



TC-1002872



TP 14578E
April 2007

Fatigue Risk Management System
for the Canadian Aviation Industry

Trainer's Handbook



Transport
Canada Transports
Canada

Canada

edu.au

FRMS consultants
Adelaide, Australia

Project Team

Edu.au

Kirsty McCulloch
Angela Baker
Sally Ferguson
Adam Fletcher
Drew Dawson

Transport Canada

Isabelle Marcil, Transportation Development Centre (TDC)
Jacqueline Booth-Bourdeau, Civil Aviation
Mark Laurence, Civil Aviation
TDC Communications Unit

Notices

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Transport, 2008.

All rights reserved. This document may be reproduced in part or in whole and by any means only in the context of personal or public non-commercial use only. Any other use or any modification of this document is strictly forbidden under the applicable copyrights law without prior written permission of Transport Canada. Please contact the Civil Aviation Communications Centre at 1-800-305-2059 (EST) for assistance. The information in this publication is to be considered solely as a guide and should not be quoted as or considered to be a legal authority. It may become obsolete in whole or in part at any time without notice.

Transport Canada does not endorse products or manufacturers. Trade or manufacturers' names appear in this report only because they are essential to its objectives.

Une traduction de ce document est également disponible en français : *Système de gestion des risques liés à la fatigue pour le milieu aéronautique canadien : Manuel du formateur*, TP 14578F.

Preface

This document is part of the Fatigue Risk Management System (FRMS) Toolbox for Canadian Aviation developed by Transport Canada and fatigue consultants *edu.au* of Adelaide, Australia.

The FRMS toolbox includes the following components:

1. *FRMS for the Canadian Aviation Industry: An Introduction to Managing Fatigue*, TP 14572E: introductory material intended to raise awareness about fatigue
2. *FRMS for the Canadian Aviation Industry: Fatigue Management Strategies for Employees*, TP 14573E: provides the knowledge and skills required to apply appropriate fatigue management strategies at the individual level
3. *FRMS for the Canadian Aviation Industry: Employee Training Assessment*, TP 14574E: an optional module intended to assess employee competence in topics covered in the Fatigue Management Strategies for Employees workbook
4. *FRMS for the Canadian Aviation Industry: Developing and Implementing a Fatigue Risk Management System*, TP 14575E: explains how to manage the risks associated with fatigue at the organizational level within a safety management system framework
5. *FRMS for the Canadian Aviation Industry: Policies and Procedures Development Guidelines*, TP 14576E: proposes a policy structure while providing examples and guidelines to help organizations through the process of designing fatigue risk management policies and procedures
6. *FRMS for the Canadian Aviation Industry: Introduction to Fatigue Audit Tools*, TP 14577E: provides an overview of tools available to employers to help determine whether scheduling provides employees with adequate opportunities to get sufficient sleep
7. *FRMS for the Canadian Aviation Industry: Trainer's Handbook*, TP 14578E: in addition to a training presentation on fatigue, fatigue management systems, and individual fatigue management strategies, the package includes background information for delivery of the workshop, learning outcomes, and questions frequently asked by participants

These documents are available on the Transport Canada web site at www.tc.gc.ca.

Contents

How to Use This Handbook	1
Purpose of the Trainer’s Handbook	1
Format of the Training	1
Slideshow Presentation	2
Speaking Notes	2
Prepare for the Workshop	2
Training Techniques	2
Frequently Asked Questions	3
Reference Material	7
Appendix A – Slideshow Presentation	

How to Use This Handbook

Purpose of the Trainer's Handbook

An important part of a fatigue risk management system (FRMS) consists of training all employees in the management of fatigue as a safety hazard. Training materials have been designed to meet the business needs of participating organizations and the skills development needs of their employees in relation to fatigue risk management.

This handbook is intended to provide you, as a trainer, with the tools and strategies to prepare and deliver the face-to-face component of the employee training, *Fatigue Management Strategies for Employees*:

- slideshow presentation
- speaking notes
- information on how to prepare the workshop
- frequently asked questions
- bibliography of reference material

Format of the Training

The slideshow presentation is structured so that it can be tailored to different employee groups (e.g., maintenance employees, flight crew, cabin crew). The presentation provides a good overview of fatigue risk management and is intended to be used in conjunction with the paper- or web-based employee training tools and assessment to ensure that participants have understood and can apply the knowledge presented in the workshop.

The presentation is most effective for groups of 10 to 20 people to allow for participant interaction. Participants in groups this size tend to retain more knowledge and get greater benefit from the face-to-face training sessions.

Slideshow Presentation

The most important component of this handbook is the slideshow presentation (see Appendix A). The presentation is approximately 180 minutes long, and has been divided into three modules:

1. Causes and Consequences of Fatigue
2. Fatigue Risk Management
3. Personal Fatigue Countermeasures

The presentation should be casual, and participants encouraged to ask questions and/or share personal anecdotes. Group activities are provided throughout to encourage interaction. You should use a whiteboard or flipchart to document participant responses to the group activities.

Speaking Notes

The notes section of the presentation contains a comprehensive set of speaking notes for each slide. You should use the text as a guide, and adjust the words, phrasing, and examples to your own presentation style and experience.

Prepare for the Workshop

You should be familiar with the organization's FRMS. Review the training material and make changes as required to ensure the slides are consistent with company policy. Pay particular attention to slides 19 and 20, which are intended to outline the specific responsibilities of employees and management under the organization's FRMS.

Make yourself familiar with the training material – in particular, the frequently asked questions section of this handbook. It's a good idea to become familiar with the other manuals, guides, and workbooks in this series. Consult the list of reference material if you would like to know more about certain topics.

Training Techniques

As a trainer, it is important to understand that different people learn in different ways. It's important to incorporate a variety of training techniques within your presentation style. Get the group participating through class discussion, group activities, anecdotes from participants, etc.

Help the group retain the information presented by repeating it and by illustrating the discussion using examples or analogies.

Remember that the training is competency-based rather than awareness raising. Participants should demonstrate that they can apply the skills presented in the workplace.

This handbook is intended as a support tool for the *Fatigue Management Strategies for Employees* workbook. You may decide to use the workbook during the presentation, using some of the scenarios, case studies, or exercises as activities the students can complete in small groups.

Frequently Asked Questions

1. *Why so much emphasis on mental fatigue? Isn't physical fatigue equally important?*

Physical fatigue can impair physiological and psychological performance in a similar way to mental fatigue. However, unlike mental fatigue, physical fatigue can be managed with rules governing hours of service. Mental fatigue, on the other hand, is more complex and needs attention on many different levels. Using a systems-based approach to managing mental fatigue will also manage physical fatigue.

2. *Is it true that older people need less sleep than younger people?*

It is true that older people get less sleep than younger people. However, there is no evidence that they need less sleep. As we age, it is common for our sleep patterns to change. While the overall amount of sleep we get remains roughly the same, older people tend to wake more often during the night and get their sleep in shorter blocks. Age also brings hormonal changes that affect the type of sleep we get – older people experience less REM (dreaming) sleep than younger people. This is one of the reasons that adapting to shiftwork becomes more difficult as we get older.

3. *How do you determine whether fatigue is a factor in accidents?*

In accident statistics, fatigue is generally inferred from the time of day that the incident took place (midnight to 6 a.m.). Single vehicle accidents in which suicide has been ruled out are also included. Other factors that are considered include time on task (greater than 9 hours) and the work schedule of the previous seven days. You can see that this is not very exact – the contribution of fatigue to accidents is probably underreported.

4. *When you look at the graph showing performance after being awake for a long time (Slide 12), why does performance start to go back up after being awake for 24 hours?*

This is a demonstration of the effect of the body's circadian rhythm. When the sun rises, our body "resets" (to a degree), and performance improves as the body naturally wakes and becomes active. Many people call it getting a second wind. However, it's not likely that performance will reach the same level as the previous day.

5. *Can performance testing be used in the workplace as a check of fitness for duty?*

Some workplaces may use performance tests for exactly that. However, there are a number of limitations. First, every employee must be tested against his or her own baseline (when they are not fatigued). Second, performance testing requires a lot of data management, and supervisors and employees need feedback right away. Third, it is difficult to draw a line at which an employee is "unfit for duty" based on the test. Tests can be used as a tool to determine how often and under what conditions employee performance is worse than normal.

6. *Isn't an FRMS just dictating to employees what they do in their time away from work?*

An FRMS is not about controlling employees' lives, but it is about setting an expectation that they arrive at work fit for duty. This includes managing their time away from work to ensure they receive adequate rest and sleep. If, for whatever reason, employees aren't able to get enough rest, it is their responsibility to report it as a potential risk. It's no different from rules about the number of hours you must wait between drinking alcohol and starting work.

7. *You say individuals need 5-6 hours sleep to sustain appropriate levels of performance. What if an employee maintains he or she only requires 2 hours sleep a night, and feels perfectly fine?*

Research has found that most people need 5-6 hours sleep. A small percentage of people can get by on less. More often what happens is that people get used to functioning on less sleep. Their standard of feeling wide awake and alert drops, and they get used to living and performing at a lower level of alertness. It becomes normal. When these same people take a long holiday, they usually sleep a lot more than 5 hours and feel a lot more alert. If you consistently report getting less than 5 hours' sleep, but don't display any fatigue-related symptoms, you're not likely to be a significant risk to the organization. However, conduct an experiment and try to get 6-8 hours sleep for a couple of weeks. If you feel a positive difference in your level of alertness, you should aim to get this much sleep on a more regular basis. On the other hand, if you still feel you can get by on less than 5 hours of sleep, you should consider seeing a doctor to find out whether your performance is really as good as it could be, or whether you may have a sleeping disorder.

8. *How do I know if I have a sleep deficit?*

Besides feeling tired all the time, one of the major signs of sleep deficit is sleep latency – how long it takes you to fall asleep. A normal sleep latency is approximately 15 minutes. If you need a lot less to fall asleep, it may mean that you have a sleep deficit – particularly if you fall asleep within one or two minutes, or find yourself falling asleep unintentionally. If you take a lot longer to fall asleep, you may be suffering from insomnia.

9. *Is there an ideal length for a nap?*

If you are really fighting sleep, and are trying to perform a job that involves any level of risk (e.g., driving, engine overhaul, refuelling), any nap is better than no nap. Research has found that naps as short as 10 minutes can be effective in increasing alertness. The longer the nap, the longer the benefits will last. However, longer naps are also associated with longer periods of sleep inertia (that groggy feeling when you wake up) afterward. When napping is permitted in the workplace, it should be limited to about 40 minutes.

10. *Caffeine doesn't seem to affect me at all – in fact, if I don't have a coffee before bed, I wake up with a headache. Why is that?*

Caffeine is only effective when used strategically. People who regularly drink caffeine will not get the same level of stimulation as people who only drink caffeine when they are tired and need a kick. Caffeine is addictive. Regular caffeine drinkers who suddenly stop often experience headaches, dizziness, and/or nausea. If you wake up with a headache if you don't have a coffee before bed, it may mean that your body is over-dependent on caffeine.

11. *I find that rolling down the window or listening to the radio or chewing gum helps me to stay awake when driving home. How effective are these strategies for reducing the risk of a fatigue-related accident?*

Contrary to popular opinion, these techniques for staying alert while driving are not enough to safeguard you against falling asleep at the wheel or causing an accident. Driving fatigued impairs your performance in a similar way that driving drunk does. Even if you think you're okay, bear in mind that sleep can come when you're not expecting it. You are not always able to accurately judge just how sleepy you really are.

12. *Why do we need to sleep?*

Scientists don't know the exact reason we need to sleep, although it is clearly necessary to allow the body to recover from the stresses of the day. Humans that have suffered prolonged sleep deprivation experienced symptoms such as hand tremors, slurred speech, increased sensitivity to pain, and reduced mental and physical performance.

13. *When is the human body most susceptible to the effects of fatigue?*

The lowest point in the circadian rhythms that affect the body's alertness is between 2 a.m. and 6 a.m. If you wake from a nap in this period, remember that you're likely to experience long sleep inertia. If you're awake during these times, your alertness may be affected.

14. *Why is fatigue receiving so much attention now, when it has never been an issue in the past?*

First, our understanding about the risks associated with fatigue has evolved a lot in recent years. And as more and more people take up shiftwork and other alternative working arrangements, the potential for fatigue-related accidents increases. This risk is made worse by the increasing use of high-powered machinery, where the margin for error is lower and the consequences of accidents potentially very serious.

15. *Would you encourage the use of sleeping pills as an aid to getting enough sleep in time away from work?*

If you cannot sleep at all, or have a lot of difficulty getting to sleep, sleeping pills can be an effective strategy to retrain your body to sleep. However, you shouldn't use them over the long term. You can develop a dependency on sleeping pills after just one week. Long-term use of sleeping pills can cause irritability, headaches, nausea, depression, muscle loss, and increased appetite. You should use them only for short periods.

16. *Does shiftwork have any impact upon pregnancy?*

Although the effects of shiftwork on pregnancy are slight (only marginally higher than for day workers), there are some effects that are worth being aware of. Some types of shiftwork have been linked to increased time to conception, increased risk of premature birth, lower rates of fetal growth, and increased risk of miscarriage. Although these risks are slight, you may wish to discuss them with your doctor.

Reference Material

General Topic	References
Background to Fatigue	<p>Batelle Memorial Institute (2002) <i>An Overview of the Scientific Literature Concerning Fatigue, Sleep, and the Circadian Cycle</i>. http://cf.alpa.org/internet/projects/ftdt/backgr/batelle.htm</p>
The Circadian Clock	<p>Rajaratnam, S.M.W. & Arendt, J. (2001) 'Health in a 24-h society', <i>The Lancet</i>, Vol. 358, pp. 999-1005.</p> <p>Eastman, C. I., Gazda, C. J., Burgess, H. J., Crowley, S. J. & Fogg, L. F. (2005) 'Advancing circadian rhythms before eastward flight: A strategy to prevent or reduce jet lag', <i>Sleep</i>, 28(1), pp. 33-44.</p>
Sleep	<p>Eastern Perth Public and Community Health Unit, Royal Perth Hospital & the Alcohol and Other Drugs Program, Public Health Division, Department of Health (2005) <i>A Good Night's Sleep</i>, Department of Health, Government of Western Australia. www.population.health.wa.gov.au/pdfs/Files/9720sleepweb.pdf</p> <p><i>Common Sleep Disorders</i> www.clevelandclinic.org/health/health-info/docs/3300/3373.asp?index=11429</p> <p><i>Sleep Disorders</i> www.healthieryou.com/sleep.html</p>

Consequences of Fatigue	<p>Dinges, D. (1995) 'An overview of sleepiness and accidents', <i>Journal of Sleep Research</i>, Vol. 4 (Suppl 2), pp. 4-14.</p> <p>Leger, D. (1994) 'The Cost of Sleep-Related Accidents: A Report for the National Commission on Sleep Disorders Research', <i>Sleep</i>, 17(1), pp. 84-93.</p>
Comparing Fatigue & Alcohol	Lamond, N. & Dawson, D. (1999) 'Quantifying the performance impairment associated with fatigue', <i>Journal of Sleep Research</i> , Vol. 8, pp. 255-262.
Commuting	<p>Åkerstedt, T., Peters, B., Anund, A. & Kecklund, G. (2005) 'Impaired alertness and performance driving home from the night shift: A driving simulator study', <i>Journal of Sleep Research</i>, Vol. 14, pp. 17-20.</p> <p>Connor, J., Whitlock, G., Norton, R. & Jackson, R. (2001) 'The role of driver sleepiness in car crashes: A systematic review of epidemiological studies', <i>Accident Analysis and Prevention</i>, Vol. 33, pp. 31-41.</p>
Psychosocial Consequences of Shiftwork	Bültmann, U., Kant, I.J., van den Brandt, P.A. & Kasl, S.V. (2002) 'Psychosocial work characteristics as risk factors for the onset of fatigue and psychological distress: Prospective results from the Maastricht Cohort Study', <i>Psychological Medicine</i> , Vol. 32, pp. 333-345.
Shiftwork & Health	Smith, C.S., Robie, C., Folkard, S. et al. (1999) 'A Process Model of Shiftwork and Health', <i>Journal of Occupational Health Psychology</i> , 4(3), pp. 207-218.
Responsibility for Fatigue Risk Management	Jones, C., Dorrian, J. & Dawson, D. (2003) 'Legal Implications of Fatigue in the Australian Transportation Industries', <i>The Journal of Industrial Relations</i> , 45(3), pp. 346-361.
Defences in Depth: Fatigue Risk Management Model	Dawson, D. & McCulloch, K. (2005) 'Managing Fatigue: It's about sleep', <i>Sleep Medicine Reviews</i> , Vol. 9, pp. 365-380.

Scheduling Practices

Baker, A., Heiler, K. & Ferguson, S.A. (2003) 'The impact of roster changes on absenteeism and incident frequency in an Australian coal mine', *Occupational and Environmental Medicine*, Vol. 60, pp. 43-49.

Reid, K. & Dawson, D. (2001) 'Comparing performance on a simulated 12 hour shift rotation in young and older subjects', *Occupational and Environmental Medicine*, Vol. 58, pp. 58-62.

Smith, L., Folkard, S., Tucker, P. & Macdonald, I. (1998) 'Work shift duration: A review comparing eight hour and 12 hour shift systems', *Occupational and Environmental Medicine*, Vol. 55, pp. 217-229.

Fatigue Modelling

Roach, G., Fletcher, A. & Dawson, D. (2004) 'A Model to Predict Work-Related Fatigue Based on Hours of Work', *Aviation, Space and Environmental Medicine*, 75 (3, Section II), pp. 61-69.

Fletcher, A. & Dawson, D. (2001) 'A quantitative model of work-related fatigue: empirical evaluations', *Ergonomics*, 44(5), pp. 475-488.

Sleep/Wake & Performance

Ferrara, M. & De Gennaro, L. (2001) 'How much sleep do we need?', *Sleep Medicine Reviews*, 5(2), pp. 155-179.

Van Dongen, H., Maislin, G., Mullington, J.M. & Dinges, D.F. (2003) 'The Cumulative Cost of Additional Wakefulness: Dose-Response Effects on Neurobehavioral Functions and Sleep Physiology From Chronic Sleep Restriction and Total Sleep Deprivation', *Sleep*, 26(2), pp. 117-126.

Blagrove, M., Alexander, C. & Horne, J. A. (1995) 'The effects of chronic sleep reduction on the performance of cognitive tasks sensitive to sleep deprivation', *Applied Cognitive Psychology*, Vol. 9, pp. 21-40.

Harrison, Y. & Horne, J. A. (2000) 'The impact of sleep deprivation on decision making: A review', *Journal of Experimental Psychology*, 6(3), pp. 236-249.

Dinges, D. F., Pack, F., Williams, K., Gillen, K. A., Powell, J. W., Ott, G. E., Aptowicz, C. & Pack, A. I. (1997) 'Cumulative sleepiness, mood disturbance, and psychomotor vigilance performance decrements during a week of sleep restricted to 4-5 hours per night', *Sleep* 20(4), pp. 267-277.

Van Dongen, H. P., Baynard, M. D., Maislin, G. & Dinges, D. F. (2004) 'Systematic individual differences in neurobehavioral impairment from sleep loss: Evidence of trait-like differential vulnerability', *Sleep*, 27(3), pp. 423-433.

Sleep Hygiene

Thorpy, M. (2003) *Sleep Hygiene*
www.sleepfoundation.org/site/c.huIXKjMOIXF/b.2422637/k.8FF1/Sleep-Hygiene.htm

Sleep Hygiene
www.disability.vic.gov.au/bhcv2/bhcArticles.nsf/pages/Sleep_hygiene?OpenDocument

Brown, F.C., Buboltz, W.C. & Soper, B. (2002) 'Relationship of Sleep Hygiene Awareness, Sleep Hygiene Practices and Sleep Quality in University Students', *Behavioral Medicine, Vol. 28*, pp. 33-38

Gilbert, S., van den Heuvel, C.J., Ferguson, S. & Dawson, D. (2004) 'Thermoregulation as a sleep signalling system', *Sleep Medicine Reviews, Vol. 8*, pp. 81-93.

Öhrström, E. & Rylander, R. (1982) 'Sleep disturbance effects of traffic noise – A laboratory study on after effects', *Journal of Sound and Vibration, 84(1)*, pp. 87-103.

Napping

Anthony, C. W. & Anthony, W. A. (1999) *The Art of Napping at Work*. Burdett, NY: Larson.

Purnell, M. T., Feyer, A.-M. & Herbison, G. P. (2002) 'The impact of a nap performance and alertness of 12-h shift workers', *Journal of opportunity during the night shift on the sleep research, 11(3)*, pp. 219-227.

Caffeine & Other Stimulants	Kilgore, W., McBride, S., Kilgore, D. & Balkin, T. (2006) 'The Effects of Caffeine, Dextroamphetamine and Modafinil on Humor Appreciation During Sleep Deprivation', <i>Sleep</i> , 29(6), pp. 841-847.
Nutrition	Strand, E. (2003) <i>Fighting Fatigue with Diet</i> , www.medicinenet.com/script/main/art.asp?Articlekey=37733 <i>Over Consumption of Sugar Causes Fatigue</i> www.naturalways.com/sugar.htm
Exercise	Sobel, D.S. <i>Exercise Improves Sleep</i> . www.healthy.net/scr/article.asp?ID=424
Relaxation	<i>Relaxation Techniques</i> www.umm.edu/sleep/relax_tech.html#Progressive%20Relaxation

Other Useful Sources of Information

Website	Description
University of South Australia, Centre for Sleep Research	General information, reports and papers about sleep and fatigue www.unisa.edu.au/sleep
Transport Canada	General information and regulatory advice about fatigue risk management www.tc.gc.ca
Australian Civil Aviation Safety Authority (CASA)	General information and regulatory advice about fatigue risk management www.casa.gov.au/aoc/fatigue/FRMS/index.htm
National Sleep Foundation	General information and quizzes about sleep and fatigue www.sleepfoundation.org

NAPS database	Search scientific abstracts about sleep and fatigue www.websciences.org/bibliosleep/naps/
PubMed	Search scientific abstracts about sleep and fatigue www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed
Drew Dawson's Homepage	General information, industry reports and PowerPoint presentations about fatigue risk management www.drewdawson.com

Appendix A

The most important component of this handbook is the slideshow presentation. The presentation is approximately 180 minutes long, and has been divided into three modules:

1. Causes and Consequences of Fatigue
2. Fatigue Risk Management
3. Personal Fatigue Countermeasures

The presentation should be casual, and participants encouraged to ask questions and/or share personal anecdotes. Group activities are provided throughout to encourage interaction. You should use a whiteboard or flipchart to document participant responses to the group activities.