Civil Aviation Safety Authority
of Papua New Guinea

Advisory Circular

AC122-1

Flight and Duty Time Scheme

Issue 1

01 December 2022

GENERAL

Civil Aviation Safety Authority Advisory Circulars (AC) contain information about standards, practices and procedures that the Director has found to be an Acceptable Means of Compliance (AMC) with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices or procedures are found to be acceptable, they will be added to the appropriate Advisory Circular.

This Advisory Circular also includes Explanatory Material (EM) where it has been shown that further explanation is required. Explanatory Material must not be regarded as an acceptable means of compliance.

PURPOSE

This Advisory Circular provides methods, acceptable to the Director, for showing compliance with the flight and duty time scheme requirements of Part 122 and explanatory material to assist in showing compliance.

RELATED CAR

This AC relates specifically to Civil Aviation Rule Part 122.

CHANGE NOTICE

This AC replaces the Initial Issue dated 01 July 2002.

APPROVAL

This AC has been approved for publication by the Director of Civil Aviation

TABLE OF CONTENTS

1. Introduction

Fatigue has been defined as weariness from exertion. It can result in a degradation of human performance capability, alertness and mood.

Studies have shown that continued wakefulness after 16 hours has resulted in lower levels of alertness, vigilance, sustained attention to tasks and reaction times of between 12 and 15 percent.

Fatigue is an operational concern because it can reduce the performance capacity of crew members. Performance degradation can be gradual and insidious, and effectively reduces the physical and mental resources that an individual has available to meet their job requirements.

During the onset of fatigue, the person experiencing this condition is the least capable of making any assessment of their performance.

Fatigue is most likely to increase when a person is subject to unusual or high workload situations, or when an individual must respond under time pressure – this can lead to errors. There are many recognised factors that can contribute to fatigue-related performance degradation.

(1) The duration of a duty period, and the pattern of workload.

(2) Trying to work after inadequate sleep, – both the duration and quality of prior sleep are important.

(3) Trying to work against the circadian biological clock, which effectively programmes people to sleep at night and be awake during the day.

(4) The cumulative effects of extended duty periods.

2. Purpose

The purpose of this AC is to assist certificate holders to develop their own scheme for the regulation of flight and duty times providing advice on how the full potential of Part 122, Subpart K, may be used tailored for their own unique schedule of operations.

3. Subpart K – Fatigue of Flight Crew

3.1 AMC 121/125/135.801 Flight and Duty Time Limitations

The intent of this rule is to require a certificate holder operating under Part 121, 125 or 135, to schedule crew members' flight and duty times in compliance with Part 122.

4. Part 122 – Flight and Duty Time Limitations

4.1 AMC 122 General

The intent of this rule is that the certificate holder schedules crew members flight and duty times in accordance with—

(1) the applicable requirements prescribed in Subparts A, B, C, D, E, F and G; or

(2) the requirements prescribed in Subparts A, B and a flight and duty time scheme established under Subpart H by the certificate holder that is acceptable to the Director.

4.2 AMC 122.351 Crew Member Flight and Duty Scheme

Any scheme presented for acceptance must contain fixed limits in regard to flight, duty and rest periods. These limits are to be defined and monitored by the certificate holder. In developing these limitations, and a certificate

holder must address the following factors where appropriate to the certificate holder's operation —

(1) rest periods prior to flight:

(2) acclimatisation:

(3) time zones

(4) night operations:

(5) maximum number of sectors:

(6) single pilot operations:

(7) two pilot operations:

(8) two pilots plus additional flight crew members:

(9) crew member qualifications:

(10) mixed duties:

(11) dead-head transportation:

(12) reserve or standby periods:

(13) flight duty period:

(14) in-flight relief:

(15) type of operation:

(16) cumulative flight time:

(17) discretionary increases in flight or duty time limitations:

(18) circadian rhythm:

(19) days off:

(20) record keeping.

The working documents used in the development of a scheme could be presented in the form of a matrix showing the elements that have been addressed and the weightings that have been applied to each element. Consideration must take into account all the elements that may affect fatigue in relation to the scope of the intended operations.

5. IEM 122.351 Crew Member Flight and Duty Time Scheme

5.1 General Rule Requirements

This Rule allows the certificate holder to develop flight and duty time limitations applicable to the particular operation in a method acceptable to the Director. The rule requires that the certificate holder take consideration of some 21 factors in the design and development of this scheme. In the presentation of a scheme for the regulation of flight and duty times, the Director may accept that scheme for a lesser period than the validity of an AOC. This restriction is to show a scheme to be proven and acceptable for a long term approval. During that trial period the CAA may conduct monitoring of the scheme to assess its effectiveness.

5.2 Definitions

When developing a flight and duty scheme the definitions contained in Part 122 must be used. However where Part 122 does not contain a definition, the following definitions could be used.

Disrupted schedule means a schedule that, by reason of circumstance outside the control of the certificate holder, is prevented from being completed within its scheduled time:

Duty means any task (including positioning) that a crew member is required to carry out associated with the business of the certificate holder.

Flight duty time means the period of time that starts when a crew member reports for a flight, or reports as a crew member on standby, and includes the time required to complete any duties assigned by the certificate holder. For a flight engineer it includes the time required to complete aircraft maintenance duties prior to or after a flight.

Positioning means the practice of transferring crew members from place to place as passengers in surface or air transport at the behest of a certificate holder.

Recovery period means a period free of duty following a duty cycle of length greater than 48 hours during which the crew member may recover from the cumulative effects of fatigue.

Rest period means any period of time on the ground during which a crew member is relieved of all duties by the certificate holder, where the rest is not interrupted by the certificate holder. It should not include travel time to or from the rest facility, meals or time for personal hygiene.

Split duty means a flight duty period, which consists of two duties separated by a break on the ground during which the crew member is relieved of all duty.

Split-duty time means a split-duty period during a day where the crew member has:

(1) advanced notice of the split-duty time; and

(2) the crew member receives adequate rest in suitable accommodation.

Tour of duty means the period of time commencing at the start of duties at home base prior to a series of flights and ending at home base on completion of the duties associated with the series of flights:

Note: *When a crew member is based temporarily at a place other than his home base, that place, for the period of the detachment, is regarded as home base:*

Unforeseen operational circumstances means an event that is beyond the control of the certificate holder, such as unforecast weather, equipment malfunctions, or air traffic control delays.

5.3 Flight and Duty Time Schemes

A scheme for the regulation of flight and duty times should aim to take a broader approach to the consideration of fatigue as an operational factor, addressing all possible causes of fatigue. Implicit in this approach is the recognition that factors outside the workplace that can make an important contribution to fatigue, and that fatigue management is a shared responsibility of air certificate holders and individual flight crew.

The considerations and determinations made for each element contained in the Rule should be documented, and records kept, allowing a continuous review to be made for the entire duration of the scheme. The information should be submitted in support of the flight-and-duty scheme for acceptance and will need to show in the scheme how the limitations and rest requirements of both of these operations are to be managed.

A scheme for the regulation of flight and duty times should be based on policies and systems. These policies and systems should include, but are not limited to—

(1) identification and assignment ofresponsibilities;

(2) ongoing education of management and staff;

(3) a fatigue and incident/accident reporting and investigation system;

(4) workload monitoring;

(5) identification and management of fatigued personnel; and

(6) system review.

5.4 Items for Consideration in the Development of a Scheme

A certificate holder submitting a flight-and-duty scheme for acceptance must address the elements contained in Rule 122.351. In addressing this rule and developing a scheme for the regulation of flight and duty times, a certificate holder should ensure that at least these five factors below are addressed—

(1) The scheme should identify all the factors influencing fatigue and apply appropriate weightings to these.

(2) The organisation's management, in conjunction with the crew members, have developed the scheme.

(3) The crew members or the crew member representatives have been consulted on all aspects of the scheme.

(4) The scheme should contain a formal method of feedback from flight crew.

(5) As a part of a quality management system, the scheme should contain a monitoring system with a provision for regular reviews of the scheme by management and crew members. This review should provide the assurance that the scheme is effective and is achieving the desired outcomes.

5.5 Monitoring of Workload of Flight Crew while on Duty

The method by which a certificate holder chooses to monitor the workload of crew members should be defined in a policy. The policy should indicate trigger levels in the monitoring system that indicate to management and staff at the regular review meetings the need to reassess the current situation and to make any necessary adjustments. The following indicators should be considered -

- **Geography** – Terrain.
- **Meteorological Conditions** – Wind, visibility and low cloud, significant hazardous phenomena, special phenomena.
- **Type and Density of Traffic** – Type of air traffic, density of air traffic, aircraft activity forecasts, peak IFR movements.
- **Air Traffic Services** – Provision of air traffic control services, provision of flight information services, provision of alerting services, proximity of controlled airspace.
- **Instrument approaches** – Instrument approach procedures, approach sequencing, IFR training.
- **Circuit Patterns** – Aerodrome circuit selection, non-standard circuit patterns, noise abatement procedures.
- **Aerodrome and approach facilities** – Runways, railways, navigation approach and landing aids, radio and radar coverage.
- **Other Aerodromes** – Aerodromes in the vicinity of the aerodrome. Special aircraft operations – Non-scheduled larger aircraft, special events, non-radio equipped aircraft, sport/recreation aircraft, Military aircraft.
- **Air safety incidents and other occurrences** – Air safety incidents, emergencies and accidents, bird hazard, air safety incident reporting, non-compliance with CAA rules, security.

5.6 Shift Rotation in use

Many aspects of rosters can potentially be modified (duration and timing of operations, number of consecutive operations, direction of rotation, duration of rest periods, etc) and an infinite number of combinations is possible. The type of rostering system that a certificate holder may have in place is less important than the reflection of accepted fatigue management principles in a regulation of flight and duty times' scheme. These principles include the following-:

- An individual in the management structure who has the responsibility for rostering has received education about the effects of shift work, and shift work management strategies.
- Personnel responsible for designing rosters have received education about the effects of shift work, and shift work management strategies.
- Personnel working shifts have received education about the effects of shift work and personal coping strategies.
- Personnel working shifts have had the opportunity to participate actively in roster design.
- Consideration has been given to the rate of accumulation of sleep debt across the roster, and the provision of regular recovery opportunities (two full nights off).
- There is a real-time system for monitoring actual (as opposed to rostered) hours worked, and for prioritising eligibility for callback.

There is a system for monitoring concerns about rosters, and regular review of the issues raised. The review team will include representatives of management and the workforce, and will have the capacity to call upon independent expertise, where appropriate.

5.7 Methods of Grading Contributing Factors to Fatigue

Fatigue Weighting – It is recommended that a certificate holder develop a method of grading the levels of fatigue that could be expected to be experienced during any particular type of operation, taking into account those elements contained in Rule 122.351(1).

Example A – a military system may specify an 8-hour flight and an 18-hour duty period. It will then go on to apply a multiplier for each hour of a particular operational mode. This is shown in Appendix A.

Example B – could list each element of fatigue that has been identified and must be considered for the proposed operation. When satisfied that all the elements have been identified, apply a weighting to fatigue on a scale of minus 10 to plus 10 against each element. As every element that adds to fatigue has a plus factor the certificate holder will then need to apply elements of rest, meal breaks, time free of duty etc that would apply negative fatigue factors to balance the scheme at an acceptable level. An example of this may be found in Appendix B.

As previously stated, any scheme must contain a monitoring system with regular management and crew member reviews that will provide the assurances that the scheme is not only being complied with, but is effective and is achieving the desired outcome of managing fatigue within acceptable levels.

6. IEM 122.51 Certificate Holder Responsibilities

The intent of this rule is to minimise the likelihood of fatigue in flight crew conducting air operations.

6.1 IEM 122.51(a)

This places the responsibility on the certificate holder to ensure that each crew member assigned for duty does not exceed the flight and duty times prescribed in Part 122 or those established in a flight-and-duty scheme.

6.2 IEM 122.51(b)

This is a prohibition and places a responsibility onto the certificate holder performing an air operation to not cause or permit any person to fly in an aircraft as a crew member if the certificate holder knows or has reason to believe that person is suffering from or is likely to suffer from fatigue. A scheme in itself is not sufficient to satisfy this rule as the effects of fatigue are variable between individuals, and the certificate holder will have to monitor the individual fatigue performance and provide within the scheme a method of feedback from staff and make adjustments to the scheme as appropriate.

6.3 IEM 122.51(c)

This rule requires the certificate holder to keep and retain accurate records in relation to flight and duty and could be covered within the administrative procedures for all types of record.

7. IEM 122.53 Crew Member Responsibilities

7.1 IEM 122.53(a)

The intent of this rule is to place a responsibility on the crew member not to act as crew when fatigued or likely to become fatigued to a point which may endanger the aircraft or its occupants. This is a prohibition that could be included in the scheme or initial training programme.

7.2 IEM 122.53(b)

This rule is a prohibition and places a responsibility on the flight crew member from conducting other hire-or-reward duties where these would exceed the flight-and-duty scheme. Crew members working on a freelance basis will need to maintain an individual record of their flying and duty hours so that it can be presented to an certificate holder before undertaking a flying duty.

7.3 IEM 122.53(c)

This is a prohibition and places the responsibility on the crew member to ensure that the limitation prescribed in the flight-and-duty scheme of the air certificate holder are not exceeded.

This in effect requires the crew member to have access to the progressive totals and limitations of the scheme. The crew member must have the ability to project the flight-and-duty time for the intended flight or series of flights during planning for flights.

7.4 IEM 122.53(d)

This rule is self-explanatory.

Note: *The combination of Rule 122.51 and Rule 122.53 makes the management of fatigue a partnership between the certificate holder and the employee, as both have a shared responsibility to ensure that fatigue is taken account of responsibly.*

8. IEM 122.351(1) Crew Member Flight and Duty Scheme

8.1 IEM 122.351(1)(i) Rest Periods prior to Flight

It is recommended that the rest period prior to commencing a duty is a minimum of 12 hours. This break should provide adequate opportunity for sleep to minimise the effects of fatigue prior to commencing a duty cycle.

The greatest risk of fatigue is experienced on night operations. This is where the 12-hour minimum break will be most beneficial to staff and valuable in the management of fatigue. The period may vary but it should provide for adequate sleep, meals, travel and recreation.

The recovery value of rest periods depends on how much sleep a person is able to obtain. This, in turn, depends on how much of the rest period coincides with the time of day when the brain and the body are primed for sleep,

by the circadian biological clock.

8.2 IEM 122.351(1)(ii) Acclimatisation

The intention of this rule is to consider the effects of physiological adaptation to environmental stress. It is recommended that where crew members are being transferred between temperate, artic or tropical climates a suitable rest period be provided prior to the commencement of duty for acclimatisation. This period may vary dependant on the period of transition between climatic zones. This should also consider the effects of night operations and split duties.

8.3 IEM 122.351(1)(iii) Time Zones

It is recommended that where crew members are being transferred between time zones, a suitable period of rest is provided prior to the commencement of duty for realignment of the normal circadian rhythms. This period may vary dependant on the period of transition between time zones, the direction of travel and the time differences being experienced.

8.4 IEM 122.351(1)(iv) Night Operations

The intention of this rule is to ensure a certificate holder takes consideration of the effects of night operations and its effect on performance. Night operations will have the greatest effect on an individual's alertness and ability to perform complex tasks due to disruption sleep patterns. Alertness reaches a low point in the early hour of the morning (about 3-5 am, or slightly later on night operations) when the physiological drive for sleep is the greatest. The urge to fall asleep at this time is stronger when prior sleep has not been adequate. Consideration should be given to rest and meal breaks to overcome the low point in the circadian rhythm during this period of operation.

8.5 IEM 122.351(1)(v) Maximum number of Sectors

The intention of this rule is to ensure that a certificate holder takes consideration of the number of sectors with respect to workload. Emphasis, in this assessment, may be given to operations that involve high- frequency operations, this is due to generally greater workloads that may be experienced.

8.6 IEM 122.351(1)(vi) Single Pilot Operations

It is recommended that a certificate holder consider this rule with respect to workload that may be expected in the operation. It is generally accepted that there is high workload associated with single-pilot operations, this will apply to the majority of Part 135 operations. Additional consideration should be given to single pilot IFR operations that may increase workload, this may include night operations.

8.7 IEM 122.351(1)(vii) Two Pilot Operations

It is recommended that a certificate holder consider this rule with respect to workload, and the impact of the second pilot. It is generally accepted that the presence of a second pilot has an effect of sharing the workload and possibly reducing fatigue levels. This will have limited impact on Part 135 certificate holders.

8.8 IEM 122.351(1)(viii) Two Pilots plus Additional Flight Crew Member

The intention of this rule is to have a certificate holder consider the further fatigue-reducing effects of further shared responsibility. This will have limited impact on Part 135 certificate holders.

8.9 IEM 122.351(1)(ix) Flight Crew Member's Qualifications

The intention of this rule is to give consideration to qualifications over and above the minimum qualification required for the duties being performed by flight crew that could have the effect of reducing the level of fatigue associated with the duties being performed. In the consideration of this rule, experience of the pilot in the situation and environment should not be overlooked. Taking into consideration these two factors an assessment should be made as to a persons ability, with regard to effects of fatigue, to handle the situation in which they are operating.

8.10 IEM 122.351(1)(x) Mixed Duties

The intention of this rule is to give consideration to the mixture of duties likely to be undertaken during any duty period and apply a weighting to the likely stress levels. For example a combination of high-concentration lifting operations and relatively lower level sightseeing operations being conducted during the same duty period may require a reduction in the duty period or an increase in rest to maintain an adequate level of alertness throughout the period.

8.11 IEM 122.351(1)(xi) Dead Head Transportation

The intention of this is to ensure that a certificate holder considers how this time is to be addressed, it is not treated as rest time but should be included as duty time. In the event of crew members being transferred as passengers after the completion of a flight, or to the commencement of a flight, consideration should be given to this time.

8.12 IEM 122.351(1)(xii) Reserve or Standby Periods

The intent of this rule is to require any period of reserve or standby away from the place of work or duty to be considered as a form of duty, and some weighting in relation to fatigue should be made. Consideration should also be made for the time of day of commencement and cessation of standby in relation to duty.

8.13 IEM 122.351(1)(xiii) Flight Duty Period

The intent of this rule is to take into account the overall effects of fatigue over one duty period. This is from the time that a person is required by an certificate holder to present themselves for duty to the time that an certificate holder no longer requires that person for duty. For example this would normally effect operations where flight crew work to a roster of a month on and a month off, or any similar arrangement. This may have the effect of extending rest periods.

8.14 IEM 122.351(1)(xiv) In-Flight Relief

The intent of this rule is to allow for relief where multiple flight crews are available to provide in-flight relief of the duty crew. Overall all flight crew will be on duty, but the overall flight and duty period could be extended due to the relief provided by a second flight crew. This consideration is unlikely for operations conducted under Part 135, and would normally only apply to large airlines flying over very long routes.

8.15 IEM 122.351(1)(xv) Type of Operation

The intent of this rule is to take into account the stress and associated fatigue that will affect flight crew when undertaking various types of operations. A consideration should also be given where flight crew are required to perform more than one type of operation within the same flight-and-duty period. The workload of the various types of operation should be analysed and a fatigue weighting applied. Some examples are:

VFR air operation between airports with paved runways, low traffic density and good weather patterns that is the primary operation of an certificate holder would have a medium to low fatigue weighting.

IFR air operation into areas of high traffic density with poor weather patterns would have a high workload and a higher fatigue weighting.

Air operation operating a low level or a lifting operation in a confined area would require a high level of concentration and therefore high stress levels and a higher weighting in regard to fatigue.

Air operation to an unfamiliar aerodrome or landing site would require more pre-flight planning and a higher level of concentration during the flight. Consequently a higher fatigue weighting.

8.16 IEM 122.351(1)(xvi) Cumulative Duty Time

The intent of this rule is to consider the effects of duty over periods of time. This includes the normal working day and the overall period encompassed by the scheme. For example this could include the duty day including any rest and meal breaks, and the annual duty cycle including public holidays, weekends and annual leave allotments. The weightings against fatigue could be negative in relation to a daily period and positive over the annual period where public holidays, weekends and leave are taken into account. Overall there should be a balance.

8.17 IEM 122.351(1)(xvii) Cumulative Flight Time

The intent of this rule is to consider the effects of flight periods over time. This includes the normal working day and the overall period encompassed by the scheme. For example this could include many factors. The weightings against fatigue could vary in relation to a large number of flights over daily period, morning and afternoon operations with a large rest period during the middle of the day, a combination of mixed air transport, commercial transport operations, lifting or agricultural duties. The scheme should also consider the effects of fatigue over the annual cycle of the scheme. A workload assessment should be carried in relation to the support provided to flight crew in carrying out their duties and the complexity of the flights within the scope of the operation.

8.18 IEM 122.351(1)(xviii) Discretionary Increases in Flight Time Limitations or Flight Duty Times or Both

The intention of this rule is to provide for discretionary increases in flight and duty times within the scheme to provide for contingencies that arise from time to time due to unforeseen operational circumstances. Increases in flight and duty times should be assessed, as having a negative effect on fatigue and provisions should be made to increase rest periods, provide meal breaks or any other strategy that will provide for fatigue recovery.

8.19 IEM 122.351(1)(xix) Circadian Rhythm

This rule is considered in the assessment of many of the elements of fatigue that are required to be considered in this Subpart. It must be recognised that people do not function, physically or psychologically, at a steady, unchanging level across the 24-hour day. All of the organs of the body cycle through daily peaks and troughs of efficiency known as circadian rhythms, which are coordinated by a biological clock in the brain. The biological clock keeps the body “in step” with the day/night cycle by being sensitive to light and darkness, to work/rest patterns, and to the patterns of activity of other people. The clock is genetically based, and effectively programmes the body for sleep at night and for wakefulness during the day. It does not usually adapt much to night operations because it is constantly being drawn back to its preferred orientation by the unchanged day/night cycle and the activities of the rest of day active society.

Two aspects of circadian rhythms are directly relevant to fatigue management and safety in air operations.

1. There are circadian rhythms in alertness and performance capacity, which can affect how a person responds to job demands.

Alertness reaches its daily low-point in the early hours of the morning (about 3 –5am, or slightly later on night operations) when the physiological drive for sleep is greatest. There is a second drop in alertness, and increase in sleepiness, in mid-afternoon, corresponding to the nap time in siesta cultures. The urge to fall asleep at these times is stronger when prior sleep has not been adequate.

Both physical and mental performance capacity reach a daily low-point at a similar time in the early morning (about 3 – 5am, or slightly later on night operations). People working under time pressure, or with high workload, are most likely to make errors at this time. Particularly for tasks that require vigilance, there is also a secondary slump in performance capacity in the mid-afternoon. The time of day of best performance depends on the nature of the task. For example, people usually perform best around noon on tasks that require complex mental processing. On the other hand, they generally perform best in the early evening on tasks requiring physical coordination and vigilance.

In practical terms, the circadian rhythms in performance capacity mean that people cannot be expected to function equally well at all times of the day, and that they are likely to have most difficulty on night operations.

2. There are also circadian rhythms in the ability to sleep. In other words, people simply cannot sleep “at will”. As already mentioned, the physiological drive for sleep is strongest in the early hours of the morning (about 3 – 5am, or slightly later on night operations). The physiological drive for waking up is strongest about 6 hours later. As a result, after night operations, people frequently wake up spontaneously after only a few hours of sleep. The daytime sleep of night workers is consistently found to be about one third shorter than their sleep at night.

In practical terms, the circadian rhythms in sleep propensity mean that it is possible to obtain more

sleep in a nigh- time rest period than in a daytime rest period of the same length. Thus night work is associated with maximum sleep loss and with working around the daily low-point in performance capacity.

8.20 IEM 122.351(1)(xx) Days Off

The intent of this rule requires the certificate holder to consider the number of days off within the overall scheme. The number of days off including leave entitlements have a bearing on the cumulative effects of fatigue as has already been stated and should be assessed as an integral part of the scheme.

Short term and accumulated sleep deficit To be alert and able to function well, each person requires a specific amount of nightly sleep. The average for an adult is about 7 – 8 hours, but there are people who require more or less than this average. When this individual 'sleep need' is not met, waking function is degraded. For most people, getting two hours less sleep than they need on one night (an acute sleep loss of two hours) is sufficient to degrade their performance and alertness the next day. The reduction in performance capacity is particularly marked if less than about 5 hours sleep is obtained. The effects of consecutive nights of reduced sleep accumulate into a sleep debt, with alertness and performance becoming progressively worse.

To recover from the effects of sleep loss generally requires two nights of undisturbed sleep. Recovery sleep is usually deeper and more efficient, and the lost hours of sleep do not need to be recovered hour for hour.

In practical terms, any work pattern that requires a person to change the timing of their sleep, particularly night work, is likely to cause sleep loss. Because of the cumulative effects of sleep loss, it is important in roster design to consider the rate at which sleep loss is likely to be accruing across the roster. This should determine the number of consecutive night operations before a scheduled opportunity for recovery (two full nights).

8.21 IEM 122.351(1)(xxi) Record Keeping

The intention of this rule is to take into account and clearly establish any record keeping activities the certificate holder requires of the flight crew that are to be considered as a duty under the overall scheme. This will also extent to the records, forms and results of the review meetings generated during monitoring of the scheme

APPENDIX A

Example A

Crew Endurance Guide

Type of flight	Multiplier
Day	1.0
Day contour flight	1.3
Instrument flight	1.4
Night terrain flight	2.1
Night flight with NVGS	2.3

APPENDIX B

Example B

In this example an assessment of fatigue has been made and applied to each element relating to fatigue. This weighting is from minus 10 to plus 10. Overall when all the elements of fatigue are totaled up, an acceptable level of fatigue has been established.

For example, a fatigue level of 2 or less may be acceptable, and 3 and above may not. In the event of the level being high, adding factors that apply a negative weighting and bring the overall weighting down to an acceptable level may offset this.

The figures contained in the following table are provided as an example to illustrate the concept of fatigue weighting.

Rest periods prior to flight	-10
Acclimatisation Increase of 15degrees C	+5
Time zones difference 12 hours	+7
Night operations	+9
In flight relief	-3
Type of operation	+6
Meal breaks	-4
CTO operation with sling	+8
IFR	+2
Single pilot	+2
Two pilot	-2
Cumulative duty time	+2
Cumulative flight time	
Discretionary increases in flight and duty time	+4
Rest periods	-5
Standby periods	+2
Total acceptable	+5

Monitoring the scheme and applying adjustments as necessary in a formal manner would be required to make the scheme acceptable.

Monitoring of the scheme would require the following:

(1) Formal completion of questionnaire by flight crew on a regular basis.

(2) Formal completion of questionnaire by flight crew on a random basis.

(3) Feedback from flight crew.

(4) Results from analysis of incident and accident investigation required by Rule 12.59.

(5) Results from analysis of any incident or accident investigation conducted by the company that is not required by Part 12.

The following questionnaire is an example that could be used to monitor fatigue of flight crew, but this could be modified where it is more complex than needed for a small certificate holder.

Fatigue Questionnaire

1. Daily report or after an occurrence

..... am or pm?

2. Duty History Prior to Monitoring or Prior to an Event

	Duty Period		Operational Duty		Rest Period	
	Start	Finish	Start	Finish	Start	Finish
Day of monitoring/event						
Day before monitoring/event						
2 days before monitoring/event						
3 days before monitoring/event						

3. Sleep History Prior to Monitoring or the Event

	Sleep Periods		Naps		Sleep Quality		
	Start	Finish	Start	Finish	Good	OK	Poor
Day of monitoring/event							
Day before monitoring/event							
2 days before monitoring/event							
3 days before monitoring/event							

4. Sleep Need

How long would you normally need to sleep at night to feel fully rested the next day?

..... hours ..... minutes

5. Has a doctor ever told you that you have a particular sleep problem (for example, sleep apnoea, insomnia)?

1☐Yes 2☐No 3☐Don't Know

If yes, please describe: ……..

……

6. How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

PLEASE TICK ONE BOX ON EACH LINE

	would never doze chance	Slight chance	Moderate chance	High chance
Sitting and reading	☐ 0	☐ 1	☐ 2	☐ 3
Watching TV	☐ 0	☐ 1	☐ 2	☐ 3
Sitting inactive in a public place (eg. theatre, meeting)	☐ 0	☐ 1	☐ 2	☐ 3
As a passenger in a car for an hour without a break	☐ 0	☐ 1	☐ 2	☐ 3
Lying down in the afternoon when circumstances permit	☐ 0	☐ 1	☐ 2	☐ 3
Sitting and talking to someone	☐ 0	☐ 1	☐ 2	☐ 3
Sitting quietly after a lunch without alcohol	☐ 0	☐ 1	☐ 2	☐ 3
In a car, while stopped for a few minutes in traffic	☐ 0	☐ 1	☐ 2	☐ 3

PLEASE MAKE SURE YOU HAVE TICKED ONE BOX ON EACH LINE

7. Do you believe that fatigue played a part in this working day or this event?

1 ☐ Yes 2 ☐ No 3 ☐ Don't know

Please explain (use extra pages if necessary)