FSG 1400-03
FATIGUE MANAGEMENT IN THE ROYAL CANADIAN AIR FORCE

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References:

A. General Recommendations on Fatigue Risk Management for the Canadian Forces. DRDC Toronto Technical Report TR 2010-056 April 2010

B. Management of Circadian Desynchrony (Jetlag and Shiftlag) in CF Air Operations. DRDC Toronto TR 2010-002. December 2010.

C. Air Force Order 8008-0, Fatigue Risk Management System for the Royal Canadian Air Force, June 2016

Record of Amendments

Date	Change/Reason
June 2018	Changed title from “Fatigue Management in Aircrew” to “Fatigue Management in RCAF”. Added Reference C “Air Force Order 8008-0, FRMS in the RCAF.” Added Definitions section.
June 2018	Paras 6 and 7. Deleted recommended fatigue management approach for the RCAF prior to adoption of FRMS. Added brief overview of current RCAF FRMS program elements. Deleted Aerospace Medical Community as holding responsibility for managing medical aspects of fatigue management. Added RCAF Surg as holding these responsibilities per Ref C.
June 2018	Paras 8 to 15. Changed title from “General Measures for Fatigue Management” to “Fatigue Countermeasures.” Added term SFCM to description of education on sleep hygiene, anchor sleep, and naps.
June 2018	Paras 16 and 17. Changed title from “Screening Aircrew for Sleep Disorders” to “Screening Personnel for Sleep Disorders.” Paragraphs changed to be inclusive of air and ground personnel.
June 2018	Paras 31 to 33. Moved sections on “Light Devices” from section on melatonin to section on circadian planning.
June 2018	Para 34. Changed title from “Medication and Light for Fatigue Countermeasures” to “Pharmacological Fatigue Countermeasures.” Changed description of process for authorizing PFCMs.

June 2018	Para 35. Added ground testing definition, intent, and procedure. Added clause permitting other HCPs authorized by the RCAF Surg (eg. pharmacists) to direct ground testing.
June 2018	Para 38. Deleted restriction of PFCM prescriptions to 7 days. Deleted prohibition on sustained or chronic use of sleep medication.
June 2018	Para 39. Changed title from “Chronobiologic Medications and Devices” to “Chronobiotic Medications”
June 2018	Para 40. Changed to indicate that melatonin is now available through the CAF formulary.
June 2018	Para 45. Changed to indicate that caffeine is an approved PFCM whereas dexamphetamine and modafinil are NOT approved.
June 2018	Para 47. Deleted Stay Alert gum as an example of chewable caffeine, as it is not available to the CAF. Added specific onset time for effects of chewable caffeine (5 -10 minutes). Added benefits of chewable caffeine (portable, convenient, no fluid loading).
June 2018	Para 48. Changed to indicate that moderate use of caffeine containing products is permitted by aircrew. Deleted clause discouraging specific use of Red Bull.
June 2018	Para 49. Deleted restriction of use of caffeine Chewpod tablets to Op IMPACT. Reformatted RCAF Surg directions for use of caffeine Chewpod tablets. Subpara (c): Changed “will be chewed” to “may be chewed.” Added “in a 24 hour period” to the maximum dosing direction. Subpara (d): Added directions for discontinuation of use.
30Nov16	Page 8/Para 35/Table - Grounding period for zopiclone increased from 8 to 12 hours because of concerns re lingering cognitive effects after 8 hours. CF Formulary designations updated. Clarification of baseline trial requirements.
30Nov16	Page 8/Para 37 - Clarification that melatonin has been approved for use by RCAF aircrew for circadian phase shifting and as a sleep aid, as outlined in Annexes D and E. Melatonin 1mg immediate release and 1mg Sustained Release is being procured for the CF Formulary.
30Nov16	Page 10/Para 46 - Chewable caffeine (Chewpods) is being trialed during Op Impact as an alertness medication. Use in aircrew is currently limited to this trial.

DEFINITIONS

Fatigue Counter Measure (FCM)	As per Ref C, a FCM is any tool, practice, or procedure, including medication, which is used for fatigue risk mitigation. This includes Pharmacological Fatigue Counter Measures (PFCMs) and Standard Fatigue Counter Measures (SFCMs).
Fatigue Risk Management System (FRMS)	As per Ref C, a FRMS is a multi-layered approach to preventing fatigue and managing risk which is command-driven and inclusive of air and ground personnel.
Ground Testing	This is the process of providing personnel with the opportunity to utilize a PFCM in a non-safety sensitive environment to ensure there are no adverse effects or safety concerns before use in an operational setting. Ground testing is completed according to the directions of an aviation medicine provider (ie. Flight Surg or BAvMed provider) or other healthcare provider (HCP) that may be authorized by the RCAF Surg (eg. a pharmacist).
Pharmacological Fatigue Counter Measure (PFCM)	As per Ref C, a PFCM is any medication which promotes sleep, alertness, and/or manipulation of circadian rhythms and which is used for fatigue risk mitigation.
Standard Fatigue Counter Measure (SFCM)	As per Ref C, a SFCM is any tool, practice, or procedure, excluding the use of medication, which is used for fatigue risk mitigation.

TABLE OF CONTENTS

INTRODUCTION

1. Fatigue can be defined as a physiological and/or psychological state characterized by a diminished capacity to perform, usually accompanied by a feeling of tiredness. Fatigue is a pervasive risk factor in Canadian Armed Forces operations, and nowhere more so than in Air Force operations, with shift work, sustained and high tempo flight operations, night flying operations, and transmeridian flights all potential (and often combined) sources for inducing fatigue. Both ground crew and aircrew (including ground controllers) are susceptible, with potential adverse effects on flight safety. In the air environment, additional factors including sustained noise, vibration, heat, and mild hypoxia are all cumulative, contributing to fatigue. Fatigue has been identified as a cause factor in a number of air incidents in recent years.

2. Fatigue can be acute (acute sleep deprivation, e.g. poor sleep before a single mission), chronic (due to medical or psychologic illness), or cumulative (due to progressive sleep deprivation over time). Acute sleep deprivation but not cumulative fatigue can generally be relieved with a single good quality sleep period.

3. The effects of fatigue as a causative factor in accidents are well documented, and under-estimated. Forward adjustment of clocks to daylight savings time each spring results in a next day increase in motor vehicle accidents by 7%, with the reverse occurring each fall when clocks are set back to standard time.

4. The consequences of fatigue include degradation of performance (attention, vigilance, short term memory, judgment, decision-making, situational awareness), and affect (irritability, impatience, loss of emotional control, diminished Crew Resource Management).

5. Fatigue negatively impacts performance with qualitative similarities to alcohol. Seventeen hours of sustained wakefulness produces performance impacts similar to a blood alcohol concentration (BAC) of 0.05%, and after 24 hours, equivalent to a BAC of 0.10%.

FATIGUE RISK MANAGEMENT SYSTEM

6. As per Air Force Order 8008-0 “FRMS for the RCAF” (Ref C), the RCAF recognizes fatigue as a threat that degrades operational effectiveness, Flight Safety, and the retention of trained personnel. In order to optimize safe and effective air operations, the RCAF maintains a robust FRMS which is suited to military aviation, inclusive of all personnel (air and ground), leverages existing CAF Risk Management processes, and is executed through the chain of command. Fatigue is deliberately considered in decision-making (DM) and mission-related Risk Management (RM) processes. Ref C provides a program

overview, including governance, guiding principles, authorities and accountabilities. In general, the RCAF FRMS fatigue control measures are based on the principle of "defence in depth" and are organized according to six layers of defence:

a. Education;

b. Scheduling;

c. Sleep quality;

d. Workplace/Mission design;

e. Alertness Maintenance; and,

f. Reporting and feedback

7. This FSG stands in partial fulfillment of the RCAF Surgeon's responsibilities according to Ref C. In support of the RCAF FRMS, the RCAF Surgeon is responsible for:

a. Coordinating development and promulgation of technical guidance to CF H Svcs Group Health Care Providers (HCPs) to manage fatigue and sleep-related disorders, in the context of RCAF operations;

b. Coordinating development and promulgation of technical guidance to CF H Svcs Group HCPs and RCAF Commanders on the use of PFCMs to optimize safe and effective operations;

c. Regulating and monitoring the use of PFCMs by RCAF personnel; and,

d. Coordinating and providing oversight of fatigue Subject Matter Expert (SME) support from the CF Environmental Medical Establishment/Defence Research and Development Canada.

FATIGUE COUNTERMEASURES (FCMs)

Education and Sleep Hygiene

8. Education on good sleep hygiene is an important SFCM which should be undertaken with aircrew and promoted by Flight Surgeons and BAvMed Providers during Periodic Health Assessments and other opportunities. The following is excerpted (modified) from Ref A.

9. Sleep hygiene refers to health and behavioural practices and environmental factors that influence quality of sleep. Sleep loss is one of the most common causes of fatigue. Sleep cannot be stored or built up, however, the preload (total amount of sleep loss prior to mission commencement) can be reduced. It is often said that there is no substitute for a good night's sleep. Therefore, the primary recommendation for good sleep hygiene is to obtain adequate sleep prior to the duty period, along with regular exercise and proper nutrition. Abiding by sleep hygiene practices will lead to good quality sleep that is restful,

rejuvenating and restorative. In contrast, poor sleep hygiene practices increase the likelihood of non-restorative sleep that can lead to daytime sleepiness.

10. Whenever possible, obtaining a sufficient quantity (i.e. 7-8 hours) of high quality sleep on a daily basis should be the main focus in mitigating fatigue. The quality of sleep has been shown to be enhanced by favourable environmental conditions. This may be difficult to achieve during military operations and should be addressed at an early stage in operational planning.

11. Sleeping accommodations should be single, quiet, dark, and maintained at a comfortable temperature. Eye shades and ear plugs are simple and portable solutions to shield off bright light and to reduce noise when sleeping. Whenever possible, those in shared accommodations should have common shifts to minimize disturbances.

12. Alcohol should not be used as a sleep aid. Although it induces drowsiness, it disrupts the sleep architecture, resulting in easily disturbed, lighter sleep. Alcohol consumption in conjunction with sedative use will amplify the effect of the sedative and is contraindicated (inadvisable).

13. Exercise and stimulants including caffeine and nicotine should be avoided before planned sleep/rest periods. Annex A outlines recommendations for good sleep hygiene and habits.

Anchor Sleep

14. Some work schedules may not allow an operator to obtain a full 8 hours of sleep at the same time period every day. In order to effectively cope with such schedules, anchor sleep – a SFCM defined as a regular sleep period of at least 4 hours duration and obtained at the same time each day – is a useful strategy, which can be supplemented with naps. Anchor sleep helps to stabilize the circadian rhythm to a 24-hour period. If possible, the anchor sleep period should be timed so that the individual's circadian rhythm high and low points correspond to the work and sleep periods.

Napping

15 As a SFCM, a nap is defined as a short sleep period of up to 2 hours which can be utilized to supplement sleep. To avoid the sleep inertia associated with deep sleep (stages III and IV), naps should be less than 30 minutes or more than 90 minutes in duration.

SCREENING PERSONNEL FOR SLEEP DISORDERS

16. Personnel should be screened for sleep disorders during routine Periodic Health Assessments. The routine questionnaires DND 2552 Periodic Health Assessment and DND 2452 Aircrew and Diver Health Examination, do not contain adequate screening questions for sleep disorders (DND 2452 contains a single question). Flight Surgeons and BAvMed Providers should include specific questions regarding sleep quality and quantity, and symptoms of daytime sleepiness and fatigue as part of the periodic medical on all aircrew and groundcrew. A questionnaire/guide for screening for sleep disorders is included as Annex B.

17. For individuals suspected of having a sleep disorder or sleep hygiene practices which may be causing daytime fatigue, the Epworth Sleepiness Scale (Annex C) provides a quick, objective assessment of daytime sleepiness. If there is a clinical suspicion of a sleep disorder based on sleep symptoms and/or the Epworth score, members should be referred to a sleep specialist for further evaluation.

CIRCADIAN PLANNING

Shift lag and Jetlag Disorders

18. Jetlag disorder occurs after transmeridian travel across time zones, resulting in a temporary misalignment of the individual's internal circadian clock with the local sunrise/sunset. Night in the new time zone often coincides with daytime in their home time zone, and attempts at sleep before adaptation has occurred often results in insomnia. On average, it takes about one day of adaptation for each time zone crossed.

19. Shiftlag disorder results from rapid transitions between different work schedules. The circadian stress from a rapid change from day to night shift is similar to jetlag caused by flying half-way around the world.

20. Symptoms of jetlag and shift work disorder include sleep disruption, excessive sleepiness when awake, irritability, and a decrease in performance. Both increase the risk of accidents. Night work increases the risk of accidents by 30%, and evening work by 18% compared with morning shifts.

21. Long term circadian desynchrony may be associated with health risks. Desynchronization of internal circadian rhythm results in impairment of metabolic processes including circulating lipids, glucose, insulin and fats. Several studies have shown that shiftwork is associated with weight gain, and the risk for endocrine, metabolic and cardiovascular disease is increased. In 2007, the World Health Organization defined shift work that involves circadian desynchrony as a probable carcinogen.

Physiology

22. Many aspects of human physiology, metabolism and behaviour are dominated by 24 hour cycles including sleep-wake cycle, alertness and performance patterns, core body temperature rhythms, and production of hormones including melatonin and cortisol. Endogenous near-24 hour rhythms are generated by a circadian (circa – around; dies – day) pacemaker located in the suprachiasmatic nucleus (SCN) of the anterior hypothalamus. Cells in the SCN generate rhythms with a periodicity close to (but not exactly) 24 hours (ranging from 23.6 to 25 hours in different people). To synchronize the SCN rhythm generator with the outside world, environmental time cues (zeitgebers – "time givers") reset the internal time clock to generate rhythms to coincide with real time. The prime zeitgeber is photic (light-dark cycle), although non-photic cues including social interactions and meal timing can also have milder effects. Light/dark information reaches the SCN from retinal photoreceptor cells that are distinct from rods and cones. These cells represent approximately 2% of all retinal ganglion cells in humans and contain the photopigment melanopsin, which has peak absorption at 484 nm (blue light). The

photosensitive retinal cells, through a neural pathway, entrain the SCN in response to (blue) light.

23. The SCN modulates melatonin secretion by the pineal gland. During daylight, melatonin secretion is suppressed to barely detectable levels. At dusk, as retinal signals to the SCN decrease, melatonin secretion increases. Melatonin induces sleepiness and is secreted throughout the night. With exposure to morning light, melatonin secretion is suppressed. For most people with bedtimes around 2200h to midnight and who are acclimatized to their local photo period, melatonin starts to rise at about 2100h and falls to barely detectable daytime levels around 0700h. The time of evening onset of melatonin secretion is termed DLMO (dim light melatonin onset). There is also individual variability in melatonin secretion, with “morning types” or “larks” and “evening types” or “owls” having correspondingly varied onset and offset of melatonin secretion. Recognizing these individual differences in physiology plays a role in developing optimal circadian shift plans. Melatonin secretion also shows seasonal changes in high/low latitudes with corresponding changes in sunset and sunrise.

Managing Circadian Desynchrony

24. Circadian dysynchrony, whether due to jet lag or shift work, is a significant cause of sleep disruption with resultant fatigue and performance decrements. Both can be ameliorated by the use of appropriately timed light exposure (and light avoidance at inappropriate times), along with appropriately timed melatonin.

25. The key for both phase advance and phase delay is appropriate timing for both light and melatonin, based on phase response curves to light and melatonin. Importantly, incorrectly timed light exposure or inappropriate melatonin administration (dosage, formulation, or timing) can impede or even reverse circadian adaptation.

26. Circadian adaptation can be further facilitated by the judicious use of certain sleep medications to facilitate sleep during periods of circadian misalignment (biologic day).

27. Findings of the DRDC circadian phase shifting project show that appropriately-timed light and melatonin can produce phase shifts of up to 1.5 hours per day for phase change adaptation.

28. Terminology:

a. Phase Advance: Eastward travel towards later time zones, or shift change forward to later shift e.g. dayshift to nightshift (AdvancE = Eastward).

b. Phase Delay: Westward travel towards earlier time zones.

c. DLMO (“dilmo”): The time at which melatonin secretion increases in response to the onset of darkness. DLMO is used as an anchor point for the timing of circadian phase shifting treatments (melatonin and light). Operationally, DLMO can only be estimated by determining the normal, average bedtime/sleepiness onset of the individual.

Travel Treatment Protocols

29. Annex D explains how a treatment grid can be created for precise travel advice to patients. At present, the process of developing a specific treatment-grid protocol is a time intensive effort requiring the services of a circadian physiology expert. CFEME is pursuing development of an application to create such grids on mobile devices, but this project is still in its infancy. However, in certain circumstances (e.g. transport operations with repetitive transmeridian scheduling) requests for treatment-grids can be directed to CFEME/Military Medical Services.

30. Aviation medicine providers can use the basic principles of sleep shifting with adjunctive treatment of light and/or melatonin to provide guidance to aircrew prior to missions which involve travel over 4 or more time zones to a destination which they will be at for at least several days. For shorter duration stays, it is more advisable to try to remain on home time, with judicious use of sleep medications to enhance sleep during the layover period. Similar guidance can be provided to shift workers to facilitate shift changes. Examples of generic advice can be found in Annex E for phase advance/eastward travel, phase delay/westward travel, transition from day to night shifts, and from night to day shifts. A copy of the relevant protocol should be given to the patient.

Light Treatment Devices

31 To achieve phase shifting with light therapy, the light needs to be of the appropriate intensity and wave length (blue light, circa 480 nm wavelength, which stimulates the retinal photosensitive cells). The best light therapy is daylight, which produces 40,000-100,000 lux depending on cloud cover. For light therapy in the absence of sunlight, there are various light treatment devices available. In the DRDC Toronto study, the two best devices were the Light Tower (Sunnex Biotechnologies, Winnipeg, http://www.sunnexbiotech.com) and the Feel Bright Light (Physician Engineered Products, Fryeburg, ME, www.feelbrightlight.com). Since the DRDC study, there have been a variety of other light source devices marketed, for example the Phillips Energy Lights, a family of compact and portable devices.

32. For optimal phase shifting, individuals should use these devices for a one hour period at the appropriate times. Shorter exposure times may give some benefit, but the magnitude of the effect has not been studied. At present, the CF formulary does not include any light treatment devices for phase shifting.

33. Circadian adaptation can be disrupted by light exposure at inappropriate times, and avoiding bright light during these periods is important for successful circadian adaptation. There are a variety of specific circadian-adaptation glasses under evaluation for use in the CF (e.g. Zircadian®). These filter light with wave-lengths around 480 nm (blue light). At present, the best current advice when light should be avoided to facilitate circadian adaptation is to wear dark sunglasses.

PHARMACOLOGICAL FATIGUE COUNTERMEASURES (PFCMs)

34. The RCAF Surgeon is responsible for regulating and monitoring the use of PFCMs, which include any medications which promote sleep, manipulation of circadian rhythms (ie

chronobiotics), and or alertness for the purposes of fatigue risk mitigation. This operational use of medications is different from normal clinical practice and requires special oversight and monitoring. All PFCMs must be evaluated for safety and effectiveness by the Aerospace and Undersea Medical Board (AUMB), recommended by the RCAF Surgeon, and approved for use by the Surgeon General. Requests for changes to PFCMs (including types, personnel eligible to use, dosing and allotment, indications, or directions for use) shall be staffed to the RCAF Surg through the Aerospace Medicine professional technical network.

Ground Testing

35. Before receiving a prescription for operational use, air and ground crew members must ground test PFCMs under the direction of an authorized HCP (see “Ground testing” in definition section) to ground test a PFCM, the authorized HCP shall:

a. Prescribe a trial dose of the PFCM to the individual;

b. After completion of the trial, review the member’s ground testing experience to determine if it was successful (ie. absence of concerning adverse effects or safety concerns). Sample questionnaires that may be used to facilitate ground testing are located at Annex F (sleep medications) and Annex G (alertness medications). Local over-the-counter medication (OTC) forms may also be adapted to document ground testing.

c. Document successful or unsuccessful ground testing in the member’s medical record (ie. CFHIS). Members successfully completing ground testing may be prescribed the medication thereafter for operational fatigue management IAW RCAF Surg directions.

Sleep Medications

36. Sedative hypnotics are used to induce and sustain sleep, generally in situations where the individual’s circadian rhythm is not programmed for sleep. Such circumstances may occur during stopovers when transiting to operations in a new time zone, during the first few nights after arrival in a new time zone, or for daytime sleep prior to night operations. Such use of hypnotic medications may facilitate transition to the new operational time zone, and permit daytime sleep prior to night operations.

37. Melatonin may also be helpful in initiating and sustaining sleep. For sleep effects, the recommended dosage is 1-3mg sustained release.

38. Aircrew must have completed a baseline trial of any sleep medication before a prescription for operational use is provided. The baseline trial should begin with the lowest dose and titrate upwards only if required to achieve an adequate sleep, with a repeat documented baseline trial at each dosage level. The following are examples of acceptable indications for prescribing sleep medications:

a. During transit layovers when sleep is required at an off-nominal circadian time;

b. On arrival in a new theatre of operations to promote sleep during the first 7 days/nights of circadian acclimatization; or

c. To facilitate daytime sleep prior to night operations.

Table 1 shows the sleep medications currently approved for use by RCAF aircrew.

Table 1: Sleep Medications

Medication	Trade Name	Type	Half-Life (hours)	Grounding (hours)	CF Formulary	Dosage (mg)
Temazepam	Restoril	Benzodiazepine	8-9	12	BL	7.5/15
Zopiclone	Imovane	Non-benzo "Z" Cyclopyrrolone	5	12	BL	3.75/5/7.5
Zolpidem	Sublinox	Non-benzo "Z" Imadazopyridine	2-3	6	SA	10
Melatonin SR				Not required	SA	1 to 3 mg SR

Chronobiotic Medication

Melatonin

39. Melatonin is considered by Health Canada to be a 'natural health product' (NHP). These are regulated under both the Natural Health Products Regulations and the Food and Drugs Act. Standards to assure the reliability of preparations sold in Canada have been in effect since 2007, and updated in August 2010. Melatonin is available in both short-acting and sustained-release forms. Melatonin is effective in enhancing circadian phase shifting (chronobiotic effect) and may be effective in sleep induction and sleep maintenance (sleep effect).

40. In addition to its use as a sleep medication, the AUMB recommends the use of melatonin by RCAF aircrew for circadian phase adjustment or to facilitate sleep at off-nominal times as described in Annex D. Melatonin 1mg immediate release and 1mg sustained release formulations have been approved for use by aircrew, and are available through the CAF Formulary for use IAW RCAF Surgeon direction.

41. For chronobiotic effects, the following preparations have demonstrated efficacy:

a. Phase Advance:

(1) Melatonin 0.5 mg regular release, taken 2 hours before DLMO (for phase advance in the days before travel).

(2) Melatonin 3 mg sustained release, taken approximately 5 hours before DLMO (on the day of travel, to facilitate phase advance and help with sleep during the flight).

b. Phase Delay:

(1) Melatonin 3 mg regular release taken 9-10 hours after DLMO.

Alertness medications

45. Alertness medications are central nervous system stimulants, and include caffeine dexamphetamine, and modafinil. Caffeine is the only medication currently approved as an operational PFCM. Dexamphetamine and modafinil are NOT approved as operational PFCMs.

Caffeine

46. Caffeine is widely used to promote wakefulness and is available from a variety of sources including beverages, tablets and chewing gum. Caffeine is an adenosine inhibitor which increases acetylcholine, epinephrine, dopamine, norepinephrine, and serotonin. Coffee is the most common beverage source, but energy drinks such as Red Bull are also widely used. Ingested as a beverage, caffeine is absorbed slowly with an onset after about 45 minutes, a peak at 1 hour, and duration of 4-5 hours. However, the stimulating effect and duration of caffeine is highly variable from person to person depending on habitual intake and is greatly attenuated in individuals who routinely drink more than 3 cups of coffee per day. Increased ingestion of caffeine by habituated individuals can lead to caffeine intoxication, resulting in anxiety, palpitations, and cardiac arrhythmias.

47. Chewable, immediate release oral caffeine products (eg Chewpod tablets) provide a more reliable dose of caffeine with rapid absorption through the buccal mucosa, with onset usually within 5-10 minutes. Compared to beverages, chewable caffeine products are convenient, portable, and do not load the user with excess fluid. Table 2 below shows the caffeine content of common sources.

Table 2: Caffeine Content of Various Products

Product	Serving Size	Caffeine Content (mg)
Caffeine tablets	Regular strength	100
Tim Hortons coffee	Small (10 oz)	100
Starbucks coffee	Tall (12 oz)	240
Espresso	45-60 ml	100
Coke Classic	12oz (355 ml)	34
Mountain Dew		54
Jolt Cola	695 ml	280
Red Bull	8 oz	80
StayAlert gum	1 piece	100

48. Moderate use of caffeine-containing products (eg. beverages, gum, chews) is permitted for air and ground crew.

49. Caffeine Chewpod tablets have been approved as a PFCM in the framework of the RCAF FRMS, per Ref C. However, use of caffeine Chewpods shall be IAW specific direction issued by the RCAF Surgeon. When authorized by the RCAF Surgeon, the following principles will be followed for caffeine Chewpod tablets.

a. Caffeine Chewpod tablets shall not be used as an operational substitute for appropriate sleep scheduling.

b. Prior to use:

(1) caffeinated beverages (eg coffee, tea, soft drinks) should be limited to not more than three per day for at least 3 days before use of caffeine gum as an operational alertness medication. Higher beverage caffeine usage induces tolerance, which reduces the effectiveness of chewable caffeine as an alertness medication, but may still result in other caffeine adverse effects eg palpitations, shakiness;

(2) Caffeine Chewpod tablets shall be ground-tested before using operationally;

c. Directions for use: For operational use, two chewable 50mg caffeine Chewpod tablets may be chewed if human performance related to fatigue is suspected or expected.. Dosing may be repeated hourly as required up to a maximum of 4 doses (400mg) in a 24 hour period; and

d. Discontinue use: Members shall discontinue use and report any concerning side effects (eg. anxiety, palpitations, or arrhythmias) to their HCP.

ANNEX A: TIPS FOR GOOD SLEEP HYGIENE/HABITS

1. Good sleep is restorative and important for optimal waking performance and function. Sleep hygiene recommendations are as follows:

   a. Avoid intentional sleep restriction – use your head, go to bed;

   b. Ensure sufficient daily sleep;

   c. Try to keep consistent wake-up and bed times every day including weekends;

   d. If unable to fall asleep after 30 minutes, do not remain in bed awake. Instead, get up to avoid associations of waking and anxiety with sleeping in the bed. Stay up for several minutes and try again, repeat if necessary until fatigue takes over; and

   e. After 24 to 48 hours of sleep deprivation, do not sleep overly long during the recovery sleep (no more than 10 hours). Sleeping too long may interfere with the normal sleep/wake schedule and will cause significant sleep inertia and lethargy. One normal sleep period for an individual is usually sufficient to recover from 24 hours of sleep deprivation.

2. Sleep environment recommendations include:

   a. Associate environment with sleep, i.e., use bed and bedroom for sleep, rather than for watching TV, etc.;

   b. Sleep environment should be quiet and comfortable;

   c. When possible, sleep in complete darkness and avoid even brief exposure to sunlight/bright light during the sleep period;

   d. When sleeping outside the usual sleep period (during the day) or location, prepare as if it were the normal sleep period and wear normal sleep clothes, darken the room, keep noise to minimum, or use white noise generator (e.g., a fan); and

   e. Sleeping quarters should isolate night-shift personnel from the activity of day-shifters to reduce environmental noise.

3. Exercise recommendations include:

   a. Exercise can promote good sleep. Vigorous exercise should be done in the morning or late afternoon and avoided within 2 hours of bedtime; and

   b. Relaxation exercises like yoga or meditation can be performed before bed to help promote a good night’s sleep.

4. Caffeinated beverages/smoking recommendations:

    a. Caffeine should be avoided up to 12 hours before sleep but individuals with tolerance may be able to tolerate it much closer to bedtime (up to 4 hours); and

    b. Nicotine is a stimulant and smoking should be avoided within 2 hours of bedtime (ideally completely; never ever in bed).

5. Alcohol/food recommendations:

    a. Alcohol may help induce sleep, but it disrupts sleep stages (deep and REM) and results in non-restorative sleep, especially in higher doses. Avoid having more than 2 drinks in the 4 hours before going to bed;

    b. Foods that cause gastro-esophageal reflux may disrupt sleep. Avoid large, spicy meals especially in the 2 hours before bedtime; and

    c. High fat and high carbohydrate meals should be avoided when phase shifting due to the metabolic impact on circadian dysynchrony.

ANNEX B: SCREENING FOR SLEEP DISORDERS

Sleep screening should include questions about:

1. Sleep hygiene – ask about usual time to bed and to arise, weekdays and weekends. Usual number of hours of sleep during workdays and weekends/holidays. Bedroom set-up (bed, lighting, ventilation, TV, etc). Questions to consider include:

    a. Are you able to fall asleep in 15 minutes or less?

    b. Do you wake up during the night and have difficulty getting back to sleep?

    c. Do you wake up one or two hours early in the morning?

    d. Do you have thoughts racing through your mind or anxiety that keeps you from sleeping?

    e. Are you bothered by pain during the day or which keeps you awake at night?

    f. Do you grind your teeth at night? Do you have sore jaws on awakening or during the day?

6. Nocturnal awakenings – how many on average; causes if identified (nocturia, heartburn, pain, children, uncertain).

7. Use of sleep medications or herbal sleep aids.

8. Family history of sleep disorders.

9. Use of alcohol, caffeine products in evenings.

10. Screening for sleep disorders:

    a. Obstructive sleep apnea:

        (1) Snoring – Do you snore or does your bed partner report that you snore?

        (2) Witnessed apneas – Do you stop breathing during sleep, or does your bed partner report that you stop breathing?

        (3) Do you suffer from morning headaches?

        (4) After a night's sleep, do you feel refreshed?

        (5) Do you feel tired or sleepy through much of the day?

    b. Narcolepsy – Do you have sudden, uncontrollable sensations to sleep during the day, or periods of inexplicable sudden weakness?

c. Periodic leg movements of sleep – While in bed, do you experience crawling and/or achy feelings in legs while with an urge to move legs, walk?

d. Parasomnias:

(1) Do you sleep walk?

(2) Do you talk during sleep?

(3) Do you experience repetitive nightmares?

11. Mental Health – screen for mental health issues (depression, anxiety, etc.), which may significantly impact sleep.

ANNEX C: EPWORTH SLEEPINESS SCALE

Use the following 0-3 scale to rate how likely you are to doze off or fall asleep in the following situations, in contrast to just feeling tired.
0 – Would never doze
1 – Slight chance of dozing
2 – Moderate chance of dozing
3 – High chance of dozing

SITUATION	CHANCES OF DOZING
Sitting and reading	
Watching TV	
Sitting, inactive in a public place (e.g. theatre or meeting)	
As a passenger in a car for an hour without a break	
Lying down in the afternoon when circumstances permit	
Sitting and talking with someone	
Sitting quietly after lunch without alcohol	
In a car, while stopped for a few minutes in traffic	

SCORING
1-6 – No sleepiness concerns
7-9 – Normal
≥ 9 – Requires further investigation/follow-up

ANNEX D: TREATMENT-GRID PROTOCOLS

The DRDC circadian phase shift project showed that to facilitate circadian changes, the following interventions proved beneficial:

For Phase Advance and Eastward travel (e.g. Canada to Europe):

1. Melatonin

    a. 3.0 mg sustained release 5 hours before DLMO; or

    b. 0.5 mg regular release 2 hrs before DLMO.

Note that the small 0.5 mg dose of melatonin can achieve a similar phase shift magnitude to that provided by a 3.0 mg dose as long as the 0.5 mg dose is taken at its optimum time. Since the 3 mg dose often results in sleepiness and the 0.5 mg dose does not, the 0.5 mg dose is preferable when sleepiness should be avoided (e.g. for phase advance before travel) whereas the 3.0 mg dose is used when sleepiness is beneficial (e.g. during travel to facilitate sleep).

2. **Light Treatment** - Bright light (natural, or through specific devices) 9-11 hours after DLMO, corresponding for most individuals to 0600-0800h in the home time zone (e.g. for travel from Ontario to Western Europe, this equates to 1100-1300h in Europe).

3. **Light Avoidance** - Avoid light in the period 4 to 6 hrs after DLMO (e.g. for travel from Ontario to Western Europe, early morning light in Europe).

For Phase Delay Westward Travel (e.g. Canada to Japan):

4. **Melatonin** - 3.0 mg regular release about 9-10 hours after DLMO, i.e. about 0600h home time in an individual with a DLMO of 2100h.

5. **Light Treatment** - In the interval 4 to 6 hours after DLMO, i.e., one hour light exposure between about 0100h to about 0300h home time for an individual with DLMO 2100h.

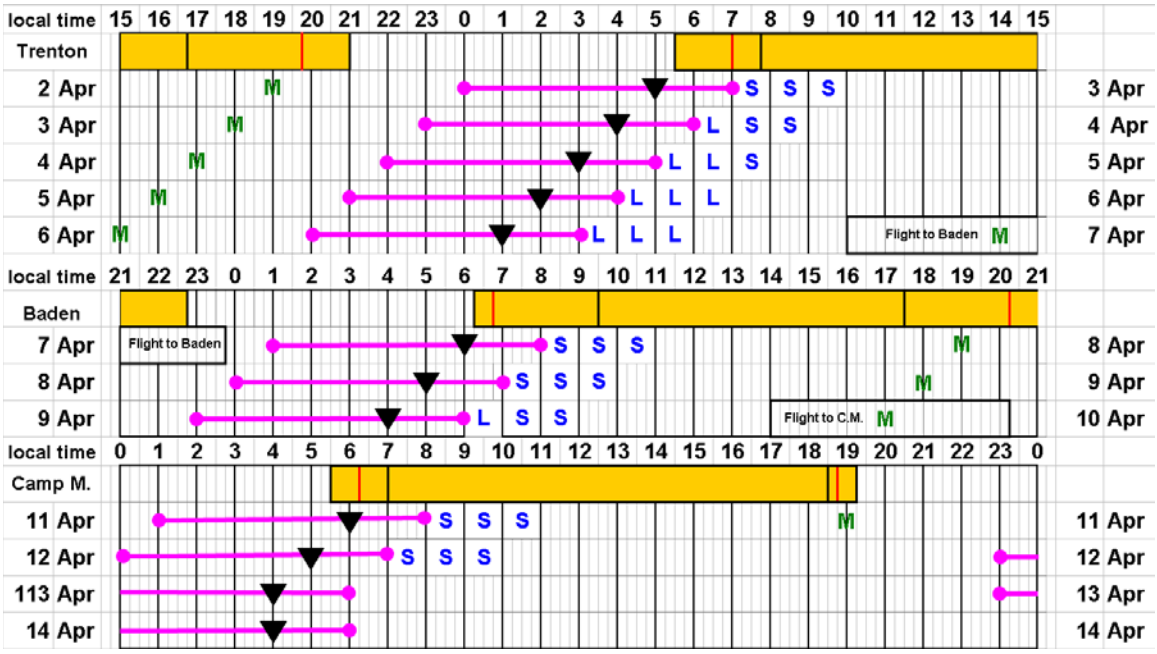
6. **Light Avoidance** - Avoid light during the phase advance portion of the light PRC (from 9 to 11 hours after the DLMO).

Phase Shifting Treatment Grid Protocols

7. Ideally, light and melatonin interventions for phase shifting are prescribed by way of specific treatment-grid protocols. An example of a phase advance treatment-grid protocol for adaptation for travel from Trenton to Camp Mirage is shown below. A similar treatment-grid protocol can be constructed for a phase delay itinerary. Treatment-grid protocols can be constructed for any itinerary, or, for shift work schedules.

8. The decision as to whether to use a phase advance or phase delay approach is based on a variety of factors including the direction of proposed travel, the magnitude (time zones or hours) of the phase shift, operational factors, and the individual's natural rhythm ("larks" do better with phase advance while "owls" do better with phase delay).

Figure 1: Pre-adapt to C.M. by Circadian Phase Advance



9. Notes:

a. Horizontal yellow bars illustrate maximum photoperiod (at summer solstice) for each of the cities on this itinerary. The vertical bold black lines in the yellow horizontal bars illustrate the minimum photoperiod (at winter solstice). Vertical Red lines illustrate the current photoperiod.

b. The pink bars with a circle on each end represent times in bed.

c. The black triangles represent the body's core temperature minimum (Tmin), a phase marker for the circadian clock, the sleepiest circadian time, and a rough marker for crossover from phase delays to phase advances in the light PRC. The body generally delays about 1.5 hours per day and advances 1.0 hours per day with appropriate light and melatonin treatment. Hence, during advance treatments, the Tmin advances by an hour a day and for delay treatments, the Tmin is delayed by 1.5 hours per day.

d. The blue **"S**" indicates sunlight exposure, whereas the blue **"L"** indicates use of a light treatment device which is typically used when treatment is given during a time of darkness where there is no sunlight in the local area.

e. The green **"M"**indicate ingestion timings for a 0.5 mg dose of melatonin.

ANNEX E: GENERIC PHASE SHIFT ADVICE

Eastbound Travel (Phase Advance)

1. For the 2-3 days before the flight:

    a. Try to get to bed earlier and wake up earlier (ideally, an hour a day).

    b. Take melatonin 0.5 mg 2 hours before DLMO (nominally, 7 pm first day then one hour earlier each day).

2. Travel day:

    a. Use caffeine only until 10 am.

    b. Take melatonin 2-3 mg SR prior to boarding.

    c. After 2 hours on the flight eastward, use an eye mask and earplugs, and try to sleep for the rest of the flight. When you are not asleep, avoid light and wear sunglasses. Do not take caffeine on the flight.

3. Day of arrival:

    a. Avoid light and wear sunglasses until noon local time.

    b. From noon onwards, try to get as much bright light exposure as possible until bedtime, particularly in the afternoon. If you have to be indoors, try and get regular breaks outside (even short intermittent exposure will help).

    c. Use caffeine through the day to 6 pm (1 caffeinated beverage every 1-2 hours).

    d. Nap only if necessary, late in the afternoon, max 1.5 hours (use alarm).

    e. Take melatonin 2-3 mg SR at bedtime.

4. Day after arrival:

    a. Sleep in as long as you can.

    b. Avoid bright light before 10 am. Wear sunglasses.

    c. After 10 am, get as much bright light as possible through the day.

    d. No caffeine after 3 pm.

    e. Take melatonin 2-3 mg SR at bedtime.

5. Second day:

a. Get bright light in the morning and early afternoon.

b. No caffeine after 3 pm.

6. Repeat for 1-2 days.

Westbound Travel (Phase Delay)

7. For the 2-3 days before the flight:

a. Try to stay up later and wake up later (ideally, 1.5 hours per day); get as much bright light exposure as possible in the evenings.

b. Take melatonin 0.5 mg regular release 11-12 hours after DLMO nominally, 8 am day 1, 9 am day 2, etc.).

c. Stay out of bright light or wear sunglasses in the morning.

8. Day of travel:

a. Avoid light; wear sunglasses until the flight.

b. No caffeine before the flight.

c. Try to get to sleep early on the flight. Use eye mask/earplugs to help.

d. If you wake up later on the flight, try to get bright light exposure.

9. Day of arrival:

a. Get bright light exposure, particularly in the evening until bedtime.

b. If you need to nap, have it late afternoon (20-45 mins max, use alarm).

c. Go to bed as late as you can up to 0100h local time.

d. Use melatonin 3 mg regular release at bedtime.

e. Sleep as long as you can.

10. Day after arrival:

a. Avoid bright light first thing in the morning, but get as much bright light as possible from mid-afternoon to bedtime.

b. No caffeine after 3 pm

c. Use melatonin 2-3 mg regular release at bedtime.

11. Following 1-2 days:

a. Bright light in the afternoons/evenings.

b. No caffeine after 3 pm.

Transition to Night Shifts

12. For the two days before starting the night shift, go to bed as late as possible and sleep in the next day as late as possible.

13. Take 1 mg regular release melatonin 0600-0800h.

14. Sleep in as late as possible on the morning before starting the night shift (to max 10 hours total sleep time).

15. Take a nap (1.5-3 hours) late afternoon before starting the first night shift. If this is not possible even 20-45 minutes is helpful.

16. Get as much bright light as possible in the evening and during the shift.

17. Use caffeine every 1-2 hours until 3-4 am during the shift.

18. After the night shift:

a. Get bright light on the way home.

b. Take 1 mg SR melatonin at home.

(1) If this isn't enough to sustain an 8 hour sleep, take 2 mg or 3 mg SR the next few mornings.

c. Go straight to bed/sleep.

d. Sleep as long as possible.

(1) Use eye-mask or blackout curtains, earplugs.

(2) Turn off phones, pagers where possible.

e. Take a nap in the late afternoon/evening

f. Get bright light exposures after the nap.

19. Back on nightshift:

a. Get as much bright light as possible.

b. Use caffeine through the early portion of the shift.

(1) Avoid caffeine late in the shift, within 5-6 hours of next sleep.

20. Repeat through the night shifts:

    a. Take melatonin (1-3 mg SR) on arrival at home and sleep as soon and as long as possible.

    a. Take an evening nap.

    b. Get bright light on the way to work and at work.

    c. Use caffeine during the early shift. Stop 5-6 hours before next sleep period.

Transition from Night Shift To Day

21. After the last night shift, get to sleep as soon and as long as you can.

22. Take melatonin 1-3 mg SR before bed (to sustain sleep).

23. When you awake, get as much bright light as possible but avoid light in the 2-3 hours before bedtime.

24. Do not take an afternoon nap.

25. No caffeine for 5-6 hours before bedtime.

26. Get as much bright light as possible throughout the day.

27. Repeat for the next 2-3 days.

    a. Take melatonin at bedtime.

    b. Bright light on awakening, and throughout the day.

    c. No caffeine in the 5-6 hours before bedtime.

ANNEX F: GROUND TESTING FOR SLEEP MEDICATIONS

Exercise I: Effectiveness for Sleep Onset

Take medication at 1800-2000h and attempt to go to sleep in a cool, dark, quiet room. Avoid alcohol or stimulants.

1. Medication _____ Dosage _____ Start time _____

Complete the assessment below upon awakening. If the medication did not help you fall asleep consult a flight surgeon for a new dose or different medication.

2. At what time did you awaken? _____

3. How many hours/minutes did you sleep? _____

4. Rate the quality of your sleep

   Not Restful 1 2 3 4 5 6 7 Very Restful

5. What were the positive aspects of the medication (if any)?

6. What were the negative aspects of the medication (if any)?

Exercise II: Part 1 Emergent Awakening

Take the medication at normal bedtime. Set alarm to awaken at 90 minutes. Answer the questions immediately after turning off the alarm.

1. Medication _____ Dosage _____ Start Time_____

2. How did you awaken and feel with the alarm?

   With Difficulty 1 2 3 4 5 6 7 Easily

   Feeling Groggy 1 2 3 4 5 6 7 Feeling Alert

3. Print your name: _____

Go back to sleep. Continue on the back of this paper after awakening in the morning.

Exercise II: Part 2 Morning Awakening
Answer the questions immediately after awakening in the morning.

1. How easily were you able to fall back asleep after emergent awakening in Part 1?

   Very Difficult 1 2 3 4 5 6 7 Very Easily

2. How do you feel this morning?

   Groggy 1 2 3 4 5 6 7 Alert

3. What were the positive aspects of the medication (if any)?

4. What were the negative aspects of the medication (if any)?

Please return this completed document to your flight surgeon

ANNEX G: GROUND TESTING FOR ALERTNESS MEDICATIONS

Take alertness medication immediately upon awakening.

1. Medication _____ Dosage _____ Start time _____

2. How alert did you become with the medication? (Circle one)

   Not Alert 1 2 3 4 5 6 7 Very Alert

Complete the following day.

3. What were the positive aspects of the medication?

4. What were the negative aspects of the medication?

5. Did you experience any of the following? (Please circle all that apply)

   Nervousness Anxiety
   Tremors

   Palpitations Headache
   Abnormal sweating

   Other (please elaborate)

6. How alert were you able to stay the rest of the day?

   Not Alert 1 2 3 4 5 6 7 Very Alert

7. How easily were you able to fall asleep that night?

   Not Alert 1 2 3 4 5 6 7 Very Alert

8. Any other comments about this trial?

Please return this completed document to your flight surgeon.