximum FDP limit

Operating under two or more appendices in a single FDP – Minimum ODP

Procedure:

- Establish the total length of FDP: 10 hours in this case
- Work out the minimum ODP if the whole FDP was completed under each appendix:
 - Aerial Work – Appendix 5: 10 hours (8 hours would not include 2300 and 0529 local time)
 - Charter – Appendix 4: 12 hours at home base (10 hours away from home base)
- As the FCM is at home base the minimum ODP is 12 hours (the higher of the minimum ODPs)

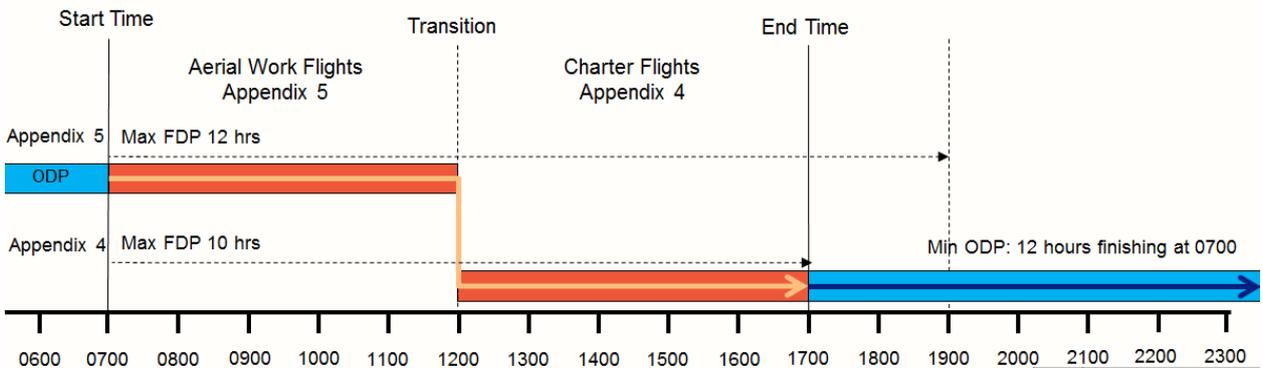


Figure 3: Operating under two or more appendices in a single FDP - Minimum ODP limit

Appendix C

Appendices limits and requirements

The guidance material in this appendix can be used to develop content for an operations manual to ensure it has satisfactory procedures and limits for the clauses in each appendix that an operator wishes to adopt and comply with (i.e. split duty, augmented crew operations, standby, positioning etc.).

Each section of this appendix has been divided up according to the clauses in each of the appendices of CAO 48.1. For each clause there is an introduction setting out the general rationale for the limits and/or requirements, as well as a section titled 'What should be in your operations manual' including specific aspects for each appendix of CAO 48.1. Readers should consider the information for the appendix or appendices relevant to their operation.

C.1 Sleep opportunity before an FDP or standby

C.1.1 Introduction

- C.1.1.1 An FCM needs to have adequate sleep prior to an assigned FDP in order to be well rested for the FDP. In general, an FCM should have the opportunity to sleep for at least 8 consecutive hours, ideally ending as close as reasonably practicable to the start of the FDP.
- C.1.1.2 There are minimum sleep opportunity requirements in all appendices except Appendix 4B and 5; however, Appendix 4B and 5 have a requirement that, if duties are undertaken in the 8 hours immediately preceding an FDP, a reduction in the available FDP duration is then required.
- C.1.1.3 There should be mutual understanding between the FCM and the operator as to where the sleep opportunity sits within the period preceding the FDP.
- C.1.1.4 The FCM should not be contacted by the operator during the prior sleep opportunity, except in a manner that could reliably be expected not to interrupt the FCM if they were asleep. Normal circumstances refer to those situations where the operator wishes to preserve the prior sleep opportunity. Abnormal circumstances refer to the case where the operator needs to contact the FCM and it is understood that this will mean that the prior sleep opportunity has been interrupted. The FCM will then not be able to commence the FDP without completing a period of prior sleep opportunity commencing from the end of the interruption. An example of when this might occur is if the operator needs urgent information from the FCM such as airworthiness related information about an aircraft the FCM flew in the previous FDP and the operator has decided it cannot wait until the prior sleep opportunity is over.

Example:

If the commute time at a particular away base location is 15 minutes, then the operator must ensure the ODP allows for:

- commute to and from the suitable sleeping accommodation (in this case 30 minutes in total)
- a period sufficient for meeting the reasonable requirements of bodily functioning (i.e. eating, drinking, toileting, washing and dressing (60 minutes might be appropriate)
- the required minimum sleep opportunity (8 hours).

As in this example, there will be many cases where the minimum ODP will more than cover the requirements to ensure an 8 hour prior sleep opportunity; however, when longer periods are required such as when commuting time is longer, where extended hotel check-in or check-out times are required or extended customs/quarantine clearance periods are required then the ODP may need to be extended to ensure the 8 hour prior sleep opportunity.

C.1.1.5 The requirement for prior sleep opportunity may result in an increased minimum ODP at some locations if there is not sufficient time available for the prior sleep opportunity. The following table can be used to help determine the required minimum ODP to ensure the minimum sleep opportunity requirements are met.

Table 1: Calculating an off-duty period taking into account commute time and sleep opportunity

| Requirement | Time required | ODP |
|---|----------------------|--|
| Commute time to suitable sleeping accommodation | ____ hours : minutes | Determine minimum ODP using the limits in Section C9. and enter below: |
| Sufficient time for the reasonable requirements of bodily functioning such as eating, drinking, toileting, washing and dressing | ____ hours : minutes | |
| Prior sleep opportunity | 8 hours | |
| Commute time from suitable sleeping accommodation to sign-on | ____ hours : minutes | |
| Total time | ____ hours : minutes | |
| Actual Minimum ODP (higher of two totals in the row above) | ____ hours : minutes | |

C.1.1.6 Where an FCM is interrupted during sleep opportunity, the FCM's capacity to adequately prepare for their next FDP is affected; therefore, this may affect the FCMs fitness for duty before the start of, or during the next FDP.

C.1.2 What should be in your operations manual

C.1.2.1 Where there is the requirement for prior sleep opportunity (in all appendices except Appendix 4B and 5), the operations manual should have:

- the operator's policy for managing the prior sleep opportunity requirements so that FCMs are aware when sleep should be planned with reference the start time of their assigned FDPs. This policy should be determined after consultation with FCMs.
- procedures to ensure that the minimum sleep opportunity prior to an FDP or standby can be met within rostered off-duty periods.
- procedures directing the operator's employees not to interrupt the FCM's sleep opportunity when making contact with FCMs prior to the start time of an FDP.
- procedures detailing specified contact methods and protocols that have proven to be effective at not interrupting the FCM's prior sleep opportunity, as well as identifying and communicating suitable times of contact.⁴
- procedures to ensure that, as far as reasonably practicable, each FCM is aware that they have a responsibility to make appropriate use of the sleep opportunity prior to commencing an assigned FDP (or standby period, if standby is allowed by the applicable appendix) to achieve adequate alertness for the assigned FDP.

Note: Required procedures could be as simple as ensuring FCMs, rostering personnel and all those that might have reason to contact an FCM prior to an FDP have been informed of this requirement on induction into the company. They should all be made aware that any contact (other than in accordance with the operator's procedures) during the sleep opportunity period, has the potential to impact the FCMs fitness for duty for the subsequent FDP.

Appendix 1

The operations manual must have procedures to ensure that an FCM has at least:

- 8 consecutive hours of sleep opportunity at home base within the 12 hours immediately preceding the start of an FDP
- 8 consecutive hours of sleep opportunity if away from home base, within 10 hours immediately preceding the start of an FDP.

Appendices 2, 3 and 4

The operations manual must have procedures to ensure that an FCM has at least:

- 8 consecutive hours of sleep opportunity at home base within the 12 hours immediately preceding the start of an FDP or standby
- 8 consecutive hours of sleep opportunity if away from home base, within 10 hours immediately preceding the start of an FDP or standby.

⁴ These procedures should be in a form that is clear and readily available to the operator's employees who are involved in rostering activities, as well as affected FCMs.

The operations manual should reflect that, if an FDP is delayed:

- the requirements for sleep opportunity relate to the original FDP start time rather than the delayed start time when the delay is less than 10 hours
- when there is a single delay of 10 or more hours, the prior sleep opportunity is then required before the delayed start time.

Appendix 4A

The operations manual must have procedures to ensure that an FCM has at least either:

- 8 consecutive hours of sleep opportunity in the 10 hours immediately preceding the FDP; or
- 10 consecutive hours of sleep opportunity, of which at least 6 must be consecutive, within the 24 hours immediately before commencing the FDP.

Appendices 4B and 5

Appendix 4B and 5 deal with the need for adequate sleep prior to an FDP differently than the other appendices. These appendices stipulate that if the operator requires the FCM to perform non-flying duties in the 8 hour period immediately prior to the start of the FDP, the maximum allowable FDP is reduced by the duration of time it took to complete those non-flying duties or by 30 minutes (whichever is greater).

The intent of this requirement is that the maximum FDP is reduced by any time away from suitable sleeping accommodation that results from the operator requiring the performance of non-flying duties. Therefore, any time spent commuting between suitable sleep accommodation and the location where the operator requires the non-flying duties to be performed should also be included in the time it took to complete the duties.

This requirement does not apply to an FCM voluntarily doing a task that would otherwise be considered a duty. This is particularly the case if the FCM was doing the task as part of a personal means of reducing anxiety.

Operators should not take advantage of an FCM engaging in voluntary activities prior to an FDP that would otherwise be considered required duties.

An operator must not schedule FDPs in such a manner that there is so little time available prior to the flight that meeting the flight commencement time is only achievable if the FCM accomplishes the required activities prior to the FDP commencing. In this case the activities can no longer be considered voluntary.

Example:

Not allowing sufficient time in the FDP for such activities as flight planning, weight and balance calculation because the FCM has, on previous occasions, completed these tasks voluntarily before the FDP commenced as a means of managing anxiety prior to the FDP.

Appendix 5A

The operations manual must have procedures to ensure that an FCM has at least 8 consecutive hours of sleep opportunity in the 10 hours immediately preceding the FDP.

Additionally, on each of the 3 nights immediately prior to the FDP, the FCM must not have carried out any duties during the 8 hours prior to 30 minutes before morning civil twilight at the location (i.e. typically the early hours of the morning).

Appendix 6

The operations manual must have procedures to ensure that an FCM has at least 8 consecutive hours of sleep opportunity in the 12 hours immediately preceding the FDP.

C.2 FDP and flight time limits

C.2.1 Introduction

- C.2.1.1 Limiting the duration of FDPs and flight time within an FDP is a key aspect of the management of fatigue. CAO 48.1 has FDP and flight time limits in all appendices. These are based on scientific principles and take into account many factors such as the time the FDP starts and the number of sectors to be flown in the FDP.
- C.2.1.2 FDP and flight time limits for complex, multi-pilot operations, also take into account the acclimatised state of the FCM (affected by crossing time zones) and whether or not the flight crew is an augmented crew (carry additional FCMs for the purposes of relieving one or more of the flight crew during cruise).
- C.2.1.3 CAO 48.1 has a built in requirement for hazard identification and risk management for all Tier 2 appendices. The effect of this is that the limitations specified in the appendices to CAO 48.1 may need to be modified by an operator in order to mitigate fatigue risks to an acceptable level. (Refer to Appendix F of this CAAP).

C.2.2 What should be in your operations manual

- C.2.2.1 The operations manual needs to include procedures (a roster system) to ensure that the FCM is not assigned an FDP longer than the number of hours specified in the operations manual, which themselves must not exceed the limits in the applicable appendix.
- C.2.2.2 Documented limits should be communicated to staff and the rostering practices should ensure that FDPs are assigned in such a manner that they provide sufficient allowance for the intended flight(s); as well as a sufficient period for pre- and post-flight duties that reasonably takes into account unavoidable requirements such as:
 - passenger check-in
 - passenger boarding duties
 - manifest, load and balance document completion
 - customs and immigration
 - pre-flight aircraft inspections and pilot maintenance (replenish oils etc.)
 - post-flight duties (i.e. flight and duty time data entry, aircraft cleaning, compressor washing, and other pilot maintenance).

- C.2.2.3 Training flights in a simulator are considered duty, and like all duty, must be included in an FDP if they are conducted prior to a flight and are not separated from that flight by at least a prior sleep opportunity. If the simulator training is conducted after the last flight in a duty period it does not need to be included in the FDP. When planning any FCM training, the impact of the level of FCM fatigue on the quality of training should be considered and managed accordingly.
- C.2.2.4 Operators should not take advantage of an FCM engaging in voluntary activities prior to an FDP that would otherwise be considered required duties. An operator must not schedule FDPs in such a manner that there is so little time available prior to the flight that meeting the flight commencement time is only achievable if the FCM accomplishes the required activities prior to the FDP commencing. In this case the activities can no longer be considered voluntary.

Example: Not allowing sufficient time in the FDP for such activities as flight planning, weight and balance calculation, etc. because the FCM has on previous occasions completed these tasks voluntarily before the FDP commenced as a means of managing anxiety prior to the FDP.

- C.2.2.5 If an operator records flight time from 'push-back' or 'off blocks', rather than from the moment the aircraft first moves under its own power (as per the definition of flight time), CASA deems this as acceptable.
- C.2.2.6 Likewise, for a rotorcraft operator, recording flight time from the moment the rotor blades start turning until they stop turning is also acceptable.

Appendix 1

The operations manual must have rostering procedures to ensure that:

- FDPs are only assigned to be conducted between:
 - o the beginning of morning civil twilight or 0700 hours local time -whichever is earlier, and
 - o 0100 hours local time of the following day
- FDPs are limited to:
 - o for FDPs commencing before 0600 hours local time—8 hours
 - o for FDPs commencing between 0600 and 1359 hours local time—9 hours
 - o for FDPs commencing at or after 1400 hours local time—8 hours
- not more than 3 FDPs are assigned to finish after 2200 hours local time in a week (unless an extension results in the FDP finishing after 2200)
- not more than 7 hours flight time is assigned per FDP.

Note: If an FDP commences after 1700 hours on a day, the FDP must be less than 8 hours because an FDP must not end later than 0100 hours on the following day.

Appendix 2

Complex multi-pilot operations are typically subject to crossing time zones, and therefore resulting in circadian disruption for FCMs. Therefore, FDP and flight time limits are calculated based on the location at which the FCMs 'body clock' is considered to be.

Refer to Appendix D of this CAAP for guidance on acclimatisation and adaptation.

The operations manual must have procedures capable of determining whether the FCM is in an acclimatised state and if so, where they are acclimatised to, and conversely, when they are in an unknown state of acclimatisation. These procedures must achieve the same outcome as that when using the following table:

Table 2: Determining state of acclimatisation

| Difference in local time between locations | Time since FCM commenced a duty period at a location where last acclimatised | |
|--|--|--|
| | Less than 36 hours | 36 hours or more |
| For a relevant location that has a difference in local time of less than 2 hours from a location where last acclimatised | FCM is acclimatised to the relevant location. | |
| For a relevant location that has a difference in local time of 2 hours or more from a preceding location where last acclimatised | FCM remains acclimatised to the preceding location where last acclimatised. | FCM is in an unknown state of acclimatisation. |

There must be procedures for determining the required adaption period for an FCM who is in an unknown state of acclimatisation. The adaptation periods are specified in Table 7.1 of CAO 48.1.

The limits in the operations manual must not exceed the limits for acclimatised FCMs (CAO 48.1, Appendix 2, Table 2.1) and FCMs in an unknown state of acclimatisation(CAO 48.1, Appendix 2, Table 3.1).

An FCM must not undertake more than 4 consecutive FDPs in an unknown state of acclimatisation. Once 4 consecutive FDPs are undertaken in an unknown state of acclimatisation, an adaptation period must then be undertaken before the FCM can undertake another FDP.

Appendix 3

The limits in the operations manual must not exceed the limits in CAO 48.1, Appendix 3, Table 2.1.

Appendix 4

The limits in the operations manual must not exceed the limits in CAO 48.1, Appendix 4, Table 2.1.

If an FCM conducts flight training during an FDP, the flight training must be conducted in the first 7 hours flight time of the FDP. The remaining flight time (up to the limit) may be completed conducting other, non-flight training, operations.

Appendix 4A

The limits in the operations manual must not exceed the limits in CAO 48.1, Appendix 4A, Table 4A.1.

The operations manual must have rostering procedures to ensure that an FCM does not continue in an FDP for longer than 6 hours unless they have completed or commenced a split-duty rest period of at least 4 consecutive hours.

Appendix 4B

The limits in the operations manual must not exceed the limits in CAO 48.1, Appendix 4B, Table 1.1; however, twice a week, the FDP limit may be increased to 12 hours (for a single-pilot operation) or 14 hours (for a multi-pilot operation). In order to take advantage of this increase, the increased FDP must be preceded by an ODP of at least 12 hours, and the following ODP must be at least 12 hours. An FDP increased under this provision must not be furthered increased by a split-duty rest period. Additionally, an FCM who conducts an increased FDP must have an ODP of at least 36 hours, including 2 local nights in that week.

If an FCM conducts flight training during an FDP, the flight training must be conducted in the first 7 hours flight time of the FDP. The remaining flight time (up to the limit) may be completed conducting other, non-flight training, operations.

Appendix 5

The limits in the operations manual must not exceed the limits in CAO 48.1, Appendix 5, Table 1.1; however, twice a week, the FDP limit may be increased to 12 hours (for a single-pilot operation) or 14 hours (for a multi-pilot operation). In order to take advantage of this increase, the increased FDP must be preceded by an ODP of at least 12 hours, and the following ODP must be at least 12 hours. An FDP increased under this provision must not be furthered increased by a split-duty rest period. Additionally, an FCM who conducts an increased FDP must have an ODP of at least 36 hours, including 2 local nights in that week.

If an FCM conducts flight training during an FDP, the flight training must be conducted in the first 7 hours flight time of the FDP. The remaining flight time (up to the limit) may be completed in other, non-flight training, operations.

Appendix 5A

The operations manual must have rostering procedures to ensure that:

- FDPs are only assigned to be conducted between:
 - 30 minutes before the beginning of morning civil twilight
 - the end of evening civil twilight
- FDPs are limited to 14 hours
- not more than 11 hours flight time is assigned or conducted per FDP
- if the combined total of an FCM's flying time in mustering operations as PIC and PIC under supervision is less than 500 hours, not more than 10 hours flight time is assigned per FDP
- if an FCM conducts flight training during an FDP, the flight training must be conducted in the first 7 hours flight time of the FDP. The remaining flight time (up to the limit) may be completed conducting other, non-flight training, operations.

Appendix 6

The limits in the operations manual must not exceed the limits in CAO 48.1, Appendix 6, Table 2.1.

C.3 Increase in FDP limits by split duty

C.3.1 Introduction

C.3.1.1 For many operators, providing FCMs with a split-duty rest period during the FDP is a useful way of addressing potential fatigue risk and therefore allowing an increase to the FDP limit. It involves providing the FCM with an environment that is conducive to sleep or rest during an FDP, and relieving the FCM of all duties while they are there.

C.3.1.2 Making provision for split duty is not mandatory; however, if an operator's operations manual does not include procedures for split duty, this practice is not permitted.

Note: Split duty is not permitted under Appendix 1 or 5A.

C.3.2 What should be in your operations manual

C.3.2.1 If an operator chooses to incorporate split duties into their operations, their operations manual must have procedures to ensure:

- the suitability of the accommodation is assessed and meets the minimum standard:
 - there is a different standard for sleeping accommodation and for resting accommodation. The standard for each can be found in the definitions section of CAO 48.1 and is reproduced at the start of this CAAP.
 - an FCM's home is considered suitable
 - assessments should be ongoing to ensure continued achievement of the standard over subsequent uses of the accommodation. This means re-assessing the standard periodically or when you have reason to believe there may be an issue with the standard provided.
- where an FDP contains a split-duty rest period, there is enough time allocated in the roster for the FCM to travel to and from the suitable sleeping or resting accommodation and still have enough time at the accommodation to meet the minimum requirements.
- FCMs are not disturbed during the split-duty rest period. This means having specific policies and procedures that address possible sources of disturbance. Examples are a procedure for renting rooms that requires that the hotel management agree not to try to clean the room or even the rooms nearby the one being used for a split-duty rest period or a communication protocol for managing how the FCM is contacted and how the FCM sets their mobile phone to protect against inadvertent disturbance from incoming calls.
- except for operations under Appendix 4B or 5, split-duty FDPs are assigned to an FCM as part of the roster, and are assigned so far in advance of the FDP as to provide the FCM to whom it applies to with a reasonable opportunity to plan adequate rest before their duty.
- the time spent in the split-duty rest period is always considered as duty and is included as a part of the FDP (although, for the purposes of calculating minimum off-duty periods and cumulative duty time, the duration of the FDP may be reduced).

- the entire minimum period of access to suitable sleeping accommodation or suitable resting accommodation must be achieved prior to the end of the maximum FDP before an increase in the FDP limit is permitted.

Note: Verification of an operator's facilities for suitable resting and suitable sleeping accommodation may be required.

Things for the operator to consider:

- the management of change to the suitable sleeping or resting accommodation
- a reporting mechanism for providing feedback on the standard of the suitable sleeping or resting accommodation
- consideration of the standard of suitable sleeping or resting accommodation in a formal periodic review process.

Appendices 2, 3, 4 and 6

If an operator chooses to incorporate split duties into their operations, their operations manual must have rostering procedures that ensure:

- for suitable sleeping accommodation, access for at least 4 consecutive hours in order to increase the maximum FDP by up to 4 hours.
- for suitable resting accommodation, access for at least 2 consecutive hours in order to increase the maximum FDP by half the duration of the split-duty rest period up to a maximum of 2 hours.
- for Appendices 2 and 3, after applying the increase for split duty the maximum FDP can be no more than 16 hours
- for Appendices 4 and 6, after applying the increase for split duty the maximum FDP can be no more than 15 hours
- if a split-duty rest period includes any period between the hours of 2300 and 0529 (local time) the split-duty rest period must be a consecutive period of at least 7 hours, with access to suitable sleeping accommodation. In these circumstances:
 - the maximum FDP may be increased, if not already permitted, by up to 16 hours for Appendix 2 and 3, and up to 15 hours for Appendices 4 and 6
 - there is no allowed discount or reduction of the length of the resulting FDP for the purposes of determining the minimum length of the subsequent ODP or to cumulative duty time calculations.⁵
- any remaining portion of an FDP following a split-duty rest period will be no longer than 6 hours for Appendices 2 and 3 and no longer than 5 hours for Appendices 4 and 6.

A split-duty rest period spent at suitable sleeping accommodation is a period where fatigue is being reduced; therefore, an allowance has been made to reduce the impact of the increased length of the FDP on the subsequent minimum required ODP and cumulative duty assessments.

⁵ For Appendix 2, this requirement is based on 2300 and 0529 (acclimatised time) unless the FCM is in an unknown state of acclimatisation, in which case, local time is used.

This allowance is as follows:

- for determining the required minimum ODP following an FDP, when that FDP contains a split-duty rest period at suitable sleeping accommodation, the FDP can be considered to be 2 hours shorter than it actually was.
- for calculating cumulative duty, an FDP that contains a split-duty rest period at suitable sleeping accommodation can be taken to be 2 hours shorter than it actually was.

Note: This allowance is not available when the split-duty rest period includes any period between the hours of 2300 and 0529.

Appendix 4A

If an operator chooses to incorporate split duties into their operations, their operations manual must have rostering procedures that ensures:

- access to suitable sleeping accommodation for at least 4 consecutive hours in order to increase the maximum FDP by the duration of the split-duty rest period
- the maximum FDP (after applying the increase for split duty) is no more than 15 hours
- that if a split-duty rest period includes any period between the hours of 2100 and 0329 (local time), the split-duty rest period is for a consecutive period of at least 7 hours, with access to suitable sleeping accommodation.⁶
- that any remaining portion of an FDP following a split-duty rest period will be no longer than 5 hours.

A split-duty rest period spent at suitable sleeping accommodation is a period where fatigue is being reduced; therefore, an allowance has been made to reduce the impact of the length of the FDP on the subsequent minimum required ODP and cumulative duty assessments. This allowance is as follows:

- for determining the required minimum ODP following an FDP, when that FDP contains a split-duty rest period at suitable sleeping accommodation, the FDP can be considered to be 2 hours shorter than it actually was.
- for calculating cumulative duty, an FDP that contains a split-duty rest period at suitable sleeping accommodation can be taken to be 2 hours shorter than it actually was.

Note: This allowance is not available when the split-duty rest period includes any period between the hours of 2100 and 0329.

Appendix 4B

If an operator chooses to incorporate split duties into their operations, their operations manual must have rostering procedures that ensures:

- for suitable sleeping accommodation, access for at least 2 consecutive hours in order to increase the maximum FDP by the duration of the split-duty rest period
- for suitable resting accommodation, access for at least 2 consecutive hours in order to increase the maximum FDP by half the duration of the split-duty rest period up to a maximum of 2 hours

⁶ In these circumstances the procedures must ensure there is no allowed discount or reduction of the FDP for the purposes of determining the minimum length of the subsequent ODP or to cumulative duty time calculations.

- the remaining length of an FDP after the split-duty rest period ends is no greater than what the FDP limit is at that time (as if a new FDP was to commence).
- the maximum FDP (after applying the increase for split duty) is no more than 16 hours.

A split-duty rest period spent at suitable sleeping accommodation is a period where fatigue is being reduced; therefore, an allowance has been made to reduce the impact of the length of the FDP on the subsequent minimum required ODP and cumulative duty assessments. This allowance is as follows:

- for determining the required minimum ODP following an FDP, when that FDP contains a split-duty rest period at suitable sleeping accommodation, 50% of the duration of the split-duty rest period may be deducted from the total FDP duration.
- for calculating cumulative duty, when an FDP contains a split-duty rest period at suitable sleeping accommodation, 50% of the duration of the split-duty rest period may be deducted.

If an FCM achieves a split-duty rest period of at least 10 consecutive hours (plus the number of hours difference in local time between the location where the rest period is undertaken and the location where the FDP commenced, if any) and the split-duty rest period is undertaken over a local night, then the FCM is taken to meet the ODP requirements. Therefore, the FCM may commence a new FDP (up to the maximum limit) immediately following the split-duty rest period.

Appendix 5

For operations specifically under Appendix 5 the procedures may reflect the more relaxed requirement that allows a split-duty rest period and commensurate extension to the FDP to be initiated and achieved after the FDP has already started, regardless of whether it was originally assigned to the FCM. The quality and detail of the required procedures should reflect the likely increase in fatigue risk of taking advantage of this provision particularly given the increased risk of not being able to achieve restorative sleep during the split-duty rest period at suitable sleeping accommodation when it is required at such short notice.

If an operator chooses to incorporate split duties into their operations, their operations manual must have rostering procedures that ensure:

- for suitable sleeping accommodation, access for at least 3 consecutive hours in order to increase the maximum FDP by the duration of the split-duty rest period.
- for suitable resting accommodation, access for at least 2 consecutive hours in order to increase the maximum FDP by half the duration of the split-duty rest period up to a maximum of 2 hours.
- any remaining portion of an FDP following a split-duty rest period will be no longer than 6 hours (unless an extension is permitted).

C.4 Increase in FDP and flight time limits in an augmented crew operation

Note: Applicable to Appendix 2 only

C.4.1 Introduction

C.4.1.1 Operations with more than the minimum required FCMs, to allow for one or more FCMs to be relieved of duty during flight time, can increase the maximum FDP and flight time limits in a multi-pilot operation. This is known as an augmented crew operation. Increasing the maximum allowable FDP by adding extra FCMs is only permitted in operations under Appendix 2 (or Appendix 7 (FRMS)).

C.4.1.2 Augmented crew limits are in part determined by the class of crew rest facility available. Crew rest facilities need careful design and consideration in order to permit adequate in-flight rest and sleep requirements for crew. Classes of crew rest facilities are defined in subsection 6 of CAO 48.1. In addition, when determining the acceptability of in-flight rest facility specifications, the factors discussed in section 3.4 of this CAAP should be taken into account. CASA may conduct a physical assessment of the adequacy of in-flight rest facilities that may include consideration of the dynamic issues in-flight.

C.4.2 What should be in your operations manual

C.4.2.1 If an operator chooses to incorporate augmented crew operations and take advantage of an increase in FDP, the limits in the operations manual must not exceed the limits for acclimatised FCMs (Appendix 2, Table 5.1) and FCMs in an unknown state of acclimatisation (Appendix 2, Table 5.2)

C.4.2.2 The procedures must ensure that the minimum time an FCM requires the in-flight crew rest facility, in accordance with clause 5 of Appendix 5, is available. These times are only minimums and substantially longer times in in-flight rest may be required to maintain or restore adequate alertness. As a guide, these minimums assume that the majority of the FDP is flight time, and the available rest/sleep time (cruise phase) is fully utilised and is reasonably evenly distributed amongst FCMs. Therefore, the procedures in the operations manual should reflect this goal of fully utilising available in-flight periods for gaining in-flight rest. It is for this reason that the number of sectors is limited for an augmented crew operation, to ensure FDPs contain longer sector lengths that allow adequate time for rest/sleep.

C.4.2.3 Procedures for assigning FCMs to an augmented crew FDP must ensure that the FCMs that are part of the operating crew at the end of the FDP are the same FCMs who commenced the first sector of the FDP.

For safety reasons, this is a critical condition. If, for example, a medical emergency required the disembarkation of an FCM during the FDP, for the flight to continue all of the FCMs must be replaced with a new crew, commencing a new FDP.

It is considered that managing differing FDP limits and lengths of duty and flight time, as well as allocation of in-flight rest, for each FCM is potentially too difficult for a crew and, in particular, the captain to manage safely. Given the likely pressure to support the crew and achieve the task, having one or more crew members with a significantly

different fatigue level could create disparity (i.e. in the approach to extensions). Extensions should be a decision that considers the fatigue level of each FCM independently; however, when only one FCM needs the extension, the other crew members may not support the decision to not extend.

Additionally, one fatigue mitigator for a crew is the general extrapolation of the FCM's level of fatigue to the crew. When one crew member identifies that they feel fatigued they should bring it up with the crew for discussion and management and/or start to monitor the rest of the crew more closely. If a crew includes significantly different duty times, understanding when each is fatigued becomes far more difficult and less likely to be managed effectively. It is considered that this added level of complexity should be managed under an FRMS.

C.4.2.4 In order to use augmented crew operations the operations manual must detail required augmented crew procedures. Appropriate augmented crew procedures should include:

- the requirement to designate a pilot responsible for making command decisions at all times that the PIC is accessing in-flight rest
- the requirement for a comprehensive briefing prior to FCMs rotating into and out of in-flight rest
- a means of prioritising the in-flight rest requirements so that they do not take priority over the need to optimise the crew experience levels on the flight deck for managing planned and unplanned operational threats
- designation of a responsible person amongst the crew for scheduling in-flight crew rest and reassessing crew rest schedules (in the event of unforeseen operational circumstances, particularly in-flight diversions or air returns)
- management of the possible effects of sleep inertia on performance when awakening from deep sleep
- procedures that ensure other crew members are aware of the necessity to respect the in-flight rest requirement and avoid interrupting and reduce unnecessary noise that could disturb the sleep of FCMs utilising in-flight rest.

C.5 Delayed reporting time

C.5.1 Introduction

C.5.1.1 An FCM has an obligation to use their preceding ODP and prior sleep opportunity period in order to be sufficiently rested and alert to perform their duties safely in the rostered FDP.

C.5.1.2 If the start time of an FDP is delayed, the operator must consider that an extended delay will impact the FCM's preparation and overall risk of accruing a higher fatigue level by the end of the FDP.

C.5.1.3 Delayed reporting requirements must be met to allow for the assigned FDP start time to be delayed for any period. As with other CAO 48.1 limits there must be documented procedures that explain the process by which reporting times are delayed in accordance with the limitations.

C.5.1.4 Additionally, if the operations manual contains documented procedures that specifically address how reporting times are delayed without impacting the prior sleep opportunity, in accordance with the limits contained in the applicable appendix/appendices, then the operator is permitted to make the decision to delay the FDP:

- up until 2 hours before the start time when the FCM is at home base
- up until 1 hour before the time the FCM would normally have to leave their accommodation in order to report for duty when they are not at home base.

C.5.2 What should be in your operations manual

Appendix 1

Under Appendix 1, there are no provisions for delaying an FCM's reporting time, or requirements to consider if delays occur. However, the requirement in paragraph 14.11 of CAO 48.1 regarding rosters to be published sufficiently in advance of the FDP to provide the FCM with a reasonable opportunity to plan rest before the start time, applies.

Prior sleep opportunity is always associated with the actual, assigned FDP. If the operator interrupts or disturbs the sleep of an FCM in the period of the prior sleep opportunity then the FCM has not met the requirement for a prior sleep opportunity and cannot commence the FDP. The operations manual must have procedures for protecting prior sleep opportunity as outlined in section C1 of this Appendix.

Appendices 2, 3 and 4

Delays of less than 10 hours - without operations manual procedures

If an operator is operating under Appendices 2, 3 or 4, and does not have operations manual procedures that specifically address delays of less than 10 hours, the operator can only ever delay an FDP start time if the FCM is notified at least 10 hours before the original reporting time.

When the FCM is notified of a delay less than 10 hours before the original reporting time, despite the fact that they might report later, the FDP is deemed to have started at the original reporting time. In this case, the normal limit for the FDP duration applies (i.e. maximum FDP is based on the original reporting time and can only be re-assigned to the extent of the maximum re-assignment limits). The minimum ODP requirements apply before they can be assigned another FDP. The required ODP starts at the later of either:

- the original FDP start time; or
- the time the FCM actually ceases any (non-flying) duty, which may have been performed.

The minimum ODP need only be based on the length of the actual duty achieved; however, it can be no less than the minimum ODP required following an FDP.

When informing an FCM that they can report at a later time than the original FDP reporting time, the operator must meet the requirements for sleep opportunity before an FDP. The operator needs to take this into consideration when deciding on the time and manner of notifying the FCM of any delay.

It is unacceptable to continually delay an FDP by short periods while the FDP is still 10 or more hours in the future. To continue to delay the FDP in this manner does not provide the FCM with

a reasonable opportunity to plan for, or achieve adequate rest before the resulting FDP (required under paragraph 14.11 of CAO 48.1).

Delays of less than 10 hours – with operations manual procedures

Delaying a reporting time within 10 hours of the FDP start time is permitted if an operator is operating under Appendices 2, 3 or 4, and has operations manual procedures that specifically address delaying a reporting time within 10 hours of the FDP. There are no differences in the requirements of Appendices 2, 3 and 4. Operations manual procedures should reflect the following consideration and requirements, which are also described in Figure 4:

- For delays of less than 4 hours – the assumption is that, while the FCM may well be able to rest, it is unlikely that they will be able to return to sleep. If they remain awake for this period the FCM is accruing fatigue; however, they should be able to accrue fatigue at a lower rate by managing their activities, rather than if they were on duty.
- For delays of more than 4 hours – the operator, for rostering purposes, must assume that the FCM has been awake for a reasonable period and is accruing fatigue; therefore, the maximum FDP limits are not appropriate.
- For any delay – the maximum FDP limit cannot exceed the maximum FDP limit based on the original reporting time; however, if a reporting time following a delay requires a lower maximum FDP limit than that of the original FDP, then this now becomes the maximum FDP limit. In essence, when start times are delayed and the maximum FDP limit based on that new start time increases the operator cannot take advantage of this; however, when it decreases they must abide by it. This is because maximum FDP limits based on start times after 11am reflect the greater likelihood that the FCM has been awake for an extended period prior to the start of the FDP, and if the maximum FDP limit is utilised they will finish their FDP in, or just before the WOCL.
- An operator must have procedures that set out the manner in which the FCM will be notified of the delay. That taken into account, the requirement to protect the eight hour prior sleep opportunity either:
 - in the 12 hours before the original start time if the FCM is at home base
 - in the 10 hours before the original start time if the FCM is away from home base.
- For delays of less than 10 hours that are carried out in accordance with the operations manual procedures and therefore meet the requirements of delayed reporting, the time between the original reporting time and the delayed reporting time is considered to be standby.
- Operators should have procedures that describe the way in which FCMs are notified of the delay prior to leaving their sleeping accommodation.
- Operators should also have procedures for managing when notification of the decision to delay will not meet the minimum requirements set out in the operations manual.

Rather than phoning the FCM directly, examples of procedures that manage notification and protect the prior sleep opportunity include:

- requiring that the FCM ‘checks in’ with the operator after they wake-up
or
- organising a system whereby the hotel/motel staff delay the requested wake-up call

and place a message under the door of the FCM's room.

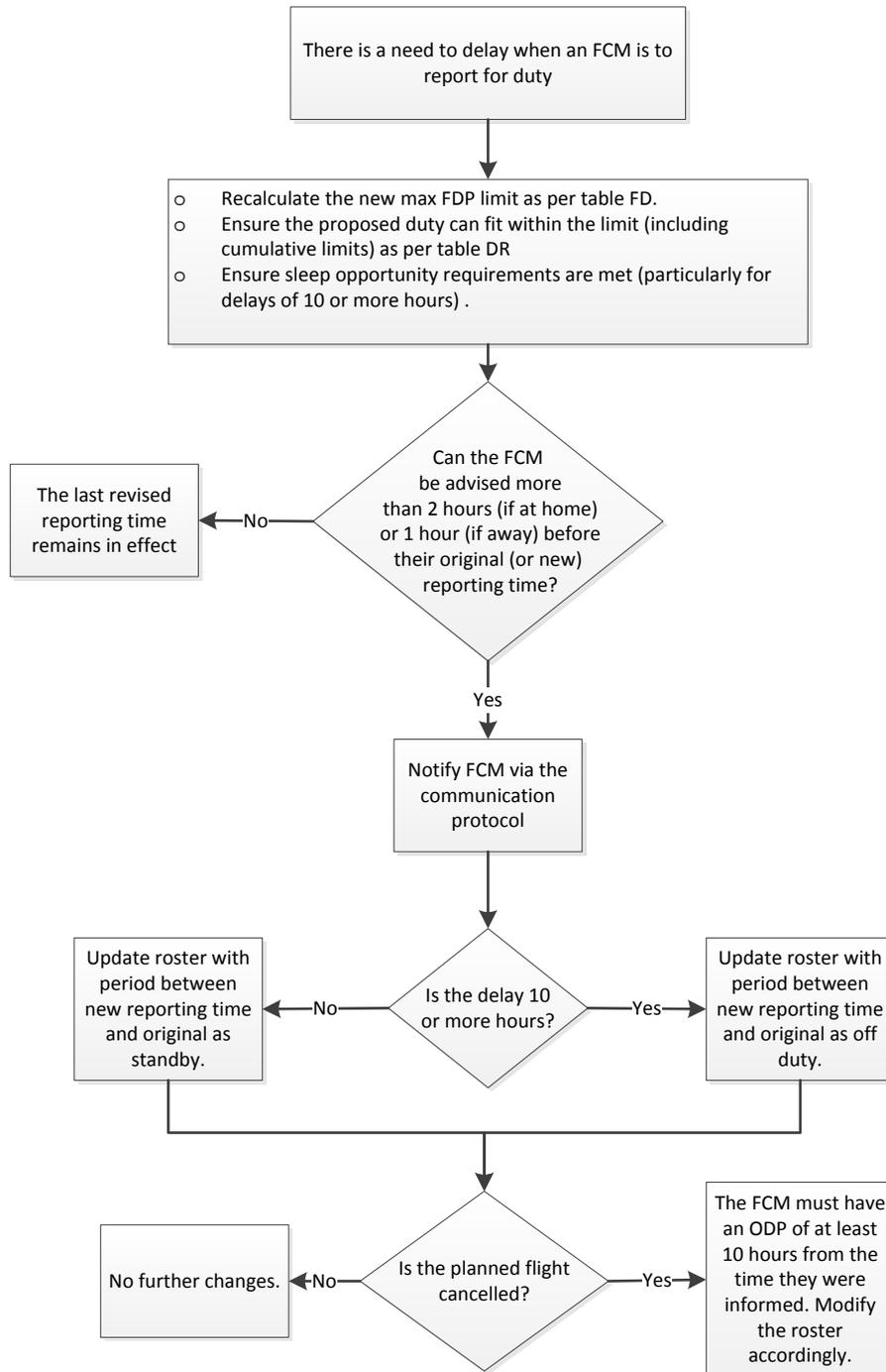
Example procedure:

All communications between Company ABC and an FCM during an ODP or that could impact on the FCM's prior sleep opportunity must be in accordance with the following communication protocol:

- An FCM must only be contacted during their sleep opportunity if there is to be a delay in FDP commencement time and then only by SMS.
- The FCM should ensure that their mobile is on 'silent' during sleep opportunity periods to, as best as possible, ensure uninterrupted restorative sleep.
- The FCM must check their SMS messages and reply to any SMS notifying the FCM of a delay, before leaving the location of the sleep opportunity.
- An SMS sent and shown as delivered is deemed to be notification however the FCM shall still reply to the SMS before leaving the location of the sleep opportunity to confirm they understand the message.
- The timing and content of SMS messages (and phone calls) regarding delays will be logged in the rostering system.

The following flow diagram may assist in understanding the requirements and provide an example of a procedure for inclusion in an operations manual. In the diagram 'table FD' refers to a maximum FDP limit table and 'table DR' refers to a table of limits that contains the cumulative flight and duty limits:

Figure 4: Delayed reporting decision flow chart



Procedures need to adequately reflect the required adjustments to maximum FDP limits when the start time is delayed. The procedures for managing maximum FDP limits should reflect the requirements listed in Table 3.

| Delay | Determining maximum FDP for delayed FDP reporting time (use maximum FDP limits in table FD) | |
|--|--|--|
| Single or multiple delay/s that total < 4 hours | If the new maximum FDP limit is higher or the same at the original maximum FDP limit - retain original maximum FDP limit | If the new maximum FDP limit is lower than original maximum FDP limit - use the new, lower maximum FDP limit |
| Single or multiple delay/s that total between 4 – 10 hours | Step 1: If maximum FDP limit at 4 hour mark is higher than original maximum FDP limit (or the same) - use original maximum FDP limit | Step 1: If maximum FDP limit at 4 hour mark is lower than original maximum FDP limit -use maximum FDP limit at 4 hour mark |
| | Step 2: Reduce maximum FDP limit worked out at step 1 by the amount of time the new reporting time is later than the 4 hour mark | Step 2: Reduce maximum FDP limit worked out at step 1 by the amount of time the new reporting time is later than the 4 hour mark |
| A single delay of 10 hours or longer | Use new maximum FDP limit from the maximum FDP table for the delayed reporting time | |

Table 3: Determining maximum FDP for delayed reporting time

Note: The delay column refers to the total delay, rather than any single delay. This is an important consideration, as an operator may initially require a delay of 2 hours and then make a further delay to the start time of 3 hours. For the purposes of determining the maximum FDP, this represents a total delay of 5 hours and must be dealt with as a five hour delay rather than two delays each of less than 4 hours.

Cancellations where sufficient notice is provided – with, or without, operations manual procedures

- The cancellation subclause in each appendix sets out the minimum off-duty requirements when an operator cancels an upcoming FDP.
- If an operator does not have detailed delayed reporting procedures in the operations manual for delays where there is less than 10 hours’ notice, the FCM must receive the cancellation notice at least 10 hours before the original reporting time.
- If an operator does have detailed delayed reporting procedures in the operations manual for delays where there is less than 10 hours’ notice, the FCM must receive the cancellation notice before they leave their sleeping accommodation:
 - 1 hours’ notice before FDP if the FCM is away from home base
 - 2 hours’ notice if the FCM is at home base.

In both cases, the FCM must then have at least 10 consecutive hours off-duty, beginning from the time the FCM receives the cancellation notification, before they can be assigned a new FDP.

- If the notification of cancellation does not meet the notification requirements above, then for the purposes of determining the minimum ODP, the FDP is considered to have commenced at:
 - the original starting time
 - or
 - the last delayed reporting time that was notified, in accordance with procedures in the operation manual.
- The required minimum ODP must then be taken from that time or the cessation of any duties. The FCM must complete the minimum ODP required by the appendix being worked under before the FCM can be assigned another FDP even if no flight occurred.

Appendix 4A and 6

There are no provisions in Appendix 4A or 6 that address delayed reporting; therefore, it is not specifically prohibited. The requirement in paragraph 14.11 regarding publishing rosters sufficiently in advance of the FDP to provide the FCM with a reasonable opportunity to plan rest before the start time, applies.

As long as fatigue risk is managed to an acceptable level, an operator may delay a start time under this appendix. In many cases, delaying an FDP start time will result in an increased fatigue hazard purely because the FCM is no longer able to achieve a rest period that would have been more appropriate for the time of start of the delayed FDP. Paragraph 15.2 of CAO 48.1 requires procedures to manage identified fatigue risk to an acceptable level.

This appendix has the requirement for prior sleep opportunity that is always associated with the actually assigned FDP. If a start time is delayed, the operator must be able to demonstrate how the protection of prior sleep opportunity is achieved for the delayed start time. Any interruption or disturbance initiated by the operator should not infringe on the prior sleep opportunity.

If an operator anticipates delaying the start time of FDPs for other than relatively short delays, for example, delays of more than 2 hours, the operations manual should contain procedures that ensure the increased risk is managed. Examples of procedures that might be used to manage increased fatigue risk due to delayed reporting are:

- managing the process of contacting FCMs to notify them of the delay
- prohibiting increasing FDP maximum limits when a delayed start time would otherwise allow it
- requiring that, if a delayed start time requires a reduced maximum FDP (than the start time before the delay), that reduced maximum FDP limit applies
- providing a maximum limit on the extent to which a start time can be delayed in total. It is advisable to have a policy that does not allow delaying the start time by more than a total of 4 hours past the original start time unless specific circumstances indicate this would not result in an unacceptable fatigue risk.

Appendices 4B, 5 and 5A

There are no provisions in Appendix 4B, 5 or 5A that address delayed reporting; therefore, it is not specifically prohibited. The requirement in paragraph 14.11 of CAO 48.1 regarding

publishing rosters sufficiently in advance to provide the FCM a reasonable opportunity to plan rest before the start time of the FDP, applies.

The nature of the activities conducted under these appendices will often result in changes to the FDP on the day of operations. While this is expected, the potential for increased fatigue risk must also be investigated and, where identified, managed.

This means that in many cases, delaying an FDP start time will result in an increased fatigue hazard purely because the FCM is no longer able to achieve a rest period that would have been more appropriate for the delayed FDP. Paragraph 15.2 of CAO 48.1 requires procedures to manage identified fatigue risk to an acceptable level.

As long as fatigue risk is managed to an acceptable level, an operator may delay a start time under this appendix. The requirement to ensure the prior 8 hours are free of duties remains for whatever start time is maintained. Any duty performed within this eight hour period must be reduced from the allowable maximum FDP for that start time (minimum reduction is 30 minutes).

If an operator anticipates delaying the start time of FDPs for other than relatively short delays (e.g. delays of more than 2 hours) the operations manual should contain procedures that ensure the increased risk is managed. Examples of procedures that might be used to manage increased fatigue risk due to delayed reporting are:

- managing the process of contacting FCMs to notify them of the delay
- prohibiting increasing FDP maximum limits when a delayed start time would otherwise allow it
- if a delayed start time requires a reduced maximum FDP period, rather than the start time before the delay, that reduced maximum FDP limit applies
- providing a maximum limit on extent to which a start time can be delayed in total. (e.g. a policy that does not allow delaying the start time by more than a total of 4-5 hours past the original start time, unless specific circumstances indicate this would not result in an unacceptable fatigue risk).

C.6 Reassignment and extension

C.6.1 Introduction

Reassignment

C.6.1.1 These provisions set limits on the extent to which a rostered or assigned FDP can be modified for an FCM once the FDP has commenced. Reassigning refers to increasing an FDP while remaining within the operations manual limit for that activity. This is different to an extension, which refers to increasing the FDP so that it exceeds the FDP limit in the operations manual. A re-assigned FDP can subsequently be extended under the extension clause once unforeseen operational circumstances are encountered.

C.6.1.2 There may be occasions when an FCM who has already commenced an FDP needs to be reassigned (e.g. when operational requirements require an FCM to take over another's rostered sectors). There are restrictions over how reassignments are managed in order to mitigate any adverse fatigue risks associated with changing the FCM's duty expectations.

Extension

- C.6.1.3 An operator must have reasonable expectations based on previous experience and data, that the assigned FDP can be achieved within the operations manual limits. The maximum FDP limits in all appendices are not designed with the expectation that there would be extensions.
- C.6.1.4 On the contrary, it is expected that, should the operational need for an extension arise, it may not be possible because the FCM does not report fit for the extension. The requirements for extensions is included in order to have appropriate flexibility when operators need to extend an FDP when unforeseen operational circumstances occur, and where the FCM is fit for the extension. The decision to extend an FDP is taken prior to a flight commencing (usually the last flight of the FDP) when all crew members have a clear choice whether or not to continue, based on their assessment of their fitness for duty.
- C.6.1.5 The intention behind unforeseen circumstances (refer to definitions) and subsequent extensions is for operators to roster FDPs appropriately; and not to continually use flight and duty times to their maximum limits, resulting in over-use of extensions when previous experience is sufficient to indicate a greater time allowance is required.
- C.6.1.6 In both re-assignment and extension, it triggers a requirement that, in addition to the operator independently assessing the fatigue risk associated with the proposed extension, the operator must check with the FCM that they are fit to achieve the modified FDP. While the FCM remains the last line of defence, the reality is that they are not always best placed to properly assess or mitigate that increased fatigue risk, particularly if they themselves are experiencing high levels of fatigue or high levels of pressure to complete a task.
- C.6.1.7 There are limitations on extensions in all appendices and there must be acceptable procedures for the application and management of extensions in all submitted operations manuals.

C.6.2 What should be in your operations manual

- C.6.2.1 An operator's operations manual must contain procedures that:
- provide a tool, and training, for FCMs to assess their fitness for duty
 - does not permit a reassignment if the FCM does not consider and agree they are fit for the modified FDP
 - does not permit an extension to an FDP unless the FCM has been consulted by the PIC, and has had an opportunity to consider and agree they are fit for the extension
 - when extensions occur, the operator collects sufficient information such as an extension report, to enable further study and fine tuning of the rostering process to better protect against extensions in the future.

Appendix 1

Reassignment

There are no specific limits on re-assignment of an FDP in Appendix 1; therefore, there is no requirement for procedures in the operations manual that specifically address reassignment of

FDPs. The Appendix 1 rules, as a rule-set, are considered sufficiently restrictive to absorb changes on the day of operations in assigned FDPs that do not exceed the appendix FDP limits, without representing an unreasonable increase in fatigue risk.

Extensions

The procedures should clearly limit the use of extensions to those circumstances where:

- the FDP has already commenced
- the decision to extend beyond the FDP and/or flight time limit is taken prior to both the last flight and FDP, or flight time being exceeded
- the circumstances that required the extension could reasonably be classed as unforeseen
- the FCM will not exceed a cumulative flight time limit during the extension
- the extension is operationally necessary to complete the planned duty.

It is not permitted for an extension to result in an FCM exceeding the limit in subclause 2.1 that requires all assigned FDPs be completed by 0100 (local time).

Appendices 2, 3, 4 and 6

Reassignment

Procedures should, at a minimum:

- identify that, when reassigning an FDP, 4 hours is the maximum increase to the originally assigned FDP
- identify that a reassigned FDP must not exceed maximum operations manual FDP limits (for Appendix 2 or 3 operations this limit is derived after consideration of the reassigned number of sectors)
- identify that a reassigned FDP must not cause the FCM to exceed longer term or cumulative limits. Examples are that the reassigned FDP cannot cause the FCM to exceed the longer term minimum ODPs (i.e. 36 consecutive hours off-duty in the 168 hour period before the projected end of the reassigned FDP, or the cumulative flight and duty limits applicable to the appendix under which the FCM is operating)
- identify that a reassigned FDP must not cause the FCM to exceed the limit on late night operations (LNOs) for that appendix. The procedures must require that the limit on LNOs for that appendix be considered when determining whether the modified FDP is allowed and whether the reassignment will mean subsequent rostered FDPs will then exceed the LNOs limit.

It is not prohibited for the operator to reassign an FDP to an FCM as an augmented crew member when the FCM was originally assigned to a non-augmented crew and vice versa. Because the FCM will need to utilise in-flight rest, the operator should be aware that there is potential for greater fatigue risk if the FCMs preparation was not suited to an augmented crew operation. There is also potential for greater fatigue risk if the FCM was expecting an augmented crew FDP with assigned in-flight rest opportunities and is re-assigned to a non-augmented crew FDP. This increased risk should be managed by the operator and may require limitations on the use of this practice be in place.

Extensions

The procedures should clearly limit the use of extensions to those circumstances where:

- the FDP has already commenced
- the decision to extend beyond the FDP and/or flight time limit is taken prior to both the last flight and prior to the FDP or flight time limit being exceeded
- the circumstances that required the extension could reasonably be classed as unforeseen
- the FCM will not exceed a cumulative duty or cumulative flight time limit during the extension
- the extension is necessary to complete the planned duty

The procedures should also make it clear that an extension cannot be greater than:

- for augmented crew operations—2 hours for FDP and 1 hour flight time
- for non-augmented multi-pilot operations—1 hour for FDP and 30 minutes flight time
- for single-pilot operations and flight training—1 hour for FDP and 30 minutes flight time

For multi-pilot operations, the sectors for the FDP limits may be increased by 1 more than would otherwise be the case for the FDP.

If unforeseen circumstances arise after take-off on the final sector of an FDP, the flight may continue to the planned destination or an alternate, at the discretion of the PIC.

It is permitted for an extension to result in an FCM exceeding the longer term off-duty requirement of 36 consecutive hour's off-duty in a 168 hour period projected to the end of the assigned FDP.

An extension to an FDP that results in the FDP including more than 30 minutes between the hours of 2300 and 0530 does not need to be taken into account when determining whether the FCM meets the requirements of the LNOs clause as this limit only applies to what was assigned (or subsequently reassigned), not an extension to the assigned FDP.

Appendix 4A

Reassignment

There are no specific limits on reassignment of an FDP in Appendix 4A; therefore, there is no requirement for procedures in the operations manual that specifically address reassignment of FDPs. The Appendix 4A rules, as a rule-set, are considered sufficiently restrictive to absorb changes on the day of operations in assigned FDPs that do not exceed the appendix FDP limits, without representing an unreasonable increase in fatigue risk.

Extension

The procedures should clearly limit the use of extensions to those circumstances where:

- the FDP has already commenced
- the decision to extend beyond the FDP limit is taken prior to both the last flight and prior to the FDP limit being exceeded

- the circumstances that required the extension could reasonably be classed as unforeseen
- the FCM will not exceed a cumulative duty or cumulative flight time limit during the extension
- the extension is necessary to complete the planned duty

The procedures should also make it clear that an extension to an FDP cannot be greater than 1 hour.

If unforeseen circumstances arise after take-off on the final sector of an FDP the flight may continue to the planned destination at the discretion of the PIC.

Appendix 4B

Reassignment

There are no provisions in Appendix 4B that address reassignments; therefore, it is not specifically prohibited. The requirement in paragraph 14.11 regarding publishing rosters sufficiently in advance of the FDP and standby period to provide the FCM a reasonable opportunity to plan rest before the start time applies. It is accepted that the activities conducted under this appendix will often, by their nature, result in changes to the FDP on the day of operations. While this is expected, the potential for increased fatigue risk must also be considered and where unacceptable risk is identified, managed to acceptable levels. Depending on the nature of operations, an identified fatigue risk stemming from consistent or repetitive reassigning FDPs might require procedures be developed to limit the use of reassignment in response to, or in anticipation of, excessive fatigue risk.

Another consideration is that the Appendix 4B late night operations requirements relate to FDPs that are assigned, as well as conducted; therefore, the limit of four LNOs in any 168 hour period, applies to the number of FDPs that include any time between midnight and 0459, regardless of whether the FDPs were assigned prior to the day of operations or modified on the day of operations. The operator should have a procedure for ensuring re-assignments do not result in exceeding the limit of four FDPs that include any time between midnight and 0459 in any consecutive 168 hour period.

Extensions

The provisions for extensions under Appendix 4B are unique. This is due to the operational flexibility necessitated by medical transport and emergency service operations. Two different extension provisions are provided under Appendix 4B:

- extensions due to unforeseen operational circumstances
- extensions for urgent operations.

For extensions in unforeseen operational circumstances, the procedures should clearly limit the use of extensions to those circumstances where:

- the FDP has already commenced
- the decision to extend beyond the FDP limit is taken prior to both the last flight and prior to the FDP limit being exceeded

- the circumstances that required the extension could reasonably be classed as unforeseen
- the FCM will not exceed a cumulative duty or cumulative flight time limit during the extension
- the extension is necessary to complete the planned duty.

The procedures should also make it clear that an extension to an FDP cannot be greater than 2 hours for a multi-pilot operation or 1 hour for a single-pilot operation beyond the FDP limit (or the FDP limit as increased by a split-duty rest period), and an extension to the flight time limit must not be greater than 30 minutes.

If unforeseen circumstances arise after take-off on the final sector of an FDP, the flight may continue to the planned destination or an alternate, at the discretion of the PIC.

For extensions for urgent operations, the operator must have procedures that enable the classification of an operation as urgent, and should consider the preservation of life or the potential that a person's health may deteriorate as relevant factors. These procedures should identify how the FCM should go about deciding on the extension and who should be consulted as part of that decision. In these cases, an FDP may be extended by up to 4 hours beyond the FDP limit, or the FDP limit as increased by a split-duty rest period. However, an extended FDP for an urgent operation must not be greater than 16 hours or exceed a cumulative duty or cumulative flight time limit.

Appendix 5

Reassignment

There are no provisions in Appendix 5 that address reassignments. Therefore, it is not specifically prohibited. The requirement in paragraph 14.11 regarding publishing rosters sufficiently in advance of the FDP and standby period to provide the FCM a reasonable opportunity to plan rest before the start time applies. It is accepted that the activities conducted under this appendix will often, by their nature, result in changes to the FDP on the day of operations. While this is expected, the potential for increased fatigue risk must also be considered and where unacceptable risk is identified, managed to acceptable levels. Depending on the nature of operations, an identified fatigue risk stemming from consistent or repetitive reassigning FDPs might require procedures be developed to limit the use of reassignment in response to, or in anticipation of, excessive fatigue risk.

Another consideration is that the Appendix 5 late night operations requirements relate to FDPs that are assigned, as well as conducted; therefore, the limit of four LNOs in any 168 hour period, applies to the number of FDPs that include any time between midnight and 0459 regardless of whether the FDPs were assigned prior to the day of operations or modified on the day of operations. The operator should have a procedure for ensuring re-assignments do not result in exceeding the limit of four FDPs that include any time between midnight and 0459 in any consecutive 168 hour period.

Extensions

The procedures should clearly limit the use of extensions to those circumstances where:

- the FDP has already commenced

- the decision to extend beyond the FDP limit is taken prior to both the last flight and prior to the FDP limit being exceeded
- the FCM will not exceed a cumulative flight time limit during the extension
- the extension is necessary to complete the planned duty.

The procedures should also make it clear that an extension to an FDP cannot be greater than 2 hours. Each 30 minute period of extension (or part thereof) requires the subsequent minimum ODP to be increased by one hour.

If unforeseen circumstances arise after take-off on the final sector of an FDP, the flight may continue to the planned destination or an alternate, at the discretion of the PIC.

Extensions that result in the FDP (including any time between midnight and 0459) must be taken into account in the consideration of the limit of no more than four FDPs in any consecutive 168 hour period that include any time between midnight and 0459 (local time).

Appendix 5A

Reassignment

There are no specific limits on re-assignment of an FDP in Appendix 5A; therefore, there is no requirement for procedures in the operations manual that specifically address reassignment of FDPs. The Appendix 5A rules, as a rule-set, are considered sufficient to absorb changes on the day of operations in assigned FDPs that do not exceed the appendix FDP limits, without representing an unreasonable increase in fatigue risk.

Extensions

The procedures should clearly limit the use of extensions to those circumstances where:

- the FDP has already commenced
- the decision to extend beyond the FDP limit is taken prior to both the last flight and prior to the FDP limit being exceeded
- the FCM will not exceed a cumulative flight time limit during the extension
- the extension is necessary to complete the planned duty.

The procedures should also make it clear that an extension to an FDP cannot be:

- greater than 1 hour for FDP or 30 minutes flight time
- extended beyond the end of evening civil twilight.

C.7 Standby limits and standby-like arrangements

C.7.1 Introduction

C.7.1.1 Standby may be undertaken at home or at another place where suitable sleeping accommodation conditions exist. There are both advantages and disadvantages in conducting standby at the airport, at home or another location away from the airport. For example, if standby is undertaken at the airport, then it may be more likely for an FCM to be in a state of readiness whilst undertaking no actual work, even if there is access to suitable sleeping accommodation. This heightened state of readiness can

introduce stress, which may increase fatigue and decrease alertness levels faster than at home or another location away from the airport. On the other hand, standby conducted at the airport negates the need for the pilot to drive to the airport upon call-out which, depending on the time taken to travel, weather and the traffic conditions might impact negatively on fatigue levels prior to the commencement of the FDP. It is the operator's responsibilities to monitor these potential hazards and make decisions on the location of standby that manage the risk appropriately.

- C.7.1.2 Some operators may assign what they call 'airport standby'. Although no duties are assigned, typically access to suitable sleeping accommodation is not available. In these instances, this 'standby-like arrangement' must be considered as duty and not standby. This is because it is not considered possible for an FCM to use this period for genuine rest or sleep in preparation for an FDP.
- C.7.1.3 An important risk management strategy for any operator using standby periods is to maximise the effectiveness of any rest/sleep opportunities that the FCM might have while being on standby. This means reducing contact to a minimum and, where possible, not including the FCM in operational deliberations and decision-making prior to the start of the FDP.
- C.7.1.4 It is important for operators to note that for different FCMs there can be different ways to manage any additional stress, which may be present as a result of maintaining a higher level of alertness during standby. A strategy that FCMs might employ involves doing aviation-related activities while still on standby. Should an FCM decide to perform aviation-related tasks whilst on standby (entirely of their own volition), then this time is not to be considered as duty time. Operators should not take inappropriate advantage of this method of managing stress by then not allocating enough time to perform these, otherwise required duties, in the subsequent FDP.

C.7.2 What should be in your operations manual

C.7.2.1 Operations manual procedures must:

- include a means of making reliable assessments of suitable sleeping accommodation (at base and away from base) that is proposed for use in a standby period. These assessments should be ongoing to ensure the accommodation remains fit for purpose.
- ensure FCMs are not disturbed by company contact during the standby period, except to call the FCM out for an FDP or duty

Note: Stress and fatigue can be accelerated if the FCM is required to undertake duties (e.g. office duties) while on standby, and therefore any time conducting duties cannot be deemed standby.

C.7.2.2 If standby-like arrangements are employed (i.e. where an FCM is required to hold themselves available for duties, but access to suitable sleeping accommodation is not provided), this time counts as duty time.

Appendix 1

Although it is not specifically prohibited, there are no provisions in Appendix 1 that address standby. If an operator wishes to hold the FCM on standby then, in accordance with paragraph 14.11 of CAO 48.1, they need to be rostered for that standby period in such a way that the FCM is provided a reasonable opportunity to plan adequate rest for the possible FDP.

In addition to this, Appendix 1 has the requirement for prior sleep opportunity that is always associated with the actual assigned FDP. If an operator wishes to use standby, they are required to have procedures in place that are acceptable to CASA and accurately demonstrates how the prior sleep opportunity is achieved for those FDP start times that occur during rostered standby periods.

Any interruption or disturbance during the prior sleep opportunity period initiated by the operator could infringe the prior sleep opportunity requirements.

Appendices 2, 3, 4 and 6

The procedures must ensure:

- the FCM will not be held on standby for greater than a 16 hour period
- that if the FCM is called out from standby after a 12 hour period on standby, the maximum FDP limit that applies to that FCM is reduced by the length of time they are on standby in excess of 12 hours

Example:

Under Appendix 2, if the FCM is called out at 8 pm, after 14 hours of standby for a 3 sector flight, the applicable maximum FDP of 9 hours must be reduced to 7 hours, as the FCM was on standby for 2 hours in excess of 12 hours.

The procedures must ensure that if the FCM is not called-out from standby, the FCM completes a minimum ODP of at least 10 hours.

Appendix 4A

Although it is not specifically prohibited, there are no provisions in Appendix 4A that address standby. If an operator wishes to hold the FCM on standby then, in accordance with paragraph 14.11 of CAO 48.1, they need to be rostered for that standby period in such a way that the FCM is provided a reasonable opportunity to plan adequate rest for the possible FDP.

In addition to this, Appendix 4A has the requirement for prior sleep opportunity that is always associated with the actual assigned FDP. If an operator wishes to use standby, they are required to have procedures in place that are acceptable to CASA and accurately demonstrates how the prior sleep opportunity is achieved for those FDP start times that occur during rostered standby periods. Any interruption or disturbance during the prior sleep opportunity period initiated by the operator could infringe the prior sleep opportunity requirements.

Appendix 4B and 5

If no callout occurs, there is no specific limit on the length of a continuous period of standby; therefore, continuous 24 hour periods of standby are possible. However, the FCM must meet the required longer term ODP requirements and these will ultimately require the FCM to end a continuous period of standby.

Commencing an FDP marks the end of a standby period and the FCM cannot return to standby until the required minimum ODP has been undertaken.

Standby cannot be used as a means of separating FDPs. Where an FDP takes place, followed by a break or rest period, once the minimum requirements of the split-duty provisions are met then a split-duty rest period should be used if a further period of flying duty is required.

It is permissible for an FCM to return to standby after a period of duty in which no flight occurs; however, the maximum FDP limits following that period of duty are to be reduced by the amount of time spent on duty or 30 minutes (whichever is greater) while any part of that duty was performed within 8 hours of the subsequent commencement time of an FDP.

C.8 Positioning

C.8.1 Introduction

- C.8.1.1 The positioning clause allows for continued duty after the FDP has finished and before an ODP has started, in order to transport the FCM to a location other than the one at which the FDP finished. This means that any time spent positioning does not need to be contained within the FDP limit. This also means that, while positioning, the FCM will not be taking any further role as part of an operating crew until a required ODP has been completed. The subsequent minimum ODP is based on the length of the FDP as well as the time spent positioning.
- C.8.1.2 When calculating displacement time for determination of acclimatisation (which can then have an impact on the minimum length of the following ODP) an operator must also take any time zones crossed during the FCM's positioning period into consideration. Section 7 of the Instrument relates solely to an FCM's location and takes no account of the manner or role they played in getting there.
- C.8.1.3 When calculating cumulative duty, any time spent positioning must be included as it is deemed a task that is required to be carried out associated with the business of the operator.

C.8.2 What should be in your operations manual

- C.8.2.1 If an operator intends to position an FCM at the completion of an FDP, there should be procedures to ensure:
- the period spent positioning, along with the impact on displacement time, is considered when determining the subsequent minimum ODP
 - the period spent positioning is considered in the determination of cumulative duty time
 - the FCM does not participate as part of an operating crew during the period of positioning.
- C.8.2.2 Positioning before flying duties is not specifically dealt with in the appendices. However, positioning before a flight or series of flights as, defined in subparagraph 6.2 (c) of CAO 48.1, requires management by the operator. If an operator intends to position an FCM before a flight or series of flights, there should be procedures to ensure:
- the time spent positioning counts to the FDP
 - the displacement time is considered when determining the subsequent minimum ODP

- the period spent positioning is considered in the determination of cumulative duty time
- the FCM does not participate as part of an operating crew during the period of positioning.

C.8.2.3 The positioning 'sector' does not need to be considered as a 'sector' when the number of sectors is a factor in determining the maximum allowable duration of an FDP.

C.9 ODP limits

C.9.1 Introduction

C.9.1.1 It is essential that an operator and FCM understand that an ODP is a period free of all duties and standby associated with their employment. This means the FCM cannot simply switch to other non-flying duties in their required minimum ODPs and they cannot be assigned another FDP until the minimum ODP requirements have been met.

C.9.1.2 Based on the function the ODP performs, there are three broad categories of off-duty requirements:

- those that address acute fatigue (i.e. the requirement for an ODP following an FDP)
- those that address cumulative fatigue (i.e. the requirement for 36 consecutive hours off-duty, including two local nights, in any 168 consecutive hour period)
- those that are taken in order to acclimatise a FCM to the local time (an adaptation period).

Addressing acute fatigue

C.9.1.3 An operator must keep in mind that assigned ODPs will be sufficiently long enough to provide for:

- the required sleep opportunity (8 hours)
- sufficient time for the FCM's requirements of bodily functioning (i.e. eating, drinking, toileting, washing and dressing)
- enough time to travel to and from the suitable sleeping accommodation.

C.9.1.4 In some situations, particularly when there is a long commute time, the minimum ODP, as set out in the appendices, will not be adequate to meet all these requirements and must be extended to ensure the 8 hours' sleep opportunity is still provided, as well as time for the other necessary requirements (as mentioned previously). It is primarily the responsibility of an operator to ensure that enough time is available in the ODPs (both at home base and away from home base); however, it is also the responsibility of the FCM to ensure the time available is used effectively and that any issues or impediments are communicated to the operator.

C.9.1.5 It is important that an operator does not just consider the adequacy of an ODP based on the time provided, but also gives due consideration to all the other factors they have control over (i.e. the location and quality of the accommodation that is provided or that is available to the FCM when they are away from home base). The location of the accommodation will impact on commuting time and also potentially the quality of sleep.

Example:

If the accommodation is next to a noisy road or work site it will reduce the quality of any sleep the FCM can achieve. The more sleep is fragmented by waking up, the less restorative value sleep has in terms of how people feel and function the next day.

C.9.1.6 When selecting accommodation, an operator must also consider the potential for interruptions/disruptions and the available control over such aspects as discussed in section 3.2 of this CAAP.

Addressing cumulative fatigue

C.9.1.7 The off-duty limits that are more specific to cumulative fatigue are the requirements for 36 hours off-duty (including two local nights) in any 168 consecutive hour period as well as such longer term limits as the requirement for a number of full days off-duty in any consecutive 28 and 84 day period.

Note: Appendices 4B and 5 have a variation on this requirement.

Day in 'days off-duty' means the period between local midnight at home base and the subsequent local midnight at home base.

C.9.1.8 An important consideration is that, in order to start an FDP, an FCM must still meet these requirements at the projected end of the assigned FDP. This means an operator must be constantly taking into consideration the history of the FCM to determine whether the FCM can be assigned an FDP. At the end of the assigned FDP, the FCM must still have the minimum number of hours and days off-duty in the required preceding period. In the case of the minimum requirement for off-duty days, an operator cannot assign an FDP to an FCM if the FDP:

- will finish after midnight
- at midnight, 28 or 84 days before (as applicable) an off-duty day that is relied on to meet the minimum number of off-duty days commenced.

C.9.1.9 The 28 and 84 day periods are a moving period, always anchored to a point in the FDP (looking backwards). Once an FDP passes through midnight, the FCM can no longer include an off-duty day of 28 or 84 days before that point. If midnight was the starting point of a 24 hour period that constituted an off-duty day, then that is relied upon to meet the minimum requirement.

Addressing trans-meridian related fatigue

C.9.1.10 For Appendices 2 and 4, crossing more than two time-zones travelling east, or three time-zones travelling west increases the minimum ODP required following the FDP. While this is not a requirement for other appendices, this approach is advisable.

C.9.1.11 Once an FCM crosses two or more time-zones in an FDP from a location to which they were acclimatised, their body clock is assumed to migrate away from local time at that location, and after 36 hours have elapsed so they are no longer sufficiently aligned to be classified as acclimatised. At this point, they are considered to be in an unknown state of acclimatisation and require an adaptation period to become acclimatised to a location. While this approach is not a requirement for other appendices, in the absence of something more appropriate, this approach is advisable.

C.9.2 What should be in your operations manual

C.9.2.1 Each appendix has subtle differences in ODP requirements and therefore, the operations manual requirements for each appendix are set out individually in this section.

Appendix 1

An operator must have documented procedures to ensure that:

- in order to address acute fatigue—following an FDP, an FCM has at least 12 hours off-duty prior to commencing another duty period
- in order to address cumulative fatigue—before commencing an FDP, an FCM has had:
 - at least 36 consecutive hours off-duty, including 2 local nights, in the 168 hours before the projected end time of the assigned FDP; and
 - at least 7 days off-duty in the 28 consecutive days before the FDP commences; and
 - at least 24 days off-duty in the 84 consecutive days before the FDP commences.

Appendix 2

Acute fatigue

An operator must document in their operations manual the minimum ODPs that the operator will apply to their FCMs. These periods must not be less than those required by CAO 48.1 and may well be greater due to the possibilities that the circumstances require a greater ODP in order to meet all obligations and still achieve an eight hour sleep opportunity.

The documented procedures must ensure that, following an FDP an FCM has an off-duty period of at least the duration as determined by the relevant calculation below:

- If at home base and acclimatised (to any location):
 - 12 hours +
 - 1.5 times the amount the FDP exceeded 12 hours +
 - 1 hour for each time zone crossed in excess of 2 east and 3 west
- If away from home base and acclimatised (to any location):
 - 10 hours +
 - 1.5 times the amount the FDP exceeded 12 hours +
 - 1 hour for each time zone crossed in excess of 2 east and 3 west
- If in an unknown state of acclimatisation:
 - 14 hours +
 - 1.5 times the amount the FDP exceeded 12 hours +
 - 1 hour for each time zone crossed.

If the calculation above results in an ODP requirement of more than 14 hours, the ODP may be reduced to not less than 14 hours, provided that:

- the reduced ODP is undertaken away from home base
- the first FDP was not extended past the FDP limit as provided for under the operator's operations manual; and
- no other duties were undertaken following the first FDP before the ODP commences

- the FCM commences the second FDP in an acclimatised state
- the ODP following the second FDP is of at least 36 consecutive hours and includes 2 local nights.

Where an FCM's FDP (the last FDP) does not exceed 10 hours, their following ODP (ODP 2) may be reduced to no less than 9 hours, provided that:

- the ODP undertaken immediately before the last FDP (ODP 1) was at least 12 hours (including a local night)
- the FCM is acclimatised at the start of the ODP 2
- the ODP 2 is undertaken over a local night
- the ODP 2 is not undertaken at home base
- the ODP following the FDP after ODP 2 is at least 12 hours, including a local night.

Note: If an operator takes advantage of this 9 hour reduction provision, the procedures must reflect the requirement for the FCM's 8 hour sleep opportunity prior to the FDP after the reduced ODP. The FCM must still have enough time to travel to and from the suitable sleeping accommodation, meet the reasonable requirements of bodily functioning (i.e. eating, drinking, toileting, washing and dressing) and get a minimum of 8 hours sleep opportunity.

Cumulative fatigue

An operator must have documented procedures to ensure that in order to address cumulative fatigue, before commencing an FDP or standby period, an FCM has had:

- at least 36 consecutive hours off-duty, including 2 local nights, in the 168 hours before the projected end time of the assigned FDP; and
- at least 7 days off-duty in the 28 consecutive days before the FDP commences; and
- at least 24 days off-duty in the 84 consecutive days before the FDP commences.

Trans-meridian flight

An FCM must not undertake more than 4 consecutive FDPs in an unknown state of acclimatisation. An adaptation period must then be undertaken before the FCM can undertake another FDP. An adaptation can be undertaken at other times in order to acclimatise to the location where the adaptation period is undertaken.

As an adaptation period must be undertaken during an ODP, requirements for these are outlined in this section.

Table 7.1 in CAO 48.1 specifies the minimum duration for an adaptation period in order to become acclimatised to the location where it is undertaken. In applying this Table to arrive at an adaptation period, the operations manual procedures should:

- determine the time zone displacement between:
 - the location where the FCM was last acclimatised (the original location)
 - each location where an FDP or ODP was commenced since last acclimatised (later locations):
- determine the time zone displacement between the original location and whichever of the later locations gives the greatest time zone displacement
- determine the time zone change in the Table that corresponds to the greatest time zone displacement

- determine the direction (east or west) in which the FCM travelled and; therefore, the greatest time zone displacement occurred under subparagraph (b) of CAO 48.1
- determine the number of hours east or west (as the case requires) that corresponds to the time zone change chosen under subparagraph (c) of CAO 48.1.

The operations manual must, at a minimum, reflect the following requirements:

- an FCM is considered to remain in their state of acclimatisation (whether acclimatised to a particular location or in an unknown state of acclimatisation) until they have had:
 - an adaptation period in a location (the adaptation location) in accordance with Table 4
 - or
 - an adaptation period that is:
 - o in a location other than home base
 - o in accordance with Table 4, except that this is reduced by 12 hours for each previous ODP that:
 - immediately preceded the adaptation period
 - was taken at an off-duty location, which differs in local time by less than 2 hours from the adaptation location
 - is an off-duty location local night.

Table 4: Adaptation period to become acclimatised (extracted from Table 7.1 of CAO 48.1)

| Time zone change (measured in time zones) | Adaptation period to become acclimatised 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: An adaptation period under paragraph 7.4 may commence before the time when an FCM comes to be in an unknown state of acclimatisation.

For guidance in determining acclimatisation, including examples of how an FCM becomes reacclimatised in accordance with paragraph 7.4, operators and FCMs should refer to Appendix D to this CAAP.

There is ongoing debate within the scientific community about whether it is preferential for FCMs to have an extended period off-duty at an overseas location after long trans-meridian flights, or to commence the return to home base after a shorter ODP, thereby reducing the impact of being in a location where the time zone is substantially different from that at home base.

Both options are currently available under Appendix 2 and procedures for either or both are acceptable. If the operator chooses to reduce the ODP in accordance with this subclause then procedures should display an understanding of the intent of this provision and seek to minimise exposure to zeitgebers (literally: time givers), and try to keep the FCM on a schedule that fits with their sleep habits at home base.

Appendix 3

Acute fatigue

An operator must document in their operations manual the minimum ODPs that they will apply to their FCMs. These periods must not be less than those required by CAO 48.1 and may well be greater due to the possibilities that the circumstances require a greater ODP in order to meet all obligations and still achieve an eight hour sleep opportunity.

The documented procedures must ensure that, following an FDP an FCM has an ODP of at least the duration as determined by the relevant calculation below:

- If at home base:
 - 12 hours +
 - 1.5 times the amount the FDP exceeded 12 hours
- If away from home base
 - 10 hours +
 - 1.5 times the amount the FDP exceeded 12 hours.

If the calculation above results in an ODP requirement of more than 14 hours, the ODP may be reduced to not less than 14 hours, provided that:

- the reduced ODP is undertaken away from home base
- the first FDP was not extended past the FDP limit as provided for under the operator's operations manual
- no other duties were undertaken following the first FDP before the ODP commences
- the ODP following the second FDP is of at least 36 consecutive hours and includes 2 local nights.

Where an FCM's FDP (the last FDP) does not exceed 10 hours, their following ODP (ODP 2) may be reduced to no less than 9 hours, provided that:

- the ODP undertaken immediately before the last FDP (ODP 1) was at least 12 hours (including a local night)
- the ODP 2 is undertaken over a local night
- the ODP 2 is not undertaken at home base
- the ODP following the FDP after ODP 2 is at least 12 hours, including a local night.

Note: If an operator takes advantage of this 9 hour reduction provision, the procedures must reflect the requirement for the FCM's 8 hour sleep opportunity prior to the FDP after the reduced ODP. The FCM must still have enough time to travel to and from the suitable sleeping accommodation, meet the

reasonable requirements of bodily functioning (i.e. eating, drinking, toileting, washing and dressing) and get a minimum of 8 hours sleep opportunity.

Cumulative fatigue

An operator must have documented procedures to ensure that in order to address cumulative fatigue, before commencing an FDP or standby period, an FCM has had:

- at least 36 consecutive hours off-duty, including 2 local nights, in the 168 hours before the projected end time of the assigned FDP; and
- at least 7 days off-duty in the 28 consecutive days before the FDP commences; and
- at least 24 days off-duty in the 84 consecutive days before the FDP commences.

Appendix 4

Acute fatigue

An operator must document in their operations manual the minimum ODPs that they will apply to their FCMs. These periods must not be less than those required by CAO 48.1 and may well be greater due to the possibilities that the circumstances require a greater ODP in order to meet all obligations and still achieve an eight hour sleep opportunity.

The documented procedures must ensure that, following an FDP an FCM has an ODP of at least the duration as determined by the relevant calculation below:

- If at home base:
 - 12 hours +
 - 1.5 times the amount the FDP exceeded 12 hours +
 - 1 hour for each time zone crossed in excess of 2 east and 3 west
- If away from home base:
 - 10 hours +
 - 1.5 times the amount the FDP exceeded 12 hours +
 - 1 hour for each time zone crossed in excess of 2 east and 3 west.

If the calculation above results in an ODP requirement of more than 14 hours, the ODP may be reduced to not less than 14 hours, provided that:

- the reduced ODP is undertaken away from home base
- the first FDP was not extended past the FDP limit as provided for under the operator's operations manual
- no other duties were undertaken following the first FDP before the ODP commences
- the ODP following the second FDP is of at least 36 consecutive hours and includes 2 local nights.

Where an FCM's FDP (the last FDP) does not exceed 10 hours, their following ODP (ODP 2) may be reduced to no less than 9 hours, provided that:

- the ODP undertaken immediately before the last FDP (ODP 1) was at least 12 hours (including a local night)
- the ODP 2 is undertaken over a local night
- the ODP 2 is not undertaken at home base
- the ODP following the FDP after ODP 2 is at least 12 hours, including a local night.

Note: If an operator takes advantage of this 9 hour reduction provision, the procedures must reflect the requirement for the FCM's eight hour sleep opportunity to be met in the 10 hours prior to the FDP that starts after the reduced ODP. The FCM must still have enough time to travel to and from the suitable sleeping accommodation, meet the reasonable requirements of bodily functioning (i.e. eating, drinking, toileting, washing and dressing) and get a minimum of 8 hours sleep opportunity.

Cumulative fatigue

An operator must have documented procedures to ensure that in order to address cumulative fatigue, before commencing an FDP or standby period, an FCM has had:

- at least 36 consecutive hours off-duty, including 2 local nights, in the 168 hours before the projected end time of the assigned FDP; and
- at least 7 days off-duty in the 28 consecutive days before the FDP commences; and
- at least 24 days off-duty in the 84 consecutive days before the FDP commences.

Appendix 4A

An operator must document in their operations manual the minimum ODPs that the operator will apply to their FCMs. These periods must not be less than those required by CAO 48.1 and may well be greater due to the possibilities that the circumstances require a greater ODP in order to meet all obligations and still achieve an eight hour sleep opportunity.

The documented procedures must ensure that, following an FDP an FCM has an ODP of at least 10 hours.

However, an FCM may take 2 ODPs of not less than 4 consecutive hours each, with an intervening duty period of not more than 2 hours, provided the total duration of the 2 ODPs is not less than 13 hours.

Procedures must be in place to ensure that, before beginning an FDP or standby period, the longer-term cumulative fatigue requirements will be met. These procedures must ensure that the FCM has had at least 2 full days (consecutively or otherwise) off-duty in the 14 consecutive days before the projected end time of the assigned FDP.

Appendix 4B

Acute fatigue

The documented procedures must ensure that, following an FDP an FCM has an ODP of at least the following duration:

- if the ODP includes the period between 2300 and 0559 hours local time — 8, plus the number of hours of time zone displacement (if any)
- if the ODP does not include the period between 2300 and 0559 hours local time—10, plus the number of hours of time zone displacement (if any).

The documented procedures must ensure that, the ODP above must consist of at least 8 consecutive hours of which there must be access to suitable sleeping accommodation.

If the operator relies on the minimum ODP being 8 consecutive hours at suitable sleeping accommodation (including the hours of 2300 and 0529), the FCM will be afforded sufficient time to get to and from the suitable sleeping accommodation, and still get an 8 hour period at suitable sleeping accommodation.

The documented procedures must ensure that any extension to an FDP results in the required increase to the minimum ODP by 1 hour for every 30 minutes (or part thereof) the FDP is extended.

Cumulative fatigue

Procedures must be in place to ensure that, before beginning an FDP or standby period, the longer-term cumulative fatigue requirements will be met. These procedures must ensure that the FCM has had at least one of the following:

- in the consecutive 336 hour (14 day) period before the projected end of the assigned FDP or standby—1 ODP of at least 36 consecutive hours including 2 local nights
or
- in the consecutive 504 hour (21 day) period before the projected end of the assigned FDP or assigned standby—1 ODP of at least 72 consecutive hours including 3 local nights.

Appendix 5

Acute fatigue

The documented procedures must ensure that, following an FDP an FCM has an ODP of at least the following duration:

- if the ODP includes the period between 2300 and 0559 hours local time—8 hours;
- if the ODP does not include the period between 2300 and 0559 hours local time—10 hours.

The documented procedures must ensure that, the ODP above must consist of at least 8 consecutive hours of which there must be access to suitable sleeping accommodation.

If the operator relies on the minimum ODP being 8 consecutive hours at suitable sleeping accommodation (including the hours of 2300 and 0529), the FCM will be afforded sufficient time to get to and from the suitable sleeping accommodation, and still get an 8 hour period at suitable sleeping accommodation.

The documented procedures must ensure that any extension to an FDP results in the required increase to the minimum ODP by 1 hour for every 30 minutes (or part thereof) the FDP is extended.

Cumulative fatigue

Procedures must be in place to ensure that, before beginning an FDP or standby period, the longer-term cumulative fatigue requirements will be met. These procedures must ensure that the FCM has had at least one of the following:

- in the consecutive 336 hour (14 day) period before the projected end of the assigned FDP or standby — 1 ODP of at least 36 consecutive hours including 2 local nights
or
- in the consecutive 504 hour (21 day) period before the projected end of the assigned FDP or assigned standby — 1 ODP of at least 72 consecutive hours including 3 local nights.

Appendix 5A

An operator must document in their operations manual the minimum ODPs that they will apply to their FCMs. These periods must not be less than those required by CAO 48.1 and may well be greater due to the possibilities that the circumstances require a greater ODP in order to meet all obligations and still achieve an eight hour sleep opportunity.

The documented procedures must ensure that, following an FDP an FCM has an ODP of at least 10 hours.

Procedures must be in place to ensure that, before beginning an FDP or standby period, the longer-term cumulative fatigue requirements will be met. These procedures must ensure that the FCM has had at least, in any consecutive 384 hour period, a period of at least 2 consecutive days off-duty.

Appendix 6

Acute fatigue

An operator must document in their operations manual the minimum ODPs that they will apply to their FCMs. These periods must not be less than those required by CAO 48.1 and may well be greater due to the possibilities that the circumstances require a greater ODP in order to meet all obligations and still achieve an eight hour sleep opportunity.

The documented procedures must ensure that, following an FDP an FCM has an ODP of at least 12 hours, plus 1.5 times the amount the FDP exceeded 12 hours.

Cumulative fatigue

An operator must have documented procedures to ensure that in order to address cumulative fatigue, before commencing an FDP or standby period, an FCM has had:

- at least 36 consecutive hours off-duty, including 2 local nights, in the 168 hours before the projected end time of the assigned FDP
- at least 7 days off-duty in the 28 consecutive days before the FDP commences
- at least 24 days off-duty in the 84 consecutive days before the FDP commences.

C.10 Limit on cumulative flight time

C.10.1 Introduction

C.10.1.1 Limiting cumulative flight time over medium and long time periods is a means of managing cumulative fatigue prescriptively by acting to reduce the capacity of an operator to assign an FCM in an intensive manner for a sustained period.

C.10.1.2 Cumulative flight time for an FCM means the progressive total of flight time accrued by the FCM when acting as a crew member on board any aircraft, but excluding flight time accrued during recreational private operations.

C.10.1.3 For an operator to manage cumulative flight time they must track both the flight time the FCMs record when flying in their operations over the period in question, and the flight time that FCMs accrue during non-recreational flying over the period in question.

Note: Non-recreational flying is flying conducted by an FCM in a personal capacity, and at the FCM's leisure. A flight conducted by an FCM as a private operation is not a recreational private operation if it is conducted for, or on behalf of an entity, regardless of whether or not the entity is an AOC holder or Part 141 certificate holder.

C.10.1.4 For this limit to be accurately applied, an operator must be recording flight time, in accordance with the definition of flight time in CAO 48.1, which means:

- in the case of a heavier-than-air aircraft — the total time from the moment at which the aircraft first moves under its own power for the purpose of taking-off, until the moment at which it comes to rest after landing
- in the case of a lighter-than-air aircraft — the total time from the moment at which the aircraft first becomes airborne until it comes to rest on the ground, excluding any time during which the aircraft is moored.

C.10.1.5 All appendices (other than Appendix 4A, 5 and 5A) have the same two cumulative flight time limits:

- a maximum of 100 flying hours in any 28 consecutive day period
- a maximum of 1000 flying hours in any 365 consecutive day period.

C.10.1.6 Appendix 4A has a more tailored approach to managing fatigue for ballooning pilots and has a limit of 50 flying hours in any 28 consecutive day period.

C.10.1.7 Due to the nature of aerial work operations, Appendix 5 and 5A have a more complex approach with higher limits and a means of resetting the limits.

C.10.2 What should be in your operations manual

C.10.2.1 An operator's operations manual must include:

- rostering procedures and guidelines that require tracking and consideration of each FCM's cumulative flight time
- a means of monitoring the number of hours of flight time for each FCM, thereby ensuring any FCM does not exceed the applicable limits
- guidelines that are in a form that is clear and readily available to the operator's employees who are involved in rostering activities as well as affected FCMs.

C.10.2.2 There may need to be procedures for FCMs who fly for another operator. If an FCM has flown for another operator, procedures will be required for taking these flying hours into account in assessing whether the FCM is within cumulative flight time limits.

C.10.2.3 There may need to be procedures for FCMs to include in their accumulated flying record any private flying in non-recreational activities.

Appendices 1, 2, 3, 4, 4B and 6

An operator's operations manual must not permit an FCM to exceed the following cumulative flight time limits:

- 100 hours in any consecutive 28 day period
- 1000 hours in any consecutive 365 day period.

Appendix 4A

An operator's operations manual must not permit an FCM to exceed 50 hours cumulative flight time in any 28 consecutive day period.

Appendix 5

An operator's operations manual must not permit an FCM to exceed the following cumulative flight time limits:

- 50 hours in any 168 consecutive hour (7 day) period
- 170 hours in any consecutive 28 day period
- 450 hours in any 90 day period
- 1200 hours in any 365 day period.

For those sections of the aerial work industry that require high yearly cumulative flight times, there is a provision within Appendix 5 whereby, after a significant break, FCMs will be able to 'reset' their cumulative flight times. For these unique provisions to be effective, FCMs require freedom from all duty, rather than just from flying duties. Achieving the reset clauses may require adequate planning as the FCM will be unavailable over the period until the reset provision has been achieved.

The 28 day and 90 day limits may be reset to zero if the FCM achieves a period of 5 consecutive days off-duty.

The 365 day limit may be reset to zero if the FCM achieves a period of 28 consecutive days off-duty.

Operators and FCMs should be aware that, if these extended ODPs do not provide sufficient opportunity to recover from cumulative fatigue, consideration should be given to not resetting the cumulative limit. Examples of such policies to implement include:

- FCMs should be informed that non-recreational flying during ODPs that are being relied upon to reset cumulative flight time limits is not permitted.
- Procedures for tracking the flying hours of all the FCMs that work for them must be included in the operations manual. This assures that the operator will not assign an FCM to an FDP resulting in the FCM exceeding a cumulative flight time limit (this includes non-recreational private flying).

Appendix 5A

An operator's operations manual must not permit an FCM to exceed the following cumulative flight time limits:

- 100 hours in any 384 consecutive hour (16 day) period
- if an FCM has less than 500 hours experience in mustering operations (as PIC or pilot under supervision)—100 hours in any 30 consecutive day period
- 1200 hours in any 365 day period.

As with the provisions of Appendix 5 described previously, the 365 day limit may be reset to zero if the FCM achieves a period of 28 consecutive days off-duty.

C.11 Limit on cumulative duty time

C.11.1 Introduction

C.11.1.1 Limiting cumulative duty time is a means of managing the risk of excessive cumulative fatigue by limiting the total possible duty over the mid and long term.

C.11.1.2 Cumulative duty means the progressive sum of duty periods and is intended to capture any duty (including positioning) that the FCM performs for the operator.

C.11.1.3 While Appendix 5 and 5A have no direct limit on cumulative duty, operators need a process for tracking Appendix 5 and 5A duty if the operator wishes to use the FCM for operations in another appendix. This is particularly challenging when considering split-duty rest periods carried out in Appendix 5 operations. Unlike other Tier 2 appendices, Appendix 5 has no facility for discounting the first 4 hours of the split-duty rest period by 50% for the purposes of determining cumulative duty limits. Operators wishing to transition FCMs into another appendix after operating under Appendix 5 need to include all time in split-duty rest periods as duty.

C.11.2 What should be in your operations manual

C.11.2.1 Except for operators who exclusively operate under Appendix 5 or 5A, an operator's operations manual must include:

- rostering procedures and guidelines that clearly require tracking and consideration of each FCM's cumulative duty time
- a means of monitoring the number of hours of duty time for each FCM ensuring any FCM does not exceed the applicable limits
- guidelines that are in a form that is clear and readily available to the operator's employees who are involved in rostering activities as well as affected FCMs.

C.11.2.2 There may need to be procedures for FCMs who works for another operator. If an FCM works for another operator, procedures should consider this duty time when calculating cumulative duty. If the extra duty means that the FCM would exceed the cumulative duty limits, this would represent a fatigue hazard, which must be managed accordingly.

Appendix 1

There are no limits on cumulative duty under Appendix 1 because it was determined that other restrictions on what was possible in terms of duty were sufficient to manage cumulative fatigue.

Appendices 2, 3, 4, and 6

An operator's operations manual must not permit an FCM to exceed the following cumulative duty limits:

- 60 hours in any 168 consecutive hour (7 day) period
- 100 hours in any 334 consecutive hour (14 day) period.

Appendix 4A

An operator's operations manual must not permit an FCM to exceed the following cumulative duty limits:

- 45 hours in any 168 consecutive hour (7 day) period
- 84 hours in any 334 consecutive hour (14 day) period.

Appendix 4B

The cumulative duty time limits under Appendix 4B depend on whether an FCM has at least 1 ODP of at least 36 hours, including 2 local nights, during a 168 consecutive hour period.

If an FCM does not have an ODP of at least 36 hours, including 2 local nights, during the 168 consecutive hour period, the FCM is limited to 40 hours of duty during that period.

If an FCM does have an ODP of at least 36 hours, including 2 local nights, during the 168 consecutive hour period, the FCM is limited to 60 hours of duty during that period.

C.12 Limits on late night operations (LNOs)

C.12.1 Introduction

C.12.1.1 In all industries that have been studied, there is evidence of an increase in error rate and accidents after four late night duties or night-shifts in a week. Late night FDPs not only require the FCM to be on duty and flying when their body is predisposed to sleeping but also it means that they did not sleep during the period when their body usually achieves the most efficient sleep. Continuing to assign an FCM late-night FDPs results in increased cumulative fatigue and requires a longer recovery period than FDPs assigned during the day.

C.12.1.2 In shift work, forward rotating systems involve changing from morning shifts to afternoon shifts, and then from afternoons to nights. So-called backward rotating systems involve changes in the opposite direction (i.e. from morning shifts to night shifts etc.). Forward rotating systems are also known as delaying shift systems. They are defined this way because the change from one shift to the next involves delaying the phase of the body clock (i.e. effectively extending the day by remaining awake for longer).

C.12.1.3 There is strong evidence that, in contrast to backward rotation of duty period start times, forward rotation of duty start time results in improved sleep quality and length through quicker adaption by the body.

C.12.1.4 A requirement of some of the appendices of CAO 48.1 prevents backwards rotation in the roster and reduces the likelihood of acute and cumulative fatigue. This means that if an FCM is assigned an LNO FDP, and the next FDP is also an LNO, it must not commence less than 24 hours after the start time of the first LNO FDP.

C.12.1.5 Appendix 4A has no restriction on late night operations.

C.12.1.6 Late night operations under Appendix 5A are not possible due to the window in which FDPs are permitted.

C.12.2 What should be in your operations manual

Appendix 1

Operations that take place at a time later than 2200 hours are dealt with differently under Appendix 1. No more than 3 FDPs that take place at a time later than 2200 hours may be undertaken in any 168 consecutive hours. There is no specific 'late night operations' clause in Appendix 1.

Appendices 2, 3, 4, and 6

An operator must develop rostering procedures and guidelines that clearly require tracking of LNO FDPs over consecutive 168 hour periods. These procedures must also identify and track those FDPs that become LNOs due to re-assignment.

Note: An extension to an FDP that results in an FCM finishing an FDP that was assigned to finish before 2330 and further being re-assigned to finish after 2330 is not considered an LNO for the purposes of this limit.

The operations manual must contain procedures and guidelines that:

- adequately manage the roster limits on LNOs
- identify within the more tactical decision making procedure (i.e. day-of-operations decisions) the potential for the LNO provision to limit further assignment of an FDP or standby LNO (must be in accordance with Table 5).

When rostering FCMs for a proposed FDP (even if the proposed FDP is not a LNO) the number of LNOs conducted within the week preceding the proposed FDP need to be considered. The following table shows the manner in which the number of LNOs needs to be considered alongside the number of other FDPs when determining whether the proposed FDP can go ahead. This limit on LNOs applies to Appendices 2, 3, 4 and 6.

Table 5: LNOs limits

| In any consecutive 168 hour period | | Allowable FDP under LNOs Limits | |
|------------------------------------|---------------------------------|--|----------------------------|
| Number of LNOs | Total FDPs (including LNO FDPs) | Is a further FDP allowed in 168 hour period? | Can next FDP be a LNO FDP? |
| 2 | 4 or more | Yes | No |
| 3 | 3 | Yes | Yes |
| 3 | 4 | No | N/A |
| 4 | 4 | No | N/A |

As an FDP conducted in an unknown state of acclimatisation does not count as a late night operator (regardless of the time it is conducted), operators complying with Appendix 2 must also consider the number of FDPs conducted in an unknown state of acclimatisation. The operations manual procedures must reflect that during any 168 consecutive hour period if 2 or more FDPs involve an LNO, and 1 or more FDPs are conducted in an unknown state of acclimatisation, a maximum of 4 FDPs may be undertaken during that period.

There may be restrictions on whether a further FDP can be undertaken resulting from compliance with other subsections of CAO 48.1.

There must be evidence of procedures that require that the start time for a subsequent FDP after an LNO FDP is no earlier than the start time of the LNO FDP.

Appendix 4B

The operations manual must contain procedures limiting the number of FDPs that are assigned or conducted (that includes any time between midnight and 0459) to a maximum of 4 in any consecutive 168 hour period. Unlike other appendices, this restriction does not then limit the total number of FDPs in the 168 consecutive hour period.

In addition, the operations manual must have procedures to ensure that if during any 168 consecutive hour period an FCM conducts 3 or more late night operations, the FCM is limited to 40 hours cumulative duty during that period.

Appendix 5

The operations manual must contain procedures limiting the number of FDPs that are assigned or conducted (that includes any time between midnight and 0459) to a maximum of 4 in any consecutive 168 hour period. Unlike other appendices, this restriction does not then limit the total number of FDPs in the 168 consecutive hour period.

Appendix D

Determination of acclimatisation

D.1 General

- D.1.1 FCMs and operators should refer to subsection 7 of CAO 48.1, which states the determination of acclimatisation. The following scenarios are examples of how these determinations apply.
- D.1.2 These scenarios are hypothetical. The ODPs are examples, not necessarily the minimum ODP required, which is determined by the relevant appendix of CAO 48.1. The scenarios do not consider cumulative duty time limits.

D.2 Scenario 1

- D.2.1 An FCM commences an FDP in an acclimatised state in Perth (the original location). The FDP is 10 hours in duration and finishes in Auckland (4 hours' time difference displaced east from the original location) where an ODP of 16 hours commences before the start of the next FDP. At the commencement of the ODP, less than 36 hours has passed since the start of the FDP, and therefore, the FCM remains acclimatised to Perth (refer paragraph 7.2 of CAO 48.1).
- D.2.2 At the commencement of the next FDP in Auckland, only 26 hours has passed since the start of the last FDP, where the FCM was acclimatised (in Perth), the FCM is considered, by paragraph 7.2 of CAO 48.1, to remain acclimatised to Perth.
- D.2.3 The next FDP is 12 hours duration and finishes in Bangkok (1 hour time difference displaced west from the original location) where an ODP commences. At the commencement of the ODP, the difference in local time between the location (Bangkok) and the location where last acclimatised (Perth) is less than 2 hours, and the FCM has remained in an acclimatised state each time acclimatisation was tested throughout the tour, so according to paragraph 7.1 of CAO 48.1, the FCM is considered to be acclimatised to Bangkok.

D.3 Scenario 2

- D.3.1 An FCM commences an FDP in an acclimatised state in Bangkok (the original location). The FDP is 10 hours duration and finishes in Hong Kong (1 hour time difference displaced east from the original location) where an ODP of 12 hours commences before the start of the next FDP. As the time difference is less than 2 hours from the location where the FCM was last acclimatised (Bangkok), according to paragraph 7.1, the FCM is considered to be acclimatised to Hong Kong. For the purposes of determining acclimatisation, Hong Kong now becomes the 'original location'.
- D.3.2 The FCM now commences an FDP in Hong Kong in an acclimatised state. The FDP is 18 hours in duration and finishes in New York (11 hours' time difference displaced east from the original location) where an ODP of 33 hours commences before the start of the next FDP. At the commencement of the ODP, less than 36 hours has passed since the start of the FDP; therefore, the FCM remains acclimatised to Hong Kong (refer paragraph 7.2 of CAO 48.1).
- D.3.3 At the commencement of the next FDP in New York, more than 36 hours has passed since the FCM was acclimatised to the original location, and the greatest time zone displacement from the original location was more than 2 hours, so according to

paragraph 7.3 of CAO 48.1, the FCM is now in an unknown state of acclimatisation. The next FDP will therefore be conducted in an unknown state of acclimatisation, unless the ODP prior to the FDP is increased.

- D.3.4 The FCM now commences the FDP in New York in an unknown state of acclimatisation. The FDP is 8 hours in duration and finishes in London (16 hours' time difference displaced east from the original location (Hong Kong)). The next FDP will be conducted in an unknown state of acclimatisation, unless an adaptation period prior to the FDP is undertaken, in accordance with Table 7.1 of CAO 48.1.
- D.3.5 In order to determine the adaptation period required to become reacclimatised, the greatest time zone displacement from the original location needs to be determined. In this case, the greatest displacement is 16 hours east; therefore, according to Table 7.1 of CAO 48.1, 120 hours off-duty is required to become reacclimatised in London. However, if the FCM does not have that adaptation period and commences another FDP, this FDP will be conducted in an unknown state of acclimatisation.
- D.3.6 The FCM commences an FDP in London in an unknown state of acclimatisation. The FDP is 8 hours in duration and finishes in New York (11 hours' time difference displaced east from the original location (Hong Kong)). The next FDP will be conducted in an unknown state of acclimatisation, unless an adaptation period prior to the FDP is undertaken in accordance with Table 7.1 of CAO 48.1.
- D.3.7 In order to determine the adaptation period required to become reacclimatised, the greatest time zone displacement from the original location needs to be determined. In this case, the greatest displacement is 16 hours east (when the FCM had the OPD in London). Therefore, according to Table 7.1 of CAO 48.1, a 120 hour adaptation period is required to become reacclimatised in New York.

D.4 Scenario 3

- D.4.1 An FCM commences an FDP in an acclimatised state in Sydney (the original location). The FDP is 16 hours in duration and finishes in Dubai (6 hours' time difference displaced west from the original location) where an ODP of 30 hours commences before the start of the next FDP. At the commencement of the ODP, less than 36 hours has passed since the start of the FDP; therefore, the FCM remains acclimatised to Sydney (refer paragraph 7.2 of CAO 48.1).
- D.4.2 At the commencement of the next FDP in Dubai, more than 36 hours has passed since the FCM was acclimatised to the original location, and the greatest time zone displacement from the original location was more than 2 hours. According to paragraph 7.3 of CAO 48.1, the FCM is now in an unknown state of acclimatisation. The next FDP will therefore be conducted in an unknown state of acclimatisation, unless the ODP prior to the next FDP is increased.
- D.4.3 The FCM commences an FDP in Dubai in an unknown state of acclimatisation. The FDP is 11 hours in duration and finishes in Paris (9 hours' time difference displaced west from the original location (Sydney)). The FCM undertakes an ODP (including one local night in Paris).
- D.4.4 The FCM then undertakes three FDPs in an unknown state of acclimatisation during daylight hours in Europe, remaining within the same time zone (Coordinated Universal

Time [UTC]+1), or one time zone to the west (UTC). The ODPs between FDPs are all undertaken over local nights, and one of those was in London. Therefore, under subparagraph 7.4 (b) of CAO 48.1, a credit of 12 hours for each local night is available to reduce the required adaptation period specified in Table 7.1 of CAO 48.1.

- D.4.5 In order to determine the adaptation period required to become reacclimatised, the greatest time zone displacement from the original location needs to be determined. In this case, the greatest displacement is 10 hours west (when the FCM had the ODP in London). According to Table 7.1 of CAO 48.1, a 96 hour adaptation is required to become reacclimatised; however, since the FCM has spent three local nights within two time zones, a total of 36 hours may be deducted from this adaptation period. Meaning, that in order to become acclimatised, an adaptation period of 60 hours is required.

D.5 Scenario 4

- D.5.1 The original location is Adelaide. Perth is 1 hour and 30 minutes (during non-daylight savings period) earlier than Adelaide; therefore, on arrival Perth an FCM is acclimatised to Perth. If the FCM departs Perth, for Urimqi in Western China, the FCM arrives acclimatised because Urimqi is the same time as Perth (due to China being a single time zone, although at 87.5E Urimqi would normally be at least 2 hours different from Perth).
- D.5.2 If the FCM then flies 2820 NM to Narita, the time is only 1 hour difference from Urimqi and the FCM remains acclimatised. If the FCM then returns to Perth or Adelaide, they are acclimatised to either destination.
- D.5.3 Perth becomes 2 hours and 30 minutes earlier than Adelaide (during daylight savings period) and the 36 hour period to an unknown state of acclimatisation begins at the start of the FDP in Adelaide.

Appendix E

Example fatigue occurrence report

FATIGUE MANAGEMENT FOR FLIGHT CREW MEMBERS

| | | | | | | | | | | | | | |
|---|--|---|--|--|---|--|---|--|--|--------------------------------------|--|---------------------------------------|--|
| If you wish the contents of this form to remain confidential please tick here <input type="checkbox"/> | | | | | | | | | | | | | |
| NAME: | | POSITION: | | ID NUMBER: | | DATE OF BIRTH | | HOME BASE | | | | | |
| THIS FORM IS BEING COMPLETED IN RELATION TO FATIGUE ASSOCIATED WITH: (TICK ONE) | | | | | | | | | | | | | |
| <input type="checkbox"/> A lodged incident report | | | <input type="checkbox"/> An FDP extension | | | <input type="checkbox"/> A non-reported safety event | | | <input type="checkbox"/> A general concern regarding fatigue | | | | |
| WHEN DID THE EVENT OCCUR? | | Date (DD/MM/YY): ___/___/___ | | | Time (LOCAL OR UTC?): ___:___ | | | How long had you been on duty? _____ HOURS _____ MINS | | | | | |
| WHAT WERE YOU DOING AT THE TIME OF THE EVENT? | | <input type="checkbox"/> At home | | <input type="checkbox"/> Driving to work | | <input type="checkbox"/> In flight | | <input type="checkbox"/> Driving home | | <input type="checkbox"/> Positioning | | <input type="checkbox"/> Other: _____ | |
| IF RELEVANT, ON WHAT FLIGHT DID THE EVENT OCCUR? | | Flight No. _____ | | | Route: _____ | | | A/C type: _____ | | Event sector: _____ | | | |
| FATIGUE DETAILS (COMPLETE PTO IF REQUIRED) | | | | | | | | | | | | | |
| TITLE | | | | | | | | | | | | | |
| DESCRIPTION | | | | | | | | | | | | | |
| CAUSE | | | | | | | | | | | | | |
| ACTION & RESULTS | | | | | | | | | | | | | |
| SUGGESTIONS | | | | | | | | | | | | | |
| CONTRIBUTORY FACTORS | | | | | | | | | | | | | |
| Tick all factors that contributed to the event/your general concern | | | | | | | | | | | | | |
| <input type="checkbox"/> Commute <input type="checkbox"/> Deep night <input type="checkbox"/> Delay(s) <input type="checkbox"/> Health <input type="checkbox"/> Home Issues <input type="checkbox"/> Home rest <input type="checkbox"/> Hotel rest <input type="checkbox"/> Insufficient rostered rest time <input type="checkbox"/> Early to late transition <input type="checkbox"/> Late to early transition | | | <input type="checkbox"/> Early start time <input type="checkbox"/> Late finish time <input type="checkbox"/> Long duty day <input type="checkbox"/> Long-term fatigue <input type="checkbox"/> Positioning <input type="checkbox"/> Roster disruption <input type="checkbox"/> Illness/Medication <input type="checkbox"/> Don't know <input type="checkbox"/> Other (please add details above) | | | COMMUTE Duration of commute from home to home base; _____ HRS _____ MIN | | SLEEP HISTORY For the 72 hours prior to the reported event, record the start and finish times for all sleep periods (including naps): | | | | | |
| | | | | | | Duration of commute on days off to home base (if living in alternative accommodation during the duty block) _____ HRS _____ MIN | | | | | | | |
| Tick all physical and cognitive signs of fatigue that were apparent in the <u>2</u> hours leading up to the event and any counter-measures used | | | | | | | | | | | | | |
| PHYSICAL SIGNS | | | COGNITIVE SIGNS | | | | COUNTERMEASURES | | | | | | |
| <input type="checkbox"/> NO PHYSICAL SIGNS WERE NOTED <input type="checkbox"/> Fidgeting <input type="checkbox"/> Rubbing eyes <input type="checkbox"/> Yawning <input type="checkbox"/> Frequent blinking <input type="checkbox"/> Staring blankly <input type="checkbox"/> Long blinks <input type="checkbox"/> Difficulty keeping eyes open <input type="checkbox"/> Head nodding <input type="checkbox"/> OTHER: _____ | | | <input type="checkbox"/> NO COGNITIVE SIGNS WERE NOTED <input type="checkbox"/> Impaired attention <input type="checkbox"/> Impaired memory <input type="checkbox"/> Negative mood <input type="checkbox"/> Reduced communication <input type="checkbox"/> Impaired problem solving <input type="checkbox"/> Increased risk taking <input type="checkbox"/> Impaired situational awareness <input type="checkbox"/> OTHER: _____ | | | | <input type="checkbox"/> NO COUNTERMEASURES WERE USED <input type="checkbox"/> Advised colleague of fatigue risk <input type="checkbox"/> Coordinated workload <input type="checkbox"/> Increased communication <input type="checkbox"/> Caffeine <input type="checkbox"/> Food & Drink <input type="checkbox"/> Cockpit napping <input type="checkbox"/> OTHER: _____ | | | | | | |
| How alert did you feel immediately prior to the event (tick one): | | <input type="checkbox"/> 1 Fully alert, wide awake | <input type="checkbox"/> 2 Very lively, somewhat responsive, but not at peak | <input type="checkbox"/> 3 OK, somewhat fresh | <input type="checkbox"/> 4 A little tired, less than fresh | <input type="checkbox"/> 5 Moderately tired, let down | <input type="checkbox"/> 6 Extremely tired, very difficult to concentrate | <input type="checkbox"/> 7 Completely exhausted | | | | | |

Appendix F

Hazard identification and associated procedures (Tier 2)

- F.1.1 CASA has designed a set of prescriptive limitations that are designed to broadly manage the risk of fatigue due to sleep loss, time awake, time on duty and the time of day effects. Advice within the CAAP suggests that the different workplace environments can increase or decrease the accumulation of fatigue, as can differing workload, and CASA has only provided minimal consideration of these influences within the limitations, for example, the number of sectors flown.
- F.1.2 Operators should consider their own circumstances using prior company experience or discussions with other operators and groups so that these measures may be included within their operations manual.
- F.1.3 The following table is an illustration of what CASA considers a reasonable approach to hazard identification for an operator without an established risk assessment process. Operators are reminded that it may be possible to reduce the identified hazard through means other than limiting flight or duty times.
- F.1.4 These are a sample of fatigue hazards which may exist for some operators. This list is not specific to any particular operation type, but is intended to inform operators who may not be experienced in SMS-type processes about how hazards may be mitigated for the purposes of complying with the Tier 2 operator obligations. If an operator has an approved SMS, the processes within the SMS could, and should, be used for the purposes of complying with those obligations.

Table 6: Hazard identification

| Identified Hazard | Limitation Adjustment | Policies and Practices Considerations |
|--|---|--|
| <p>Flying school conducts aerobatic training which can lead to the rapid onset of fatigue</p> | <p>Any flight time whilst conducting aerobatic training to be factored by 1.5 when determining flight time limits for any FDP.</p> <p>Maximum number of aerobatic training hours may be considered on a daily basis. This may be proportional to instructor experience.</p> | <p>Training provided to instructors specific to aircraft type considerations, e.g. in aircraft with bubble type cockpits or any aircraft in summer, maintaining adequate levels of hydration may be important.</p> |
| <p>Flying school conducts late night operations in summer</p> | <p>Instructors on late night training sorties are maintained on late night training sorties and are not required for daytime operations.</p> | |
| <p>EMS operation uses night vision goggles (NVG) in operations</p> | <p>Any flight time whilst conducting NVG operations to be factored by 2 when determining maximum flight time limits for any FDP.</p> | <p>Additional training provided to FCMs on fatigue mitigation strategies specific to NVG use.</p> |
| <p>Layover port accommodation located 1 hour from airport</p> | <p>Minimum ODP increased by 2 hours at this port.</p> | |
| <p>Layover port accommodation undergoing renovations causing sleep disruption to FCMs</p> | <p>Maximum FDP following an off-duty period at this accommodation reduced by 2 hours.</p> | <p>Flights scheduled to permit ODPs to be undertaken during times when renovations are not taking place.</p> |
| <p>Reports of FCMs being unable to achieve 8 hours sleep on layovers at a particular port where minimum off-duty period is provided</p> | <p>ODPs at this port increased by 1 hour.</p> | <p>Following minimum off-duty at this port require that all FCMs complete a survey and psychomotor vigilance test (PVT) before commencing the FDP.</p> <p>Only allow FCMs to be assigned one layover at this port in every 7 days.</p> |
| <p>Aerial work activity (such as firefighting and aerial survey) creates high cognitive workload</p> | <p>30 minute breaks provided every 3 hours during an FDP.</p> | <p>Specific training for FCMs about recognition of fatigue in themselves, and others.</p> <p>Monthly meetings with FCMs to consider fatigue issues, with policies and limitations considered.</p> |

| Identified Hazard | Limitation Adjustment | Policies and Practices Considerations |
|--|---|---|
| Single pilot operations being conducted in an aircraft without an autopilot | Maximum FDP reduced by 3 hours, and maximum flight time reduced by 2 hours. | |
| FCMs returning from overseas simulator training in desynchronised state. | | Provide a minimum of three days off-duty following return to home base, before commencing an FDP. |

Appendix G

Alertness consideration table

G.1 General

- G.1.1 This table presents an example method to consider the fatigue risk involved when determining fitness for duty. It is called the alertness consideration table (ACT) and instructions for how to use it are provided.
- G.1.2 The ACT involves answering three questions that relate to perceived alertness, prior sleep and duty timing. Through the duty risk section, there may need to be a reference to the operator's SMS that will have information that addresses level of workload risk.
- G.1.3 The answers to the questions are coded and combined to enable the employee to determine what the employee may need to consider when determining whether to undertake this duty in its current form. If there is a suspected fatigue risk involved, the FCM needs to measure alertness, discuss with a supervisor whether the alertness level is suitable for this duty and consider how the risk can be effectively mitigated.

G.2 Instructions for using the ACT prior to a duty

G.2.1 Question 1 – How alert are you feeling?

- G.2.1.1 Question 1 involves the FCM rating their current alertness (ideally close to their report time) using one of the seven options on the alertness scale. The result falls into one of three bands of risk – low, moderate or high.
- G.2.1.2 If high risk, the FCM must consider discussing this with team members or their supervisor and may need to address the risk through applying previously defined risk control measures (i.e. extended rest periods or task rotation). If a decision is made to continue with the duty, proceed to Question 2.

G.2.2 Question 2 – Have you had adequate sleep?

- G.2.2.1 Question 2 involves the FCM using accruing points based on their sleep in the prior 24 hours, 48 hours, and hours awake at the end of the duty. The points sum to produce a final score, which is categorised in terms of risk as low, moderate, or high.
- G.2.2.2 If the result is high risk, the FCM must consider discussing this with team members or their supervisor and may need to address the risk through applying previously defined risk control measure (i.e. extended rest periods or task rotation). If a decision is made to continue with the duty, proceed to Question 3.

Note: While 48 hours is used in this table, this is because the table focuses almost entirely on acute or transient fatigue, and the assumption is that the FCM was well rested prior to this point. If the FCM has a longer period of disrupted or restricted sleep, then they should consider this cumulative fatigue will increase the fatigue risk. An increased cumulative fatigue will increase the risk associated with subsequent shorter than required sleep periods identified in the table. FCMs should put more weight on any symptoms (response to question 1) and take a more conservative approach to any heightened risk identified by using this table.

G.2.3 Question 3 – What time does the duty occur?

- G.2.4 Question 3 involves the FCM classifying their duty based on the time of day that the duty occurs. The result falls into one of three bands of risk – low, moderate or high.
- G.2.5 They then continue to Question 4.

G.2.6 Question 4 – What level of operational risk is associated with the duty?

G.2.7 Question 4 involves the FCM classifying the level of operational risk associated with the duty.

G.2.8 It is understood that the accumulation of fatigue will eventually diminish performance and increase error rate, to the point where the FCM becomes 'fatigue impaired', or simply too tired for the job intended. Aviation systems should be able to tolerate some human error and diminished performance capability, but very often task demands can increase, due to unforeseen circumstances. Consequently, what was previously acceptable in terms of an acceptable performance/error level now becomes unacceptable.

G.2.9 This CAAP is about the management of fatigue risk; however, operators need to also manage workload level. Fatigue risk interacts with other areas of human performance (i.e. as workload and task complexity) and all of these risks need to be addressed. Workload risk can be addressed through general risk management processes, contained within the operator's SMS.

G.2.9.1 For fatigue risk, an FCM should consider what factors are associated with the tasks allocated to them prior to presenting as fit for duty. This is because it has been well researched that reduced alertness (or the accumulation of fatigue) impacts on 'real world skills'. FCMs, teams and operators should consider fatigue risks that may be present in conjunction with other risks, such as:

- the type of task being undertaken
- the nature of the airspace
- weather considerations
- airport demands
- aircraft serviceability.

G.2.9.2 Operators and FCMs should recognise that tasks that involve cognitive performance (e.g. decision making, memory capacity) and threat and error management can potentially be poorly measured or mismanaged by an FCM who is fatigued.

G.2.9.3 Using ACT, the FCM continues to the final step, in order to assist their determination of whether they may have adequate alertness to undertake the duty.

G.3 Determine the fatigue risk level and what may need to be considered when determining whether to undertake this duty

G.3.1 Based on the results for Questions 1-4, the FCM can use the table provided to gauge the degree to which fatigue risk may be present during this duty. Together with measured levels of alertness, FCMs can begin discussing how to manage possible risks with their supervisor and subsequently develop an effective risk management plan.

Sleep requirements (user customisable)

Whilst it is easy to understand that adequate sleep is a prerequisite for an alert FCM, the notion of adequate sleep is subject to individual variability. This is further complicated by the tendency to overestimate the amount, and quality, of sleep we actually get. As a general guide an individual who was previously well rested requires at least 6 hours sleep in 24 hours, and 13 hours in 48 hours to remain adequately alert.

An FCM can develop section 2 of the ACT to suit themselves. The blue highlighted numbers in section 2, can be individualised. If the FCM believes the numbers are too low because they generally need more sleep than the average person and increasing them by 1 hour would better reflect their sleep needs, then each of the numbers to the left should also be increased by 1 hour. A good place to start is for an individual understanding how much sleep is needed to feel well rested. This may be ascertained after a day or two of waking normally (to dissipate any accumulated sleep debt). Once this figure is recognised, then a basis is formed for suggesting what reduction from this figure over a 24 and 48 hour period may lead to the risk rising until the accumulated sleep debt becomes too much. As a general guide, if starting from a well-rested state, less than 13 hours sleep in the last 48 hours and 6 in the last 24 hours should be considered significant.

It must be emphasised that the figures in this section of the tool can be tailored to account for individual needs. The average sleep needed is 7-8 hours to consistently feel well rested; however, some people may require only 6 hours and some 10 hours.

| 1. How alert are you feeling? (rate just prior to start of duty) | | RISK RESULT ① |
|---|--|---------------|
| 1 | Fully alert, wide awake | Low |
| 2 | Very lively, responsive, but not at peak | |
| 3 | Okay, somewhat fresh | |
| 4 | A little tired, less than fresh | Moderate |
| 5 | Moderately tired, let down | |
| 6 | Extremely tired, very difficult to concentrate | High |
| 7 | Completely exhausted, unable to function effectively | |
| IF 'HIGH RISK' IS INDICATED CONSIDER RISK CONTROLS, SUCH AS NAPPING, TASK ROTATION OR ADVISING THE OPERATOR YOU ARE NOT FIT FOR DUTY. | | |

| 2. Have you had adequate sleep? | | Points |
|--|----------------------------|--------|
| i) At start of duty how much sleep will you have had in last 24 hrs? (this is value 'x') | Enter points in box -----> | |
| x = ____ hrs -----> x: ≤3h 4h 5h 6+h | -----> | |
| Points: 12 8 4 0 | | |
| ii) At start of duty how much sleep will you have had in last 48 hrs? (this is value 'y') | Enter points in box -----> | |
| y = ____ hrs -----> y: ≤8h 9h 10h 11h 12h 13+h | -----> | |
| Points: 10 8 6 4 2 0 | | |
| iii) At end of planned duty how many hours will you have been awake, minus any time allocated for a rest period at suitable sleeping accommodation, or in-flight crew rest facility when part of an augmented crew? (this is value 'z') z = ____ hrs | | |
| iv) If y < z, subtract hours of sleep obtained in last 48 hours (y) from hours awake (z). Convert the resulting figure to points (1 hour = 1 point). Enter points in box -----> | | |
| ADD POINTS ABOVE TO DETERMINE YOUR SCORE -----> | | |
| Score | RISK RESULT ② | |
| 0-4 | Low | |
| 5-8 | Moderate | |
| 9+ | High | |
| IF 'HIGH RISK' IS INDICATED CONSIDER RISK CONTROLS, SUCH AS NAPPING, TASK ROTATION OR ADVISING THE OPERATOR YOU ARE NOT FIT FOR DUTY. | | |

| 3. What time does the duty occur? | | RISK RESULT ③ |
|--|--|---------------|
| All hours of the duty occurs between 0800-2200 | | Low |
| Other | | Moderate |
| Part of the duty occurs between 0200-0600 | | High |

| 4. What level of generic risk is associated with the duty? (Consider route, airports, airspace, level of crew experience, the aircraft features and serviceability and the weather conditions). | | RISK RESULT ④ |
|---|--|---------------|
| Description | | |
| All considerations rated low risk | | Low |
| At least one consideration rated moderate risk | | Moderate |
| At least one consideration rated high risk | | High |

| 5. Based on the results for ①-④ use the table below to determine what you may need to consider when determining whether to undertake this duty. | | | | | |
|---|---------|--------|--------|--------|--|
| RISK RESULTS | Example | | | | ALERTNESS CONSIDERATIONS |
| | ① | ② | ③ | ④ | |
| High risk response to Q1 or Q2 | Red | Grey | Grey | Grey | High risk: Measure level of alertness using objective and subjective methods, discuss with your supervisor why your alertness level may not be sufficient for this duty and consider a rostering alternative to manage the risk (e.g., augmented crew, longer rest periods). |
| All Moderate with at least 1 High | Yellow | Yellow | Red | Yellow | |
| Any combination of Low, Mod or High | Yellow | Yellow | Green | Red | Moderate risk: Measure level of alertness using objective and subjective methods, discuss with your supervisor whether your alertness level is suitable for this duty and consider the use of additional mitigation strategies (e.g., napping, task rotation). |
| 2 Low, 2 High | Green | Green | Red | Red | |
| All Moderate | Yellow | Yellow | Yellow | Yellow | |
| Any combination of Low or Moderate | Yellow | Yellow | Green | Green | Low Risk: Measure level of alertness using objective and subjective methods, discuss with your supervisor whether your alertness level is suitable for this duty and consider beneficial fatigue risk controls for this duty (e.g., caffeine use, nutrition). |
| 3 Low and 1 High | Green | Green | Green | Red | |
| All Low | Green | Green | Green | Green | |

Figure 5: Fatigue risk assessment