Fatigue Management for Flight Crew Members

This CAAP will be of interest to:
• all holders of an Air Operator’s Certificate (AOC); and
• all holders of a flight crew licence.

Why this publication was written
This CAAP provides guidance on meeting the AOC holder and flight crew member (FCM) obligations in relation to fatigue management, required under CAO 48.1 from 30 April 2016, or earlier if an operator transitions to the new rules before this date.

Status of this CAAP
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 is the first revision of this CAAP which adds further guidance on the practical application of CAO 48.1 (predominately contained in new Appendices A, B and C), and makes minor editorial changes.

Changes to the content of this CAAP are denoted by a change bar (as noted to the right of this paragraph).

For further information
For application and policy advice contact your local CASA office by phone on 131 757.
Contents

1. The relevant regulations and other references
   - CAO 48.1 Instrument 2013
   - 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.

2. Acronyms

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

3. Definitions

ACCESS – no restriction on, or impediment to, a flight crew member’s (FCM) 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 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 which involves 1 or more of the following:
   a. an FDP with a displacement time of two hours or more
   b. an augmented crew operation
   c. an FDP that commences when the FCM is:
      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.

CREW REST FACILITY – a facility on board an aircraft available to an FCM for the FCM to obtain rest or sleep, and classified as follows:
   a.  Class 1 means a bunk or other surface that:
      i.  allows for a horizontal sleeping position
      ii.  is located separate from both the flight deck and passenger compartment in an area that:
           A.  is temperature-controlled
           B.  allows the FCM to control light
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C. provides isolation from noise and disturbance
   b. Class 2 means a seat in an aircraft cabin that:
      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:
      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 sum of flight time, 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 – the difference in local time between:
   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 which starts when an FCM is required by an AOC holder to report for duty, and ends when the FCM is free of all duties.

FATIGUE – a physiological state of reduced alertness or capability to perform mental or physical tasks, which:
   a. may impair the ability of the FCM to safely operate an aircraft
   b. is caused by 1 or more of the following:
      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) – a comprehensive system for managing fatigue-related risks that:
   a. includes all of the elements set out in Appendix 7 to CAO 48.1
   b. is approved for implementation by CASA.

FLIGHT DUTY PERIOD (FDP) – a period of time which:
   a. starts when a person is required by an AOC holder to report for a duty period in which one or more flights as an FCM are undertaken
   b. ends not less than 15 minutes after the end of the person's final flight as an FCM.

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 eight consecutive hours which includes the hours between 2200 and 0500 local time.

MULTI-PILOT OPERATION – an aircraft operation conducted under multi-pilot procedures contained in the AOC holder’s operations manual.

OFF-DUTY PERIOD (ODP) – a period of time during which an FCM is free of all duties and standby associated with their employment.

RECREATIONAL PRIVATE OPERATION – 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).

REPORTING TIME – the time assigned to an FCM to report for 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.

SLEEP OPPORTUNITY – a period of time during an off-duty period when an FCM:
   a. is not meeting the reasonable requirements of bodily functioning, such as:
      i. eating
      ii. drinking
      iii. toileting
      iv. washing
      v. dressing
   b. has access to suitable sleeping accommodation without, under normal circumstances, being interrupted by any requirement of the AOC holder.

SPLIT-DUTY REST PERIOD – a predefined period of time during which an FCM:
   a. has access to suitable resting accommodation or suitable sleeping accommodation; and
   b. is relieved of all duties associated with his or her employment by the AOC holder.

Note: for Appendix 5 to CAO 48.1, the period of time may or may not be predefined.

STANDBY – a period of time during which an FCM:
   a. is required by an AOC holder to hold themselves available for duties
   b. has access to suitable sleeping accommodation.

SUITABLE RESTING ACCOMMODATION – a comfortable resting area:
   a. which has a comfortable temperature and minimal noise levels
   b. which contains at least a comfortable chair
   c. at which the FCM has access to adequate sustenance at times appropriate to the duty requirements.

SUITABLE SLEEPING ACCOMMODATION – accommodation not within an aircraft, consisting of facilities conducive to sleep, including the following:
   a. a comfortable self-contained room or compartment
   b. a single occupancy, at the discretion of the FCM
   c. clean, tidy and hygienic facilities
   d. a bed that is comfortable, flat and horizontal, allowing the occupant to sleep on their stomach, back or either side
   e. minimum noise levels (including low occurrence of random noise)
f. facilities to control light, temperature and ventilation

g. 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 which 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. unforecast weather, equipment malfunction, or air traffic delay).

4. Introduction

4.1 CAO 48.1 outlines the requirements for fatigue management for FCMs. Within CAO 48.1, there are a number of obligations that AOC holders (operators) and flight crew licence holders (individuals) must meet. This CAAP provides guidance in meeting those obligations.

4.2 The rules for fatigue management for flight crew members (FCMs) 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 to 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 to 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 to 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.
Table 1 – Three tiers of compliance

<table>
<thead>
<tr>
<th>Limitations</th>
<th>Operator Obligations</th>
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<tbody>
<tr>
<td>Customisable</td>
<td>Policy and documentation</td>
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<tr>
<td>Data-driven</td>
<td>Risk management processes</td>
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<td>Closed-loop</td>
<td>Safety assurance processes</td>
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<td>Safety promotion processes</td>
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<td></td>
<td>FRMS</td>
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<tr>
<td>Prescriptive</td>
<td>Hazard identification</td>
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<tr>
<td>Type-of-operation</td>
<td>Limitations taking into account</td>
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<tr>
<td>More flexible</td>
<td>identified hazards</td>
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<tr>
<td>Less restrictive</td>
<td>Continuous monitoring</td>
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<td></td>
<td>Transitional procedures</td>
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<tr>
<td></td>
<td>Training for FCMs</td>
</tr>
<tr>
<td></td>
<td>Basic</td>
</tr>
<tr>
<td></td>
<td>No additional obligations</td>
</tr>
</tbody>
</table>

4.3 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.

4.4 For operators choosing to develop and implement an FRMS under Tier 3, guidance on this is contained in the ICAO FRMS Implementation Guide for Operators. While the information in this CAAP may also provide useful guidance to operators about generic fatigue management principles, the ICAO guidance sets the standards that CASA will apply when approving an FRMS.

4.5 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 expects to update its FRMS guidance as operational and scientific knowledge of FRMS advances—CASA expects operators will ensure their FRMS remains current with developments in the field of FRMS.

4.6 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.

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

4.8 Operator obligations

4.8.1 Under subsection 14 of CAO 48.1, all holders of an AOC have a series of obligations.

4.8.2 Above all, an AOC holder 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 which may so impair the FCM’s performance that the safety of the operation may be affected.

4.8.3 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
• provision for opportunities for FCMs to consume meals
• record keeping and reporting
• for public transport services operators—determination of home bases for its FCMs
• roster publishing.

4.8.4 Tier 2 operators (i.e. operators operating under Appendix 2 through to 6 to CAO 48.1) have additional obligations. Under subsection 15 of CAO 48.1, these operators must have the following documented within their operations manual:

• procedures for hazard identification
• procedures for determining limitations which take into account potential hazards
• procedures for the continuous monitoring and evaluation of policies, limitations and practices
• transition procedures (when operations under multiple appendices to CAO 48.1 are conducted).

4.8.5 Tier 2 operators are also required to have initial and recurrent fatigue training programs for their FCMs.

4.9 Individual obligations

4.9.1 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, he or she has reason to believe 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.

4.9.2 An FCM employed by an AOC holder must, before any flight duty period (FDP), disclose to the AOC holder anything affecting the FCM, or connected with the FDP, which he or she has reason to believe may affect his or her ability to meet the AOC holder’s fatigue risk management policies; or the limits and requirements of the appendix or appendices to CAO 48.1 that the holder has chosen to apply to the FCM.

5. Operator obligations – Fitness for duty

5.1 Selecting suitable sleeping accommodation for off-duty periods

5.1.1 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).

5.1.2 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 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.

5.1.3 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.

5.2 Location of sleeping accommodation
5.2.1 Operators should carefully consider and manage how the location of sleeping accommodation may affect sleep quality. When considering location suitability, operators should examine:

- travel distance to and from the facility
- transport options
- potential interruptions/disruptions
- phone calls
- cleaning
- room service
- maintenance work
- temperature control
- crew sharing options in work contracts
- lighting control
- social cues (e.g. local meal times, arrival/departure times of other guests)
- security at each location.

5.2.2 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 individuals to adjust accordingly to the local time.

5.2.3 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.

5.3 Acclimatisation

5.3.1 ‘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.

5.3.2 For the purpose of the rules pertaining to fatigue management for FCMs, ‘acclimatisation’ is a formal term applicable to operators complying with Appendix 2 to 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 off-duty periods for an FCM. While Appendices 4 and 5 do not specifically address the impact of crossing time zones, the likely increase in fatigue risk from doing so must be adequately managed.

5.3.3 Generally, the responsibility for managing the effects of time zone changes and acclimatisation is shared between the operator and the individual. 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.

5.3.4 The individual 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.
5.3.5 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.

5.4 Augmented crew

5.4.1 Augmented crew refers to a flight crew comprising more than the minimum number of FCMs required to operate the aircraft.

5.4.2 Augmenting the crew is a strategy operators can use to assist with managing crew alertness. With appropriate procedures in the AOC holder’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 fatigue. Appropriate procedures should include:

- the requirement to designate a pilot responsible for making command decisions at all times when the pilot in command (PIC) is utilising in-flight rest
- the requirement for a comprehensive briefing prior to FCMs rotating through in-flight rest
- clear direction 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.

5.4.3 There are various studies that have described the effects of sleep inertia on performance, particularly when awakening from deep sleep. Operators and individuals should be aware of, and manage, the effect of sleep inertia in flight operations.

5.4.4 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.

5.4.5 Individuals 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 individuals receive training regarding the appropriate use of augmented crews and in-flight crew rest facilities.

5.4.6 Appendix 2 to CAO 48.1 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 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.

5.4.7 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

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• privacy needs
• lighting
• vibration
• micro-climate (air flow, ventilation, temperature, temperature gradient, humidity)
• hygiene (avoidance of pathogens, shielding)
• communications
• restraint mechanisms
• access
• evacuation
• emergency equipment.

5.5 Fatigue occurrence reporting

5.5.1 The willingness of crew members 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.

5.5.2 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
• measurements of different aspects of fatigue-related impairment (for example, validated alertness or sleepiness scales).

5.5.3 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.

5.5.4 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:
  – adding an extra crew member
  – reducing the workload of the duty
  – delaying the reporting time
  – creating the opportunity for a nap
  – 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 individual 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.

6. Operator obligations – Setting limitations

6.1 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 to CAO 48.1.

6.2 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.

6.3 Fatigue risk can only be managed, in part, by limiting the hours of duty and commensurately providing for sufficient 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).

6.4 An operator choosing to operate in Tier 2 must have hazard identification processes in place that are then used to determine operator-specific limitations. Refer to Section 11 of this CAAP for detailed guidance about setting limitations for Tier 2 operators.

6.5 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.

7. Operator obligations – Responsibilities of personnel

7.1 The operator needs to document the responsibilities of personnel so that staff are aware of their responsibilities and accountabilities with regards to their obligations under CAO 48.1.

7.2 Staff in managerial roles and other non-operational staff, whose work may have an impact on the management of fatigue and fatigue-related processes, should be educated and aware of their contributions to fatigue management in operations. Management should be aware that their responses to fatigue occurrence reporting will, to a large extent, impact the motivation of individuals to report fatigue and the subsequent effectiveness of the hazard identification processes.

7.3 Managers also need to be aware that their decisions can affect operational fatigue management and fatigue risk management. For example, decisions regarding:

- roster design
- hotel selection
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7.4 Additionally, rostering personnel have a significant influence on the management of duty periods, FDPs and ODPs, and hence crew alertness.

8. Operator obligations – Record keeping

8.1 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).

8.2 These records and reports must be retained for ten 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).

8.3 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. 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.

8.4 Unless the operation is being conducted under Appendix 5, these reports must be provided to CASA; and 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.

Note: Extensions that occur in operations under Appendix 5 to CAO 48.1 still require a report to be raised and used for hazard identification and fatigue management; however, there is no requirement to provide these reports to CASA.

8.5 Extensions due to unforeseen operational circumstances

8.5.1 For operations (in all but Appendix 5 to CAO 48.1), extensions to rostered duties may only be made in unforeseen operational circumstances, and should not be made on a regular basis. (Refer to definitions) “Unforeseen operational circumstances” refers to occurrences that are statistically unlikely, or in other words, exceptional.

8.5.2 The intention behind the use of the term ‘unforeseen circumstances’ is to prevent operators to continually use flight and duty times to their maximum limits and regularly rely 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.

8.6 For circumstances to be statistically unlikely (exceptional), they should only occur in less than five percent in any sample of similar FDPs or similar operations. For example; if an airport turn-around time is programmed for 45 minutes and yet it takes 1 hour and 15 minutes in one third of cases, relying on a 45 minute turnaround when a FCM’s FDP is close to the maximum without the 30 minutes extra can be foreseen to be required as not appropriate.

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2 An example of a Fatigue Occurrence Report is included at Appendix E to this CAAP.
8.6.1 Where an operator is encroaching on the five percent restriction, the operator should consider revising its rostering practices by creating ‘soft’ flight and duty time limits. This will avoid the necessity to exceed the ‘hard’ limits prescribed in the operator’s operations manual.

8.6.2 For a Tier 2 operator to meet their obligations, the reports on extensions should be fed into their hazard identification and continuous monitoring processes.3

9. **Operator obligations – Determination of home base**

9.1.1 An operator engaged in public transport services is required to determine and notify each of its FCMs of their ‘home base’. (Refer to definitions)

9.1.2 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).

9.1.3 Operators must ensure that changes in home base will not adversely affect aviation safety; therefore, careful consideration of what an FCM may need to do as a result of a change in home base and subsequent recovery is necessary.

9.1.4 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.

10. **Operator obligations – Publishing of rosters**

10.1 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.

10.2 It is important that AOC holders 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.

10.3 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 are managed.

10.4 **Delayed reporting time**

10.4.1 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.

10.4.2 Depending on the length of the delay, there can be unintended negative consequences unless clear procedures are in place to mitigate this fatigue risk. While designing these provisions, the principle that was followed was that delays to FDP reporting time should be allowed and the consequences managed in conjunction with operators taking a responsible approach to managing the risk of fatigue.

10.4.3 The delayed reporting time provisions divide the possible delays into three main brackets:

- less than four hours

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3 Guidance on this is contained in section 11 of this CAAP.
four hours or more, but less than 10 hours
10 hours or more.

10.4.4 For delays less than four 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 is still based on the original reporting time, which likely determined the FCM’s sleep pattern and chosen waking time. It is not permitted for the maximum FDP limit to be increased as a result of the delay—if the delayed reporting time would otherwise allow a higher maximum FDP. 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 likely will remain awake during the time of the delay.

10.4.5 In contrast, if the delayed reporting time results in a lower maximum FDP, then this does become the limiting FDP; as this means the delay has resulted in a start time for which the maximum FDP is beginning to encroach on the WOCL.

10.4.6 For delays of between four and ten hours, the determination of the maximum FDP is managed in the same way as for delays less than four hours; however, in addition, the maximum FDP limit is then reduced by the amount of time that the resulting delayed reporting time exceeds four hours after the original reporting time. This reduction reflects the expectation that the FCM will not be able to return to sleep. The assumption is that the FCM has already completed eight hours of sleep in the previous ODP; and by delaying the reporting time there will be a commensurate increase in the expected period of wakefulness by the end of the delayed FDP.

10.4.7 A four-hour extension is considered a manageable risk, while longer periods are considered to result in too great a likelihood of increased fatigue risk; therefore, the maximum FDP is reduced in a linear manner by the period the delay exceeds four hours.

10.4.8 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.

10.4.9 For an operator to implement delays of less than 10 hours, operations manual procedures that address the requirements are necessary. These required procedures must be familiar to FCMs and be capable of providing a consistent application of delayed reporting time 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, paying particular attention to protecting and not interrupting FCMs’ sleep opportunities.

11. Operator obligations – Additional obligations relating to FCMs under Appendix 2 to 6 of CAO 48.1 (Tier 2 operators)

11.1 Under CAO 48.1, 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
- training for FCMs.

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4 An example of how continuous monitoring procedures can be used in practice to satisfy the obligations is contained in Appendix F to this CAAP.
11.2 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.

11.3 Hazard identification (including use of biomathematical models)

11.3.1 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.

11.3.2 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).

11.3.3 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.

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

11.3.5 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.).

11.3.6 Over time, the database of reported hazards enables the organisation to:
- identify ‘hot spots’ of fatigue risk that need particular attention
- conduct trend analysis which can provide the basis for improvement of hazard identification.

11.3.7 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 AOC holder’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.

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

11.3.9 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.

11.3.10 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.

11.3.11 While not a necessary component, biomathematical models of fatigue can incorporates 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 which must be considered. Some limitations include:
- predicting risk probabilities for a population average rather than instantaneous 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.

11.3.12 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 takes 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.

11.3.13 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 comprehensive, multi-layered systems, in which biomathematical models provide an optional supportive role.

11.4 Setting limitations taking into account hazards

11.4.1 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; and the operator needs to continually revisit, update and modify flight time and duty limits to ensure the relevancy to operations at the current time.

11.4.2 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.
11.4.3 Risk assessments will be expected to demonstrate to CASA, during surveillance activities, that changes are properly considered.

11.4.4 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.\(^5\) Reports of these extensions must be made and provided to CASA.\(^5\)

11.4.5 Operators should take into account 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 and needs to be taken into account.

11.4.6 Training might be:
- classroom-based
- on-line
- during flight operations
- at a training facility
- or
- in a simulator environment.

11.5 All types of training could potentially affect the alertness of individuals and their subsequent operational performance. From a workload perspective, it is also possible that monitoring or training another individual could be more fatiguing than regular operations.

11.5.1 While training flights in a simulator are considered duty, a duty period that does not include a flight is not a FDP and not subject to FDP limits. Any period of duty prior to a flight, that is not separated from that flight by a prior sleep opportunity must be included in the FDP. The duty period required for a simulator training session before a flight must be included in the FDP limits but not one that follows a flight or series of flights.

11.6 Continuous improvement of policies and practices

11.6.1 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.

11.6.2 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).

11.6.3 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.

\(^5\) Operations and extensions under Appendix 5 to CAO 48.1 exempt from this requirement.
11.6.4 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.

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

11.6.6 An operator’s policies and practices should be reassessed for adequacy when there are adjustment of flight and duty time limitations.

11.7 Transition between appendices

11.7.1 Depending on the operational characteristics, operators may need to transition between different appendices to CAO 48.1. Transitioning between different appendices may produce inconsistencies in duty/flight/standby/off-duty requirements; therefore, procedures are required to ensure compliance when making these transitions. There must 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 limits.

11.7.2 To ensure compliance, particular consideration must be given by operators transitioning from Appendix 5 to CAO 48.1 (aerial work operations, other than flying training) to the other appendices. This is because concepts, such as standby, are dealt with differently in Appendix 5 (to provide more flexible standby arrangements) and, as such, may conflict with the requirements and limits in other appendices.\(^6\)

11.8 Training

11.8.1 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.

11.8.2 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 which could be included in these subject areas:

- Fatigue:
  - types of fatigue
  - contributors to fatigue
  - consequences of fatigue on safety
  - fatigue in accidents
  - high risk situations.
- Sleep:
  - sleep physiology

\(^6\) Further guidance about operating under multiple appendices is contained in Appendix B to this CAAP.
circadian body clock
- the sleep process
- amount of sleep required
- sleep debt and recovery
- quality of sleep
- sleep disorders and individual differences
- shift work
- jet lag.

- Countermeasures:
  - managing sleep habits
  - tailoring the sleep environment
  - napping
  - exercise
  - nutrition and hydration
  - caffeine
  - avoidance of alcohol before bed
  - use of sleep aids
  - avoidance of nicotine
  - keeping a sleep log.

11.8.3 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.

11.8.4 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.

11.8.5 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).

11.8.6 Fatigue training must be assessed with the level of training determining the level of assessment required.

11.8.7 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.

11.8.8 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.

11.8.9 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.

11.8.10 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).
11.8.11 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 which includes material which may be useful in developing and facilitating a fatigue management training course. (Refer to section 1 – The relevant regulations and other references – for CAAPs)

11.9 Aerial work operations under Appendix 5

11.9.1 The nature of Australian aerial work operations creates a unique set of circumstances for fatigue management. The types of activities vary widely within and between operators, across seasons and different regions, and are affected by operational requests. Operations which are ad hoc on a daily basis include:

- emergency medical services (EMS)
- fire-fighting
- flood relief.

11.10 Additionally, operators may also need to change planned operations suddenly due to environmental changes (e.g. planned aerial application operations need adjustment when weather conditions do not suit).

11.10.1 Compounding this level of complexity is the need for:

- various aerial work operations to have maximum availability through flexible standby arrangements
- the ability to cope with high-tempo short-term operations involving isolated long days or sustained, lengthy FDPs over successive days
- high aggregate cumulative yearly flight time totals.

11.10.2 To risk manage these complexities and variable conditions, the Tier 2 provisions of CAO 48.1 have a foundation of risk management responsibilities within prescriptive limits. These prescriptive limits are not considered to be excessive under ideal circumstances. They need to be further moderated by operators and individuals according to their unique circumstances.

11.10.3 To accommodate requirements unique to aerial work, CASA has made certain provisions unique to aerial work operations. These are considered appropriately flexible, whilst maintaining a satisfactory level of safety if appropriate hazard identification and risk management processes are followed. While these provisions were necessary to accommodate the nature of operations under Appendix 5, they are likely to introduce some complexity when operators and FCMs transition between Appendix 5 and other appendices. Operators are required to detail appropriate procedures to manage this transition safely and remain compliant at all times.

12. Individual obligations – Fitness for duty – individual cognitive and physical fitness

12.1 Individual alertness measurement

12.1.1 Determining fitness for duty has always been a complex and challenging task, both for operators and individuals who should provide training to employees in understanding how to meet their responsibilities, and for the individuals themselves.

12.1.2 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

12.2 Using a range of measures of varying types (i.e. both objective and subjective data) to determine an overall alertness ‘picture’ will assist the individual in making informed and accurate decisions about their fatigue and therefore whether they are operationally fit for work.

12.2.1 It is also important to recognise that individuals 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 individuals making an assessment about their fitness for duty may misread test scores or administer measurement tools incorrectly.

12.2.2 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 individual will also be less likely to determine effective ways of managing their fatigue, will be less able to address alertness issues in general and will be less able to identify potential risks and hazards. 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.

12.2.3 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.¹

12.2.4 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 individual 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 has been developed to support them when making decisions of fitness for flight.

12.2.5 It is important for operators and employees to understand that the tool in Appendix G to this CAAP is not meant to provide a ‘go or no-go’ outcome. There will also be situations when

¹ Appendix G to this CAAP provides an example of a useful method for an individual to consider factors affecting their fitness for duty.
individuals need to commence operations and manage their fatigue risk through the use of other countermeasures (i.e. task rotation or napping).

12.2.6 It is important to understand that this tool is only one example of a decision-making aid when determining fitness for duty. Operators or individuals 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.

12.3 Fatigue occurrence reporting

12.3.1 Operators’ hazard identification obligations are reliant on individuals 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. Broadly speaking, there are four instances when fatigue reporting is essential for effective hazard identification:

- Through the voluntary 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:
  - adding an extra crew member
  - reducing the workload of the duty
  - delaying the reporting time
  - creating the opportunity for a nap
  - increasing supervision/monitoring.
- Through the voluntary 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 voluntary reporting system, when the individual 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.

12.4 Health and well-being

12.4.1 The individual 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).\(^9\)

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\(^8\) An example fatigue occurrence report is provided at Appendix E to this CAAP.

\(^9\) 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.
12.4.2 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). Clearly 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. Individuals 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.

12.5 Workload

12.5.1 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 human operator and the capabilities of the operator to meet those demands.

12.5.2 Workload management for the individual requires consideration of:

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

12.6 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 individual 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.

12.6.1 Typical techniques for managing workload while on duty include:

- task shedding
- prioritisation of tasks
- task delegation
- task rotation
- personnel rotation.

12.7 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).

12.7.1 Workload is also an increasingly important factor for biomathematical models of performance prediction. Although the amount that this factor (the variance) might explain in alertness (in addition to variables such as shift length, timing or pattern) requires ongoing 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.

12.7.2 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.

12.8 Fatigue mitigating strategies

12.8.1 An individual 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.

12.8.2 One of the most effective fatigue countermeasures is napping; however, it is important to remember that napping is not a cure for 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.

12.8.3 Exercise is also a beneficial fatigue mitigator, as it improves energy and stamina, improves mood, relieves stress and results in longer and more restful sleep.

12.8.4 Adequate nutrition and hydration is also important for managing and preventing fatigue. Ideally, one 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).

12.9 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 five hours; however, it is important to consider that there are individual differences in terms of the effects of caffeine, tolerance and withdrawal can develop and use should be avoided before bedtime. Caffeine should be used only when it is timely and effective for the individual.

12.10 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.

12.10.1 An ideal way for individuals 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).

12.11 Sleep

12.11.1 An FCM should utilise ODPs to ensure fitness for the FCM’s 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 individual would need to report this to the operator before any duty periods commence.

12.11.2 It is likely that to meet their obligations, an individual 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.

12.11.3 The sleep environment should allow for an adequate sleep period with defined blocks of time during which FCMs are not interrupted. The physical 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 which is cool, dark and quiet and that provides relief from postural constraints of the work (e.g. prolonged periods strapped to a flight seat), noise and other environmental factors.

12.11.4 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.

12.11.5 It is also suggested that individuals consider their personal ergonomic and environmental needs/requirements when determining suitable sleeping accommodation/conditions at home.

12.12 Time zones and acclimatisation

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

12.12.2 The individual has an obligation to then apply this to their situation when deciding their fitness for duty. Individuals should be cognisant of their personal time zone adaptation requirements. These may differ from what CAO 48.1 specifies. Where an individual 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.

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12.13 Augmented crew

12.13.1 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 individuals. 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.

12.13.2 There are various studies which look at the effects of sleep inertia on performance, particularly when awakening from deep sleep. Operators and individuals should be aware of and manage the effect of sleep inertia in flight operations.

13. Individual obligations – Disclosure to an operator

13.1 Living arrangements – distance from base

13.1.1 Individuals 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.

13.1.2 As individual’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).

13.1.3 Individuals 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 may be where the departure base is continually noisy or overly lit during sleep/rest periods or night time and the FCM is able to obtain better quality sleep by living further away from the base. Individuals 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.

13.2 External employment and other tasks

13.2.1 Individuals 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
13.2.2 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.

13.3 Private flying

13.3.1 An individual, 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.

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

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

13.3.4 These operations are seen as more difficult to cancel or reschedule and, therefore 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.

13.4 Open and fair reporting culture

13.4.1 In accordance with maintaining an open and fair reporting culture, individuals 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. Individuals 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.

Executive Manager
Standards Division

October 14
Development sequence

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

The major development tasks, in the suggested order, are:

- a. Determine allowable appendices – confirm what operations are authorised to be conducted and therefore the applicable appendices.

- b. Determine limits (CAAP Appendix C) – determine limits which 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 (CAAP Appendix C) – 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 (CAAP Appendix B) – 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 subsection 13 and subparagraph 15.2 (d) of CAO 48.1.

- e. Develop procedures to meet requirements for fatigue risk management (CAAP Section 11) – If operations under one or more of Appendices 2-6 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 (CAAP Section 11.7) – If operations under one or more of Appendices 2-6 are to be undertaken, as required by paragraph 15.3 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 (CAAP Section 5-10) – 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.
APPENDIX B

Operations under multiple appendices

Two sections within CAO 48.1 need to be considered when assessing whether procedures for transitioning between appendices are adequate:

- subsection 13
- subparagraph 15.2 (d) (ii).

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.

The requirements for combining multiple appendices within a single FDP are addressed within subsection 13 of CAO 48.1 and operators must have procedures, which comply with these requirements (see below for considerations).

Switching from one appendix to another on consecutive FDPs could potentially be quite restrictive in some circumstances. Subsection 10 (for public transport) and subsection 11 (for aerial work) 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.

Operating under two or more appendices in a single FDP

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 that an operator and an FCM must comply with is the FDP limit contained in the appendix under which the operation is being conducted, at that particular time. This must be calculated based on the assumption that the entire FDP was conducted under that appendix. The FDP must be based on the time the original FDP started, and not on the start time of operations under each appendix
- 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. This is calculated by assuming the entire FDP was conducted under each appendix. For example, the procedure should require that:
  - the operator works out the minimum ODPs required (if the entire FDP was conducted under each appendix)
  - 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.
Managing fatigue risk when switching from one appendix to another on consecutive FDPs

An operator must clearly identify the hazards associated with their FCMs transitioning between appendices, and manage the risk associated with these transitions 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.

Transitions from Appendix 5 (aerial work other than flying training) to other appendices are likely to provide the greatest challenges in terms of meeting the different requirements across appendices. Appendix 5 assumes that no fee-paying passengers are present and that all on-board the aircraft are substantially aware of the risks associated with the operation and are therefore capable of making an informed choice as to whether to continue in the operation or not.

Some appendix limits (i.e. requiring 24 off-duty days in any consecutive 84 day period) assume the FCM is engaged in ongoing operations under that appendix and act alongside the requirement for seven off-duty days in every 28 consecutive days, to require an even distribution of off-duty days across each 84 day period. In contrast, Appendix 5 allows operations such as extended periods of 24 hour standby, that may result in the requirement for an extended number of consecutive off-duty days to be completed before the requirement for 24 off-duty days in any 84 consecutive day period can be met and an FCM can transition from Appendix 5 to another appendix. Requiring an extended number of consecutive days off duty, (greater than seven) was not the intent of this requirement.

Therefore, if an operator wanted to transition an FCM from Appendix 5 operations to conducting flying training under Appendix 6 or charter work under Appendix 4 an acceptable procedure might be for the FCM to meet all the requirements of that other appendix other than the requirement for 24 off-duty days in 84 consecutive days. An example of an acceptable approach might be for the operator to have the following procedures in their operations manual:

- Prior to transitioning from Appendix 5 to another appendix, the FCM must be rostered for the number of consecutive days off-duty required to meet the longer term off-duty day requirements of the appendix they are transitioning into (i.e. subclause 8.5 in Appendix 4 requires seven days off-duty in 28 consecutive days; and 24 days off-duty in 84 consecutive days before an FDP or standby period can commence) or seven consecutive days off-duty, whichever is the higher number of days.
- If, after being rostered for seven consecutive off-duty days, the FCM still does not meet the longer term off-duty day requirements (e.g. subclause 8.5 in Appendix 4). The FCM may commence operations under the appendix; however, they must be rostered for two consecutive days off-duty in every seven consecutive day period until they do meet the requirements of the longer term off-duty day requirements.

Note: In this example seven days has been used; however, a higher number of days might be appropriate depending on the specific circumstances. Scientific evidence indicates that recovery from a sustained period of restricted sleep can take up to seven days (and in some cases even more).

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10 This requirement is then met by means of a documented transition procedure that meets the requirements of subparagraph 15.2 (d) (ii) of CAO 48.1, and is assessed as not impacting aviation safety.
A sustained period of sleep restriction can result in the FCM stabilising their alertness level at a lower than normal level. Returning to normal levels of alertness can take as many as seven consecutive nights, where the FCM achieves their normal sleep requirement.

Seven days is therefore an acceptable minimum period in order to manage the risk of unsafe levels of cumulative fatigue accrued during the Appendix 5 operations, prior to operating to another appendix. If the FCM does not meet the requirement to have 24 off-duty days in 84 consecutive days, they could instead have a continuous period of seven days off-duty and then commence operations under the new appendix.

If there is any question regarding the suitability of this minimum period when employed in the operator’s context, then they should monitor the fatigue levels of FCMs and increase this minimum period if required. An example of a way an operator could do 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).
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 are general ‘Points to note’ and then, when required, there are specific ‘Points to note’ listed for each appendix of CAO 48.1. The format is as follows:

Section heading (For example: C1. Sleep opportunity before an FDP or Standby)

Introduction

Points to note:
- General (only used when there are ‘Points to note’ that apply across all appendices)
- Appendix 1 (used when ‘Points to note’ apply specifically to one appendix)
- Appendix 2, 3, 4 and 6 (appendices are combined when the ‘Points to note’ apply across more than one appendix)
- Appendix 5 (Appendix 5 is often specifically dealt with by its own ‘Points to note’ as it is structured differently and approaches similar fatigue risks in a different manner).
C1. Sleep opportunity before an FDP or standby

C1.1 Introduction
An FCM is required to have access to suitable sleeping accommodation during an ODP, prior to their assigned FDP, to effectively action their obligation to use the sleep opportunity to adequately prepare for the upcoming FDP. They must have access to suitable sleeping accommodation without, under normal circumstances, being interrupted by any requirement of the operator for a period of eight consecutive hours (at least) in a set period immediately before the start of the FDP.

The set period may vary depending on the appendix and whether the FCM is at home base or away from home base.

There should be mutual understanding between the FCM and the operator as to where the eight consecutive hours sleep opportunity sits within the period preceding the FDP.

Example:
If the commute time at a particular away base location is 30 minutes, then the operator must ensure the ODP allows for:
- commute to and from the suitable sleeping accommodation
- a period sufficient for meeting the reasonable requirements of bodily functioning (i.e. eating, drinking, toileting, washing and dressing, as well as the required minimum sleep opportunity).

In this case, the sleep opportunity could start nine hours before the start time of the FDP and end one hour before the start time of the FDP.

Similarly, at home base there should be a mutual understanding between the operator and the FCM as to when contact occurs.

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.

C1.2 Points to note

General
Where there is the requirement for prior sleep opportunity, the operations manual should have:
- the operator’s policy for managing the prior sleep opportunity requirement that identifies when the sleep opportunity will sit with reference the start time of the FDP for home base and for away base locations
- procedures directing the operator’s employees not to interrupt the FCM’s eight consecutive hours sleep opportunity when making contact with FCMs prior to the start time of an FDP that has not been delayed.
- for operations that have had one or more delays to an FDP start time, that are each less than 10 hours, the procedures need only relate to protection of the sleep opportunity prior to the originally assigned FDP start time.
- for operations that have had a single delay to the FDP start time, that is 10 hours or more, procedures that need only apply to the sleep opportunity prior to the start of the delayed FDP and no longer require protection of a sleep opportunity prior to the originally assigned 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.

Note: 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.

• procedures detailing a requirement to roster sufficiently in advance (also required under subsection 14.11 of CAO 48.1) to allow FCMs to plan adequate rest before their next assigned FDP.

Note: Operators should be aware that their FCMs may require some degree of certainty in organising their work/life balance, and more importantly from a fatigue management point-of-view, organising their sleep. 11

• procedures should ensure each FCM is aware that they have a responsibility to make appropriate use of the eight consecutive hours 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 upon induction to 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 detail that:

• an FCM must have eight consecutive hours of sleep opportunity at home base within the 12 hours immediately preceding the start of an FDP

• an FCM must have eight consecutive hours of sleep opportunity if away from home base, within 10 hours immediately preceding the start of an FDP.

This requirement only relates to FDPs as there is no provision for standby and no considerations on the impact of delayed reporting in Appendix 1.

### Appendices 2, 3 and 4

The requirement for sleep opportunity in Appendices 2, 3 and 4 are the same as those for Appendix 1, with the following differences. Sleep opportunity in Appendices 2, 3 and 4:

• is also required prior to standby periods

• incorporates the requirements that the sleep opportunity always relates 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.

11 While the nature of some types of operation make planning with any degree of certainty challenging, the operator should have procedures that have the capacity to publish the roster sufficiently in advance of flights covered by the roster, with a consistent lead time, and this period is communicated to all FCMs. While late changes to rosters are understandable, it is important that operators are aware that these changes should be kept to a minimum.
Appendix 5

Appendix 5 deals with the requirement for a sleep opportunity prior to an FDP in a different manner than the other appendices. This appendix stipulates that:

- if the operator requires the FCM to perform non-flying duties in the eight 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.
- 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.

Operator must not schedule FDPs so that have so little time available prior to the flight that meeting the flight commencement time is only achievable if the FCM accomplishes 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.

Appendix 6

In Appendix 6 the requirement for prior sleep opportunity is the same as that for Appendix 1, although it always relates to the 12 hours immediately preceding the FDP or standby—whether at home base or away.

Like Appendix 1, there is no consideration of delayed reporting in Appendix 6, as there is no provision for delayed reporting.
C2. FDP and flight time limits

C2.1. Introduction
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.

Procedures for complex operations must also factor in limitations such as:
- those applicable to acclimatised crews
- FCMs that are in a state of unknown acclimatisation
- FCMs that are acclimatised to a location other than the location where the FDP started.

C.2.2. Points to note

General
Rostering procedures must ensure the FCM is assigned FDPs, standby periods and ODPs that do not require the FCM to breach a limit in the operations manual and each limit in the operations manual must not exceed the limits in the applicable appendix.

Documented 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 serving (replenish oils etc.)
- post flight duties (i.e. flight and duty time data entry, aircraft cleaning, compressor washing, and other pilot maintenance)
- transit time from sign-on locations to the aircraft. (Consequently sign –on times could be base specific).

The documented limits should be communicated to staff.

Appendix 1
For Appendix 1, regardless of the length of the FDP it must be contained within the period 0700 to 2200 local time (local time at the location where the FDP is to start).

This requirement can be met by rostering guidelines that require any FDP be entirely contained between 0700 and 2200 local time. These guidelines should be in a form that is clear and readily available to the operator’s employees involved in rostering activities, as well as affected FCMs.

Operators should keep in mind the requirements of Part 3, Paragraph 14.3(b) of CAO 48.1:
- For an operator conducting operations under Appendix 1, no FDP or flight time limit should normally exceed:
  - nine hours in any one day (FDP limit)
  - seven hours in any one day (flight time limit).
- The operator must consider whether a hazard identification and risk management process is required.
While Appendix 1 FDP and flight time limits are relatively restrictive and do not specifically require dedicated hazard identification and risk management processes, these processes may be required by other regulations (if those regulations require an SMS). Depending on the nature of the activities, it may still be appropriate to tailor limits for individual FCMs and potentially for particular tasks.

Examples where this would be appropriate would be limiting FDPs for some activities (i.e. intensive flying training or hot weather operations) and this would be the case when considering new or inexperienced FCMs.

Time zone changes may also be a relevant consideration.

**Appendix 2**

Complex multi-pilot public transport services are typically subject to crossing time zones, and therefore circadian disruption for FCMs. ‘Acclimatisation’ is a complex issue and CAO 48.1 attempts to address the issue by ensuring the impact on alertness of not having the FCM’s body clock or circadian rhythm aligned with the local time at a location is considered in the limits. CAO 48.1 defines an FCM as being in the state of acclimatisation at the start of an FDP or an ODP at a particular location, when:

- the location differs by less than 2 hours from the location where the FCM was last acclimatised
- the FCM has remained in an acclimatised state since they were last acclimatised.

CAO 48.1 also goes on to define when an FCM is considered to be in an unknown state of acclimatisation and the method to become reacclimatised.

In addition to these definitions, it is important that operators understand how time zone adaptation can be individualised. The responsibility for managing the effects of time zone changes and acclimatisation is shared between the operator and the individual. The operator should provide adequate fatigue training, as well as tools for staff to use when assessing their own alertness. The individual has an obligation to then apply this 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.

For complex multi-pilot public transport operations, the operations manual must:

- include a procedure for rostering staff for FDPs that is capable of differentiating between FCMs in an acclimatised state and those in an unknown state of acclimatisation (according to the definitions in subsection 7 of CAO 48.1). The documented procedure should result in determinations of acclimatised and unknown state of acclimatisation that either agree with those of subsection 7 or result in more conservative determinations than subsection 7.

Conservative in this context would mean either or both of:

- being classed as in an unknown state of acclimatisation earlier than if the requirements of subsection 7 were used
- requiring a longer adaptation period than that required by subsection 7.

- include 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:
The operations manual must have procedures for assigning FDPs to FCMs that do not exceed the operations manual limits for acclimatised FCMs when the FCM is acclimatised and the unknown state of acclimatised limits for FCMs that are in an unknown state of acclimatisation. In developing their procedures, operators should keep in mind the following points:

- when the FCM is acclimatised, the procedures must ensure the maximum FDP limit is based on number of sectors and the acclimatised time which is the local time at the location where an FCM is acclimatised (therefore this may not be the local time at the location where the FDP is being commenced)
- there must be procedures for identifying when an FCM has transitioned from an unknown state of acclimatisation to being acclimatised, following a minimum period of adaptation.
- the limits in the operations manual must not exceed the limits in Appendix 2 for acclimatised FCMs (Table 2.1 in CAO 48.1) and FCMs in an unknown state of acclimatisation (Table 3.1 in CAO 48.1)
- for operations under Appendices 1, 3, 4, 5 or 6 that require the FCMs to cross time zones in a single duty period (acting as an operating crew member or positioning) the effect on alertness of circadian disruption as well as the effect of the reduced quality of sleep in ODPs on alertness in subsequent FDPs need to be identified as potential fatigue hazards and managed accordingly
- while it is not necessary to adopt the same approach to reducing the maximum FDP and flying time limits for those in an unknown state of acclimatisation as in subsection 7 and Appendix 2, operators who require FCMs to cross two or more time zones in a single duty period must manage any identified increase in fatigue risk due to circadian disruption in an acceptable manner
- risk management should reflect the extent to which operators require FCMs to cross time zones and the number of time zones crossed in any one duty period:
  - for instance, risk management may be as simple as increasing minimum ODPs by a fixed amount equal with the number of time zones crossed in the preceding duty periods for operations that only cross three or less time zones in any one duty period ODP.
An example of a simple and yet potentially effective method is when an operator that requires FCMs to fly to a distant international city to perform simulator training has procedures that require the rostering staff to provide a minimum of three days off-duty following return to home base, before commencing an FDP. This could be achieved coincident with any longer term off-duty requirements such as the requirement in Appendix 4 for 36 consecutive hours off duty (including two local nights) in any consecutive 168 hour period.
C3. Increase in FDP limits by split duty

C3.1. Introduction
If an operator wishes to take advantage of split-duty operations, there must be procedures in the operations manual to ensure that FCMs are aware of their entitlements to a predefined rest period. The operator also needs to show that the FCMs have access to suitable resting or suitable sleeping accommodation (as required by the roster) and are relieved of all work duties during this time. Verification of facilities for suitable resting and suitable sleeping accommodation may be required if the operator’s facilities have not been assessed by CASA before.

C3.2. Points to note

General
Split-duty operations are permitted in Appendices 2-6; however, there are some variations in the requirements across these appendices:

- the requirements for conducting split-duty operations under Appendix 2, 3, 4 and 6 are exactly the same with the exception of the allowable period of the FDP following the split-duty rest period is one hour longer for Appendix 2 and 3 (6 hours) than allowed under Appendix 4 and 6 (5 hours).
- the requirements for conducting split-duty operations under Appendix 5 differ significantly from those of all other appendices (refer to Appendix 5)
- the procedures should ensure FCMs are not disturbed during the split-duty rest period
- operators should have procedures to assess the suitability of the sleeping accommodation or suitable resting accommodation that is provided by the operator when the FCM is not at their own home. This assessment must meet the minimum standard set out in the definition section of the Order. Assessments should be ongoing to ensure continued achievement of the standard over subsequent uses of the accommodation.

Things for the operator to consider:
- the management of change to the suitable sleeping or resting accommodation managed
- 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.

Appendix 2, 3, 4 and 6
Operations manual procedures should:
- reflect the requirement for split-duty FDPs to be assigned to a FCM as part of the roster, and be 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
- clearly ensure that, where an FDP contains a split-duty rest period, the FCM has enough time allocated to travel to and from where the suitable sleeping or resting accommodation is located, in addition to access to the suitable sleeping or resting accommodation for four consecutive hours (at least)
• ensure that where there is access to suitable sleeping accommodation, the maximum FDP may be increased by up to four hours for Appendix 4 and 6, and by up to four hours for Appendix 2 and 3 provided the maximum FDP does not then exceed 16 hours.

• ensure that where there is access to suitable resting accommodation, the maximum FDP may be increased by up to two hours.

• ensure that if a split-duty rest period includes any period between the hours of 2300 to 0529 (local time) the split-duty rest period is for a consecutive period of at least seven hours, with access to suitable sleeping accommodation. In these circumstances the procedures must ensure:
  - the maximum FDP may be increased, if not already permitted, up to 16 hours for Appendix 2 and 3, and up to 15 hours for Appendix 4 and 6.
  - 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.

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

• ensure that any remaining portion of an FDP following a split-duty rest period will be no longer than six hours for Appendix 2 and 3 and no longer than five hours for Appendix 4 and 6.

For the purposes of CAO 48.1, the time spent in the split-duty rest period is always duty and is included as a part of the FDP. 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:

• specifically 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 two hours shorter than it actually was (50% of the first four hours of the split-duty rest period).

• specifically for the purposes of assessing whether an FCM is within the applicable cumulative duty limits, an FDP which contains a split-duty rest period at suitable sleeping accommodation can be taken to be two hours shorter in length than it actually was (50% of the first four hours of the split-duty rest period).

  *Note:* This allowance is not available when the split-duty rest period includes any period between the hours of 2300 to 0529 (local time). For Appendix 2 this requirement is based on 2300 to 0529 (acclimatised time), unless the FCM is in an unknown state of acclimatisation in which case local time is used.

**Appendix 5**

Ideally, procedures should reflect that split-duty rest periods be assigned to an FCM so far in advance of the FDP as to provide the FCM to whom it applies with a reasonable opportunity to plan adequate rest before their duty. For operations specifically under Appendix 5 the procedures may reflect the more relaxed requirement that allow 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.

Procedures must ensure that:
• a split-duty rest period (of at least three consecutive hours) at suitable **sleeping** accommodation permits the maximum FDP operations limit to be increased by the duration of the split-duty rest period

• a split-duty rest period (of at least four consecutive hours) at suitable **resting** accommodation permits a maximum FDP operations manual limit to be increased by a maximum of two hours

• the entire three consecutive hour minimum period of access to suitable sleeping accommodation or four hours at suitable resting accommodation is achieved prior to the end of the maximum FDP allowed for the start time of the FDP prior to an increase to the FDP limit being permitted

• any remaining portion of an FDP following a split-duty rest period will be no longer than six hours (unless an extension is permitted).
C4. Increase in FDP and flight time limits in an augmented crew operation

Note: Applicable to Appendix 2 only

C4.1. Introduction
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 public transport services. This is known as an augmented crew operation. Unless this is being conducted under an FRMS, increasing the maximum allowable FDP by adding extra FCMs is only permitted in operations under Appendix 2.

C4.2. Points to note
In order to prohibit partial crew changes, 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 that were part of the operating crew at the start 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 augmented crew commencing a new FDP.

Procedures for assigning FDPs to FCMs should ensure that when determining the maximum FDP the acclimatised time is used until such time as the FCM is in an unknown state of acclimatisation. In the case of an FCM in an unknown state of acclimatisation, the maximum FDP is based on whether the ODP immediately preceding the FDP is less than 30 hours, or 30 hours or more (see Tables 5.1 and 5.2 of Appendix 2 to CAO 48.1).

Clause 5 of Appendix 2 to CAO 48.1 stipulates the minimum time an FCM requires the in-flight crew rest facility to be 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, the augmented crew FDP limits in clause 5 of Appendix 2 to CAO 48.1 assumes 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.

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 pilot in command (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
- management of the possible effects of sleep inertia on performance when awakening from deep sleep

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- 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.

**Crew rest facility**

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.

The Class 2 crew rest facility is a horizontal or near horizontal seat. For guidance, it may acceptable to use a seat which is not entirely horizontal if the seat was designed to criteria aimed to enable a person to sleep in a horizontal or near horizontal position. CASA may need to undertake an assessment of this facility, which may require the assessor to:
- talk to crews
- be present on a proving flight
- make a physical check of the facility.

In addition, when determining the acceptability of in-flight rest facility specifications, the factors discussed in section 5.4.6 of the main body of this CAAP should be taken into account.

CASA may conduct a physical and/or in-flight assessment of the dynamic issues to be satisfied of the adequacy of in-flight rest facilities.
C5. Delayed reporting time

C5.1. Introduction
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.

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. Delayed reporting requirements are the requirements that 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.

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 two hours before the start time when the FCM is at home base
- up until one hour before start time when they are not at home base.

C5.2. Points to note

Appendix 1
Delayed reporting is not specifically prohibited in the provisions of Appendix 1 However, the requirement in paragraph 14.11 of CAO 48.1 applies, regarding rosters to be published sufficiently in advance of the FDP to provide the FCM a reasonable opportunity to plan rest before the start time.

In Appendix 1 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.

Appendix 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).

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).

If the operator delays an FDP without providing 10 or more hours’ notice before the original reporting time, and then cancels the flight, 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
- the time the FCM actually ceases any non-flying duty.

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.

**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 the Table 3 below:

- For delays of less than four 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 four 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 without modification.
- 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. When start times are delayed and the maximum FDP limit 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, bearing in mind 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.
Example:
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.

- Operators should have procedures which 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.

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:

<table>
<thead>
<tr>
<th>Delay</th>
<th>Determining maximum FDP for delayed FDP reporting time (use operations manual maximum FDP limit table)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single or multiple delay/s that total &lt; 4 hours</td>
<td>If new maximum FDP is higher than original maximum FDP limit, retain original max FDP limit. If new maximum FDP is lower than original maximum FDP limit, use the new, lower maximum FDP limit.</td>
</tr>
<tr>
<td>Single or multiple delay/s that total between 4 – 10 hours</td>
<td>Step 1: Check maximum FDP limit at 4 hour mark, if higher than original maximum FDP limit use original maximum FDP limit. Step 2: Reduce this maximum FDP limit by any time the new reporting time is later than the 4 hour mark. Step 1: Check maximum FDP limit at 4 hour mark if lower than original maximum FDP limit use maximum FDP limit at 4 hour mark. Step 2: Reduced this maximum FDP limit by any time the new reporting time is later than the 4 hour mark.</td>
</tr>
<tr>
<td>A single delay of 10 hours or longer</td>
<td>Use new maximum FDP limit for delayed reporting time. Use new maximum FDP limit for delayed reporting time.</td>
</tr>
</tbody>
</table>

**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 two hours and then make a further delay to the start time of three hours. For the purposes of determining the maximum FDP, this represents a total delay of five hours and must be dealt with as a five hour delay, rather than two delays of less than four hours (i.e. a two hour delay followed by a three hour delay).
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:
  - one hours’ notice before FDP if the FCM is away from home base
  - two 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 under their appendix.

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 5

There are no provisions in Appendix 5 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.

It is accepted that the nature of the activities conducted under this appendix 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 eight 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 two 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. It is advisable to have 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.

Appendix 6

There are no provisions in Appendix 6 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 of the FDP to provide the FCM 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 two 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 period (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. It is advisable to have 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.
C6. Reassignment and extension

C6.1. Introduction

Reassignment

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. While extension 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.

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

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 CAO 48.1 appendices are not designed with the expectation that there would be extensions.

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 for the CAO 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 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.

The following is guidance on what is considered unforeseen operational circumstances:

- Unforeseen operational circumstances are those circumstances that are statistically unlikely, or in other words, exceptional. This means that they should not be occurring on a regular basis or be reasonably predicted to occur based on past experience.
- The intention behind unforeseen circumstances 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. For operations under Appendix 1 it must be apparent from records of the operator’s previous operations that an extension could reasonable be considered unlikely.
- When extensions do occur, an operator is required to collect sufficient information from each extension occurrence to enable further study and fine tuning of the rostering process to better protect against extensions in the future.

The operator is required to submit the extension report to CASA within 14 days of the extension occurring for all operations that are not conducted under Appendix 5. It is acceptable for these reports to be sent as emails.

In both re-assignment and extension it triggers a requirement for the operator to check with the FCM that they are fit to achieve the modified FDP.
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. Rostering to planning, or ‘soft’ limits is a recommended practice to decrease the risk of requiring extensions to the operations manual or ‘hard’ limits.

C6.2. Points to note

Appendix 1

Reassignment
There are no specific limits on re-assignment of an FDP in Appendix 1 and 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 FDP 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.

There must also be a documented requirement whereby the extension does not occur unless the affected FCM has been consulted and has had an opportunity to consider and agree they are fit for the extension.

It is permitted for an extension to result in an FCM exceeding the limit in subclause 2.1 that requires all assigned FDPs be completed by 2200 (local time). This is because an extension is by definition not an assigned FDP.

Appendix 2, 3, 4 and 6

Reassignment
There are limitations on re-assignment in Appendix 2, 3, 4 and 6 and these limitations are substantially the same for each of these appendices. The only difference between these provisions, are for Appendix 2 and 3 there is the requirement to consider the reassigned FDP in terms of the new number of sectors when establishing whether the reassigned FDP is within the maximum FDP limits.

For each of these appendices there is the requirement that the operations manual procedures addressing re-assignment need to adequately reflect these provisions. Procedures should therefore, at a minimum:

- identify that, when reassigning an FDP, four 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.
• require that the FCM be consulted to ensure they consider themselves fit for the modified FDP.

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; however, 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. 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 must set out the decision to extend beyond the operations manual FDP and/or flight time limit must be at the discretion of the PIC. 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

There must also be a documented requirement whereby the extension does not occur unless the affected FCM has been consulted and has had an opportunity to consider and agree they are fit for the extension. This also necessitates consideration of whether the training provided is sufficient to ensure the FCM understands what they are doing when they evaluate their fatigue risk for the purposes of agreeing to an extension.

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.

The operator must also have a documented procedure for facilitating the writing and collection of extension reports. This requires sufficient information from each extension occurrence to enable further study and fine tuning of the rostering process to better protect against extensions in the future.
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 of CAO 48.1 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 limit relates 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
Due to the nature of some types of high pressure aerial work activities (i.e. aero-medical evacuation), there can be greater pressures for extensions in comparison to public transport operations. FCM fitness for duty could be at increased risk under these high-pressure circumstances and should be risk managed accordingly by the operator as per the ‘Additional AOC holder obligations’ requirements in CAO 48.1. In this appendix, the length of the required extension over the maximum FDP limit, determines the required increase to the minimum ODP.

Operations under Appendix 5 allow for a maximum extension of up to four hours. Each 30 minute period of extension (or part thereof) requires the subsequent minimum ODP to be increased by one hour.

As with all other appendices there must be acceptable procedures for the application and management of extensions in an operator’s operations manual.

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).

The procedures should clearly limit the use of extensions to those circumstances where:
- the FDP has already commenced
- the extension is necessary to complete the planned duty.

There must also be a documented requirement whereby the extension does not occur unless the affected FCM has been consulted and has had an opportunity to consider and agree they are fit for the extension. This may require consideration of whether the training provided is sufficient to ensure the FCM understands what they are doing when they evaluate their fatigue risk for the purposes of agreeing to an extension.

The operator must also have a documented procedure for facilitating the writing and collection of extension reports. This requires sufficient information from each extension occurrence to enable
further study and fine tuning of the rostering process to better protect against extensions in the future.

There will inevitably be an increased tendency for FDP extensions due to operational requirements for aerial work operators. In contrast to operations under the other appendices, there is no requirement to advise CASA about extensions.
C7. Standby limits

C7.1. Introduction

Standby may be undertaken at home or at another place where suitable sleeping accommodation conditions exist. 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. 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.

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.

It is important for operators to note that for different individuals 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 individuals 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.

C7.2. Points to note

General

Under all appendices, the procedures must include a means of making reliable assessments of suitable away from base sleeping accommodation that is proposed for use in a standby period. These assessments should be ongoing to ensure continued achievement of the minimum standard over subsequent uses of the accommodation.

Appendix 1

Although it is not specifically prohibited, there are no provisions in Appendix 1 that address standby. This was because it was considered that it should be used when supported by the risk management requirements that apply to Appendices 2-6. If an operator wishes to hold the FCM on standby for FDPs that occur between 0700 and 2200 (local time) 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.

Appendix 2, 3, 4 and 6

The procedures must include a means of ensuring that FCMs are not disturbed by company contact during the standby period.

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.

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 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.

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 eight hours of the subsequent commencement time of an FDP.

The procedures must ensure that FCMs are not disturbed during the standby period, except to call the FCM out for an FDP or duty.

**Notes:**

- Stress and fatigue can be accelerated if the FCM is required to undertake duties (e.g. office duties) while on standby.
- Standby cannot be used as a means of separating FDPs. Where an FDP takes place, followed by a break or rest period, if 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.
C8. **Positioning**

C8.1. **Introduction**

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.

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 FCMs positioning period into consideration.

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.

C8.2. **Points to note**

**Appendix 2, 3, 4 and 6**

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.

Positioning before flying duties is not specifically dealt with in the appendices; however, the nature of this type of positioning is defined in subparagraph 6.2 (c) of CAO 48.1. If an operator intends to position an FCM at the completion of an FDP, 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.

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.
C9. ODP limits

C9.1. Introduction
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.

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 required to acclimatise a FCM to the local time (an adaptation period).

C9.2. Points to note

General

Acute Fatigue
There are two types of ODP which are focused on addressing acute fatigue:
- those that simply follow an FDP and allow a minimum period of recovery
- those that not only follow an FDP, but also sit between or separate two FDPs, thereby preceding a subsequent FDP.

The difference in these two types is that the ODP that also precedes an FDP must contain, or overlap the ‘prior sleep opportunity’ for the following FDP (as required by clause 1 of Appendices 1, 2, 3, 4 and 6). This distinction is important as the FCM is not just traveling to suitable sleeping accommodation to recover from the previous FDP, but are also required to use that same ODP to adequately prepare for the following FDP and travel to the place where the next FDP is to start.

An operator must have procedures to ensure that the ODP will be sufficiently long enough to provide for:
- the required sleep opportunity (eight 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.

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 eight hours sleep opportunity is still provided, as well as time for the other necessary requirements (as mentioned above). 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.

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.

When selecting accommodation, an operator must also consider the potential for interruptions/disruptions and the available control over such aspects as discussed in section 5.2.1 of this CAAP.

Nine hour minimum ODP provision - applicable to Appendices 2, 3 and 4:
- If the nine-hour minimum ODP provision is to be employed, an operator must have procedures to ensure the requirements for reducing the minimum ODP away from home base from 10 hours to nine hours are met prior to assigning this reduced ODP.
- 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 nine 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.
- The procedures must reflect the FCM’s eight hour sleep opportunity requirement in the 10 hours prior to the FDP that starts after the reduced ODP.

Cumulative fatigue
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: Appendix 5 has a variation on this requirement.

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.

Trans-meridian related fatigue
For Appendix 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.

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.
Appendix 1

Acute and cumulative fatigue
Appendix 1 has a different approach to minimum ODPs that reflect the different way fatigue risk is managed in this appendix:

- An operator must have documented procedures that ensure the FCM has a minimum of 12 consecutive hour’s off-duty in any 24 hour period.
- The documented procedures must ensure that an FCM has a minimum of two days off-duty during any consecutive seven day period. (This is not a reference to a seven day period standing alone but instead, any consecutive seven day period).

Appendix 2

Acute fatigue
The minimum ODP requirement increases if the preceding FDP exceeds 12 hours, or if the FCM crosses in excess of two time zones travelling east, and three time zones travelling west. The minimum required ODP is as follows:

- The ODP must not be lower than 12 hours at home base (which must be designated for each FCM).
- The ODP must not be lower 10 hours when away from home base (other than when the specific requirements are met that allow assignment of an ODP of less than 10 hours—no less than 9 hours).

For this appendix, the minimum ODP increases when:

- the preceding FDP is longer than 12 hours (any period in excess of 12 hours requires 1.5 times that period be added to the minimum).
- the FCM crosses in excess of two time zones travelling east and three time zones travelling west (each time zone in excess of two east and three west, requires an additional hour be added to the minimum).

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.
- There must be procedures in the operations manual that state the manner in which the minimum ODP is increased for increases in the length of FDPs and crossing more than two time-zones east and three time-zones west.

These increases shall not result in a minimum ODP less than that required in the applicable appendix under which the FDP was completed.

There is an allowable reduction to the normal minimum ODP to nine hours in Appendix 2, if certain specific criteria, as listed in the subclause, are met (see nine hour minimum provision in General section above). It is paramount that an operator is aware that the requirement for prior sleep opportunity before a following FDP still remains. 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 eight hours sleep opportunity.

**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 consider the following:

- at the projected end of the assigned FDP or standby period, the FCM must have had at least 36 consecutive hours off-duty (including 2 local nights) in the previous 168 hours
- before commencing the FDP, the FCM must have had at least:
  - seven days off-duty in the 28 consecutive days before the standby or FDP commences
  - 24 days off-duty in the 84 consecutive days before the standby or FDP commences.

**Trans-meridian flight**

Once an FCM has spent time in a location where the local time differs from their home base (local time) their body clock will almost inevitably begin to align itself with the local time.

For Appendix 2 operations that cross two or more time zones, the operations manual requires procedures that address an FCM being in an unknown state of acclimatisation. This occurs when:

- the FCM commence an FDP or ODP in a location that differs in local time by two hours or more from the last location where they were acclimatised (where their body clock was aligned with local time)
- 36 hours have elapsed since the start of the FDP that originated at the location where they were last acclimatised.

Once an FCM is in an unknown state of acclimatisation they require an adaptation period to be considered acclimatised to a location. If an operator wishes to assign FCMs in an unknown state of acclimatisation, this is possible.

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 7.1 below
  - an adaptation period that is:
    - in a location other than home base
    - in accordance with Table 7.1
    - 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.
In applying Table 7.1 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):
    - choose the time zone displacement between the original location and whichever of the later locations gives the greatest time zone displacement
    - choose the time zone change in the Table that corresponds to the greatest time zone displacement
    - choose the direction (east or west) in which the FCM travelled and; therefore, the greatest time zone displacement occurred under subparagraph (b) of the Order
    - choose the number of hours east or west (as the case requires) that corresponds to the time zone change chosen under subparagraph (c) of the Order.

<table>
<thead>
<tr>
<th>Time zone change (measured in time zones)</th>
<th>Adaptation period to become acclimatised to new location (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: See definition of time zone</td>
<td>West</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>7</td>
<td>72</td>
</tr>
<tr>
<td>8</td>
<td>72</td>
</tr>
<tr>
<td>9</td>
<td>72</td>
</tr>
<tr>
<td>10 or more</td>
<td>96</td>
</tr>
</tbody>
</table>

**Note 1:** Adaptation period means a continuous ODP for an FCM to become acclimatised to a particular location.

**Note 2:** An adaptation period under paragraph 7.4 of CAO 48.1 may commence before the time when an FCM comes to be in an unknown state of acclimatisation.

**Note 3:** For guidance in determining acclimatisation, including examples of how an FCM becomes reacclimatised in accordance with paragraph 7.4 of CAO 48.1, AOC holders and FCMs should refer to Appendix D to this CAAP.

There is ongoing debate 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

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12 Table extracted from CAO 48.1.
exposure to zeitgebers (literally: time givers), and try to keep the FCM on a schedule that fits with their sleep habits at home base.

If a calculated minimum ODP exceeds 14 hours the operator can reduce this to 14 hours provided:

- the reduced ODP is not undertaken at the FCMs home base
- the FDP just completed was not extended
- the FCM commences the FDP following the reduced ODP in an acclimatised state
- the next ODP is a minimum of 36 consecutive hours that must include two local nights.

Appendix 3

Acute fatigue
The minimum ODP requirement of this appendix increases if the prior FDP exceeds 12 hours. The ODP must not be:

- lower than 12 hours at home base (which must be designated for each FCM)
- 10 hours when away from home base (other than when the specific requirements are met that allow assignment of an ODP of less than 10 hours—no less than 9 hours).

There should be procedures in the operations manual that state:

- the minimum ODPs that the operator will apply to their FCMs:
  - these periods must not be less than those required by CAO 48.1 instrument 2013, 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 manner in which the minimum ODP is increased for increases in the length of FDPs. These increases shall not result in a minimum ODP less than that required in the applicable appendix under which the FDP was completed.

For this appendix, the minimum ODPs increase when the previous FDP is longer than 12 hours. Any period in excess of 12 hours requires 1.5 times that period be added to the minimum ODP.

There is an allowable reduction to the potential minimum ODP to nine hours in Appendix 3, if certain specific criteria as listed in the subclause are met (see nine hour minimum provision in 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 consider the following:

- at the projected end of the assigned FDP or standby period, the FCM must have had at least 36 consecutive hours off-duty (including 2 local nights) in the previous 168 hours
- before commencing the FDP the FCM must have had at least:
  - seven days off-duty in the 28 consecutive days before the standby or FDP commences
  - 24 days off-duty in the 84 consecutive days before the standby or FDP commences.

Appendix 4

Acute fatigue
The minimum ODP requirement increases if the preceding FDP exceeds 12 hours, or if the FCM crosses in excess of two time zones travelling east and three time zones travelling west. The minimum required ODP is as follows:
- the ODP must not be lower than 12 hours at home base (which must be designated for each FCM)
- the ODP must not be lower 10 hours when away from home base (other than when the specific requirements are met that allow assignment of an ODP of less than 10 hours—no less than 9 hours).

For this appendix, the minimum ODP increases when:
- the preceding FDP is longer than 12 hours. Any period in excess of 12 hours requires 1.5 times that period be added to the minimum ODP
- the FCM crosses in excess of two time zones travelling east and three time zones travelling west (each time zone in excess of two east and three west, requires an additional hour be added to the minimum ODP).

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
- there must be procedures in the operations manual that state the manner in which the minimum ODP is increased for increases in the length of FDPs and crossing more than two time-zones east and three time-zones west.

Note: These increases shall not result in a minimum ODP less than that required in the applicable appendix under which the FDP was completed.

There is an allowable reduction to the normal minimum ODP to nine hours in Appendix 4, if certain specific criteria (as listed in the subclause) are met (see nine hour minimum provision in General section above). It is paramount that the operator is aware that the requirement for prior sleep opportunity before a following FDP still remains. 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 eight hours sleep opportunity.

**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 consider the following:
- at the projected end of the assigned FDP or standby period, the FCM must have had, at least 36, consecutive hours off-duty (including 2 local nights) in the previous 168 hours.
- before commencing the FDP, the FCM must have had at least:
  - seven days off-duty in the 28 consecutive days before the standby or FDP commences
  - 24 days off-duty in the 84 consecutive days before the standby or FDP commences.

**Appendix 5**

**Acute fatigue**
Appendix 5 has a set minimum ODP that is either a minimum of eight consecutive hours at suitable sleeping accommodation, if those eight hours includes the hours between 2300 and 0529; otherwise, a minimum period of 10 consecutive hours off-duty.
An operator’s operations manual must have a documented procedure for ensuring the minimum ODP is allocated:

- if an operator relies on the minimum ODP being eight consecutive hours at suitable sleeping accommodation (including the hours of 2300 and 0529), then the procedures must ensure the FCM will be afforded sufficient time to get to and from the suitable sleeping accommodation, and still get an eight hour period at suitable sleeping accommodation.

An operator must have procedures that will ensure any extension results in the required increase to the minimum ODP:

- as mentioned in the extension section for Appendix 5, each 30 minute extension to the maximum FDP time requires one hour be added to the minimum ODP (be it eight hours or 10 hours prior to the extension).

**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 consider the following:

- At any point during the FDP or standby period:
  - the FCM must have had at least 36 consecutive hours off-duty (including 2 local nights) in the previous 336 hours (14 days)
  - the FCM must have had at least 72 consecutive hours off-duty (including 3 local nights) in the previous 504 hours (21 days).

**Appendix 6**

**Acute fatigue**
For Appendix 6 the minimum ODP remains 12 hours, even when away from home base.

There should be procedures in the operations manual that state 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 minimum ODPs increases when the previous FDP is longer than 12 hours. To determine the minimum required ODP the operator must add 1.5 times any period in excess of 12 hours to the minimum ODP of 12 hours.

**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 consider the following:

- at the projected end of the assigned FDP or standby period, the FCM must have had, at least, 36 consecutive hours off-duty (including 2 local nights) in the previous 168 hours.
- before commencing the FDP, the FCM must have had at least:
  - seven days off-duty in the 28 consecutive days before the standby or FDP commences
  - 24 days off-duty in the 84 consecutive days before the standby or FDP commences.
C10. Limit on cumulative flight time

C10.1. Introduction
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.

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 when flying non-recreational flying over the period in question.

For this limit to be accurately applied an operator must be recording flight time in accordance with the definition of flying time in the Order which implies the same meaning as that in the Regulations.

Under subregulation 2(1) of the Civil Aviation Regulations (CAR) 1988, flight time 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.

All appendices (other than Appendix 5) 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.

Appendix 5 has a more complex approach with higher limits and a means of resetting the limits.

C10.2. Points to note

Appendix 1, 2, 3, 4, and 6

An operator’s operations manual must include:
- rostering procedures and guidelines that clearly require tracking and consideration of each FCMs cumulative flight hours over any consecutive 28 day and 365 day period for all FCMs operating under these appendices
- a means of monitoring the number of hours of flight time for each FCM ensuring any FCM does not exceed 100 hours in any consecutive 28 day period and 1000 hours in any consecutive 365 day period
- 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.

There may need to be procedures for FCMs who fly for another operator. If an FCM has flown for another operator in the previous 28 or 365 day period procedures will be required for taking these flying hours into account in assessing whether the FCM is within cumulative flight time limits.

There may need to be procedures for FCMs to include in their accumulated flying record any private flying in non-recreational activities.
Appendix 5

Appendix 5 has the following cumulative flight time limits:

- maximum of 50 hours in an 168 consecutive hour period (168 hours is the number of hours in a seven day period)
- maximum of 170 hours in any consecutive 28 day period
- maximum of 450 hours in any 90 day period
- maximum of 1200 hours in any 365 day period.

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

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

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. Operators and FCMs should be aware that, if these extended ODPs do not provide sufficient opportunity to recovery from cumulative fatigue, consideration should be given to not resetting the cumulative limit.

- 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).

C11. Limit on cumulative duty time

C11.1. Introduction

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.

All appendices (other than Appendix 1 and 5) have the following cumulative duty time limits:

- a maximum of 60 duty hours in any consecutive 168 hour period (168 is the number of hours in a seven day period)
- a maximum of 100 duty hours in any consecutive 336 hour period (336 is the number of hours in a 14 day period).

While Appendix 5 has no direct limit on cumulative duty, operators need a process for tracking Appendix 5 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 four 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.

C11.2. Points to note

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.

Appendix 2, 3, 4, and 6

An operator’s operations manual must include rostering procedures and guidelines that clearly require tracking and consideration of each FCMs cumulative duty time over any consecutive 168 hour and 336 hour period for all FCMs operating under these appendices. This may require:

- tracking duty hours that are accrued when employed by another operator
- a means of monitoring the number of duty hours for each FCM ensuring any FCM does not exceed 60 hours in any consecutive 168 hour period and 100 hours in any consecutive 336 hour period
- 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.

There may need to be procedures for FCMs who fly for another operator. Duty time that is accrued when employed by another operator needs to be considered.
C12. Limits on late night operations (LNOs)

C12.1. Introduction
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 period. 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.

In shift work, forward rotating system involves 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).

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.

In the appendices of CAO 48.1, once an FCM is assigned an LNO FDP, and if they are assigned a following LNO FDP, it must then be assigned so that it starts more than 24 hours after the start time for the previous LNO FDP. This prevents backwards rotation in the roster and reduces the likelihood of acute and cumulative fatigue.

C12.2. Points to note

General
LNOs are not possible under Appendix 1.

Appendices 2, 3, 4 and 6 all have the same limits on LNOs. Appendix 5 also limits late night duties; however, this appendix does not rely on the definition of late night duty, but instead limits the number to four FDPs that can be assigned or conducted (that includes any time between midnight and 0459).

An important difference between Appendix 5 and Appendices 2, 3, 4 and 6 is that Appendix 5 does not limit the total number of FDPs in the 168 consecutive hour period. Instead it specifically limits the total number of LNOs that are possible without limiting the total number of FDPs.

Appendix 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 4).

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>
<thead>
<tr>
<th>Completed number of FDPs in 168 hour period</th>
<th>Allowable FDP under LNOs Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of LNO FDPs</td>
<td>Total FDPs— including LNO FDPs</td>
</tr>
<tr>
<td>1</td>
<td>1 or more</td>
</tr>
<tr>
<td>2</td>
<td>2 or 3</td>
</tr>
<tr>
<td>2</td>
<td>4 or more</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: This table does not apply under Appendix 5; however, restrictions on operations at any time between midnight and on 0459 do apply.

There may be restrictions on whether a further FDP can be undertaken resulting from compliance with other subsections of CAO 48.1 Instrument 2013.

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 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 four 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

Individuals 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.

These scenarios are hypothetical. The ODPs are an 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.

Scenario 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).

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.

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, 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 FCM will remain in this state until an adaptation period is undertaken. This does not mean that the FCM cannot undertake duty; only that FDP and ODP limits will be based on the FCM being in an unknown state of acclimatisation.

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 4 hours east; therefore, according to Table 7.1 in CAO 48.1, 60 hours off-duty is required to become reacclimatised.

Scenario 2

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 commences. At the commencement of the ODP, less than 2 hours from the location where the FCM was last acclimatised (Bangkok), according to paragraph 7.1 of CAO 48.1, the FCM is considered to be acclimatised to Hong Kong. For the purposes of determining acclimatisation, Hong Kong now becomes the ‘original location’.

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. As the time difference is less than 2 hours from the location where the FCM was last acclimatised (Bangkok), according to paragraph 7.1 of CAO 48.1, the FCM is considered to be acclimatised to Hong Kong. For the purposes of determining acclimatisation, Hong Kong now becomes the ‘original location’.

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).

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.

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.

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 in 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.

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.

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 ODP in London). Therefore, according to Table 7.1, a 120 hour adaptation period is required to become reacclimatised in New York.

Scenario 3

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).

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.

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).

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 concession of 12 hours for each local night is available to reduce the required adaptation period specified in Table 7.1 in CAO 48.1.

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, 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 48 hours may be deducted from this adaptation period, meaning that in order to become acclimatised; an adaptation period of 60 hours is required.
# Example Fatigue Occurrence Report

If you wish the contents of this form to remain confidential please tick here [ ]

## NAME: ____________________________  ID NUMBER: ____________________________  DATE OF BIRTH: ____________________________  HOME BASE: ____________________________

___ THIS FORM IS BEING COMPLETED IN RELATION TO FATIGUE ASSOCIATED WITH: (TICK ONE) ___

- A lodged incident report
- An FDP extension
- A non-reported safety event
- 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?

- ______ HRS ______ MINS

## WHAT WERE YOU DOING AT THE TIME OF THE EVENT?

- At home
- Driving to work
- In flight
- Driving home
- Positioning
- Other: ____________

## IF RELEVANT, ON WHAT FLIGHT DID THE EVENT OCCUR?

- Flight No. ____________
- Route: ____________
- A/C type: ____________
- Event sector: ____________

## Fatigue Details (Complete PTO if required)

<table>
<thead>
<tr>
<th>TITLE</th>
<th>DESCRIPTION</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTION &amp; RESULTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUGGESTIONS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Contributory Factors

<table>
<thead>
<tr>
<th>Tick all factors that contributed to the event/your general concern</th>
<th>Commute</th>
<th>Sleep History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commute</td>
<td>Early start time</td>
<td>Duration of commute from home to home base;</td>
</tr>
<tr>
<td>Deep night</td>
<td>Late finish time</td>
<td>_____HRS _____MIN</td>
</tr>
<tr>
<td>Delay(s)</td>
<td>Long duty day</td>
<td>Duration of commute on days off to home base (if living in alternative accommodation during the duty block):</td>
</tr>
<tr>
<td>Health</td>
<td>Long-term fatigue</td>
<td>_____HRS _____MIN</td>
</tr>
<tr>
<td>Home Issues</td>
<td>Positioning</td>
<td>Start / / :</td>
</tr>
<tr>
<td>Home rest</td>
<td>Roster disruption</td>
<td>Finish / / :</td>
</tr>
<tr>
<td>Hotel rest</td>
<td>Illness/Medication</td>
<td>Start / / :</td>
</tr>
<tr>
<td>Insufficient rostered rest time</td>
<td>Don’t know</td>
<td>Finish / / :</td>
</tr>
<tr>
<td>Early to late transition</td>
<td>Other (please add details above)</td>
<td>Start / / :</td>
</tr>
<tr>
<td>Late to early transition</td>
<td></td>
<td>Finish / / :</td>
</tr>
</tbody>
</table>

## Commute

<table>
<thead>
<tr>
<th>Date</th>
<th>Time (Local or UTC?):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>/ / :</td>
</tr>
<tr>
<td>Finish</td>
<td>/ / :</td>
</tr>
</tbody>
</table>

## Sleep History

| Start | / / : |
| Finish | / / : |

## Commute

- Duration of commute from home to home base: _____HRS _____MIN
- Duration of commute on days off to home base (if living in alternative accommodation during the duty block): _____HRS _____MIN

## SLEEP HISTORY

- For the 48 hours prior to the reported event, record the start and finish times for all sleep periods (including naps):
- Date
- Time (Local or UTC?):

<table>
<thead>
<tr>
<th>Date</th>
<th>Time (Local or UTC?):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>/ / :</td>
</tr>
<tr>
<td>Finish</td>
<td>/ / :</td>
</tr>
</tbody>
</table>

## Physical Signs

<table>
<thead>
<tr>
<th>Physical Signs</th>
<th>Cognitive Signs</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>No physical signs were noted</td>
<td>No cognitive signs were noted</td>
<td>No countermeasures were used</td>
</tr>
</tbody>
</table>

## Cognitive Signs

- Impaired attention
- Impaired memory
- Negative mood
- Reduced communication
- Increased risk taking
- Impaired problem solving
- Impaired situational awareness
- Other: ____________

## Countermeasures

- Advised colleague of fatigue risk
- Coordinated workload
- Increased communication
- Caffeine
- Food & Drink
- Cockpit napping
- Other: ____________

## How alert did you feel immediately prior to the event (tick one):

<table>
<thead>
<tr>
<th>Alert Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fully alert, wide awake</td>
</tr>
<tr>
<td>2</td>
<td>Very lively, somewhat responsive, but not at peak</td>
</tr>
<tr>
<td>3</td>
<td>OK, somewhat fresh</td>
</tr>
<tr>
<td>4</td>
<td>A little tired, less than fresh</td>
</tr>
<tr>
<td>5</td>
<td>Moderately tired, let down</td>
</tr>
<tr>
<td>6</td>
<td>Extremely tired, very difficult to concentrate</td>
</tr>
<tr>
<td>7</td>
<td>Completely exhausted</td>
</tr>
</tbody>
</table>

---

DRAFT October 2014
APPENDIX F

Tier 2 – Hazard identification and associated procedures

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.

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.

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.

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>
<thead>
<tr>
<th>Identified Hazard</th>
<th>Limitation Adjustment</th>
<th>Policies and Practices Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flying school conducts aerobatic training which can lead to the rapid onset of fatigue</td>
<td>Any flight time whilst conducting aerobatic training to be factored by 1.5 when determining flight time limits for any FDP. Maximum number of aerobatic training hours may be considered on a daily basis. This may be proportional to instructor experience.</td>
<td>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.</td>
</tr>
<tr>
<td>Flying school conducts late night operations in summer</td>
<td>Instructors on late night training sorties are maintained on late night training sorties and are not required for daytime operations.</td>
<td></td>
</tr>
<tr>
<td>EMS operation uses night vision goggles (NVG) in operations</td>
<td>Any flight time whilst conducting NVG operations to be factored by 2 when determining maximum flight time limits for any FDP.</td>
<td>Additional training provided to FCMs on fatigue mitigation strategies specific to NVG use.</td>
</tr>
<tr>
<td>Layover port accommodation located 1 hour from airport</td>
<td>Minimum ODP increased by 2 hours at this port.</td>
<td></td>
</tr>
<tr>
<td>Layover port accommodation undergoing renovations causing sleep disruption to FCMs</td>
<td>Maximum FDP following an off-duty period at this accommodation reduced by 2 hours.</td>
<td>Flights scheduled to permit ODPs to be undertaken during times when renovations are not taking place.</td>
</tr>
<tr>
<td>Reports of FCMs being unable to achieve 8 hours sleep on layovers at a particular port where minimum off-duty period is provided</td>
<td>ODPs at this port increased by 1 hour.</td>
<td>Following minimum off-duty at this port require that all FCMs complete a survey and psychomotor vigilance test (PVT) before commencing the FDP. Only allow FCMs to be assigned one layover at this port in every 7 days.</td>
</tr>
<tr>
<td>Aerial work activity (such as firefighting and aerial survey) creates high cognitive workload</td>
<td>30 minute breaks provided every 3 hours during an FDP.</td>
<td>Specific training for FCMs about recognition of fatigue in themselves, and others. Monthly meetings with FCMs to consider fatigue issues, with policies and limitations considered.</td>
</tr>
<tr>
<td>Single pilot operations being conducted in an aircraft without an autopilot</td>
<td>Maximum FDP reduced by 3 hours, and maximum flight time reduced by 2 hours.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX G

Alertness consideration table

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.

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.

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 individual 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.

Instructions for using the ACT prior to a duty

**Question 1 – How alert are you feeling?**
Question 1 involves the individual 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.

If high risk, the individual 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.

**Question 2 – Have you had adequate sleep?**
Question 2 involves the individual 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.

If the result is high risk, the individual 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.

**Question 3 – What time does the duty occur?**
Question 3 involves the individual 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. They then continue to Question 4.

**Question 4 – What level of operational risk is associated with the duty?**
Question 4 involves the individual classifying the level of operational risk associated with the duty.

It is understood that the accumulation of fatigue will eventually diminish performance and increase error rate, to the point where the individual 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.
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.

For fatigue risk, an individual 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’. Individuals, 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.

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

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

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

Based on the results for Questions 1-4, the individual 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, individuals 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 individual can develop section 2 of the ACT to suit themselves. The blue highlighted numbers in section 2 below, can be individualised. If the individual 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)

<table>
<thead>
<tr>
<th>Score</th>
<th>Alertness</th>
<th>RISK RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fully alert, wide awake</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Very lively, responsive, but not at peak</td>
<td>Moderate</td>
</tr>
<tr>
<td>3</td>
<td>Okay, somewhat fresh</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A little tired, less than fresh</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Moderately tired, let down</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Extremely tired, very difficult to concentrate</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Completely exhausted, unable to function effectively</td>
<td></td>
</tr>
</tbody>
</table>

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?

<table>
<thead>
<tr>
<th>Points</th>
<th>Enter points in box</th>
</tr>
</thead>
<tbody>
<tr>
<td>x ≤ 3h</td>
<td>12</td>
</tr>
<tr>
<td>4h</td>
<td>8</td>
</tr>
<tr>
<td>5h</td>
<td>4</td>
</tr>
<tr>
<td>6h</td>
<td>0</td>
</tr>
</tbody>
</table>

i) At start of duty how much sleep will you have had in last 24 hrs? (this is value ‘x’)

\[ x = \underline{\text{______}} \text{hrs} \]

ii) At start of duty how much sleep will you have had in last 48 hrs? (this is value ‘y’)

\[ y = \underline{\text{______}} \text{hrs} \]

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’)

\[ z = \underline{\text{______}} \text{hrs} \]

ADD POINTS ABOVE TO DETERMINE YOUR SCORE

3. What time does the duty occur?

<table>
<thead>
<tr>
<th>RISK RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

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.)

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.

<table>
<thead>
<tr>
<th>RISK RESULTS</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk response to Q1 or Q2</td>
<td>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).</td>
</tr>
<tr>
<td>All Moderate with at least 1 High</td>
<td>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).</td>
</tr>
<tr>
<td>Any combination of Low, Mod or High</td>
<td></td>
</tr>
<tr>
<td>2 Low, 2 High</td>
<td></td>
</tr>
<tr>
<td>All Moderate</td>
<td></td>
</tr>
<tr>
<td>Any combination of Low or Moderate</td>
<td></td>
</tr>
<tr>
<td>3 Low and 1 High</td>
<td>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).</td>
</tr>
<tr>
<td>All Low</td>
<td></td>
</tr>
</tbody>
</table>

IF 'HIGH RISK' IS INDICATED CONSIDER RISK CONTROLS, SUCH AS NAPPING, TASK ROTATION OR ADVISING THE OPERATOR YOU ARE NOT FIT FOR DUTY.