

# The Australian Fatigue Risk Management Project

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# A Collaboration of

Civil Aviation Safety Authority

Qantas

Australian & International Pilots  
Association

University of South Australia

# Project Overview

**Study 1 (phase 1):**  
Sleep/Wake Cycles

**(phase 2):**  
Circadian Disruption/Adaptation

**Study 2:**  
Effects of Fatigue on Pilots' Performance

# Study 1, phase 1

## Sleep/Wake Cycles

What is the quantity/quality of sleep that pilots obtain whilst working various flight/duty schedules?

# Methods

## Participants.

volunteers from 737, 767, 747 fleets  
captains, 1<sup>st</sup> officers, 2<sup>nd</sup> officers, f/e

## Measures.

activity monitors  
sleep diaries  
flight/duty diaries

## Procedure.

volunteers collect data for at least 15  
days



**Sleep Diary – FRMS Study.** Month & Year: ..... FRMS ID Number: .....

Activity Monitor: ..... Monitor Start: ..... Monitor End: .....

Contacts: F/O Phil Armitage (Qantas): 0416 292 767, Tracey Sletten (Centre for Sleep Research): 0408 080 532

	Sleep Location	Start Date/Time ddhhmm (UTC)	Pre-sleep Fatigue Level	End Time hhmm (UTC)	Post-sleep Fatigue Level	Sleep Quality	Remarks
eg	H A CR N P CT	27 1400	1 2 3 4 5 6 7	2130	1 2 3 4 5 6 7	1 2 3 4 5 6	
1	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	
2	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	
3	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	
4	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	
5	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	
6	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	
7	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	
8	H A CR N P CT		1 2 3 4 5 6 7		1 2 3 4 5 6 7	1 2 3 4 5 6	

**Sleep Location**

- H = Home
- A = Away (hotel etc.)
- CR = horizontal Crew Rest
- N = cockpit Nap
- P = Passenger seat
- CT = Crew Transport

**Fatigue Level**

- 1. Fully alert, wide awake.
- 2. Very lively, responsive, but not at peak.
- 3. Okay, somewhat fresh.
- 4. A little tired, less than fresh.
- 5. Moderately tired, let down.
- 6. Extremely tired, very difficult to concentrate.
- 7. Completely exhausted, unable to function effectively.

**Sleep Quality**

- 1. very good
- 2. good
- 3. average
- 4. poor
- 5. very poor
- 6. did not sleep

**Instructions**

1. Please complete a single line of the sleep diary for each at tempted/actual sleep period (i.e. major sleeps and naps), even if you do not actually fall asleep. **Always use UTC.**
2. Record start date/time and pre-sleep fatigue level immediately prior to 'lights out'. Start time is the time that you start attempting to sleep (i.e. 'lights out'), not the time that you fall asleep. **Note:** start/end times should not include time spent reading, watching TV, etc.
3. Record end time and post-sleep fatigue level approximately 20 minutes after the sleep period ends. End time is the time that you get up or start reading, watching TV, etc. in bed. It may differ from wake up time.
4. Rate the quality of your sleep **compared to a 'normal' sleep period.**
5. Make any relevant comments (e.g. regarding the sleep environment, interruptions, ambient noise, etc.).

# Duty Diary – FRMS Study.

Month & Year: ..... FRMS ID Number: .....

Activity Monitor: .....

Contacts: F/O Phil Armitage (Qantas): 0416 292 767 , Tracey Sletten (Centre for Sleep Research): 0408 080 532

	Report Date/Time ddhhmm (UTC)	From (IATA code)	Off Blocks hhmm (UTC)	Pre-flight Fatigue Level	To (IATA code)	On Blocks hhmm (UTC)	Post-flight Fatigue Level	No. Crew (eg 3P 1F) or SIM or PAX	Remarks
eg	28 0600	SYD	0705	1 2 3 4 5 6 7	LAX	2036	1 2 3 4 5 6 7	4P	
1				1 2 3 4 5 6 7			1 2 3 4 5 6 7		
2				1 2 3 4 5 6 7			1 2 3 4 5 6 7		
3				1 2 3 4 5 6 7			1 2 3 4 5 6 7		
4				1 2 3 4 5 6 7			1 2 3 4 5 6 7		
5				1 2 3 4 5 6 7			1 2 3 4 5 6 7		
6				1 2 3 4 5 6 7			1 2 3 4 5 6 7		
7				1 2 3 4 5 6 7			1 2 3 4 5 6 7		
8				1 2 3 4 5 6 7			1 2 3 4 5 6 7		

## Instructions

1. Please complete a single line of the duty diary for each flight sector. **Always use UTC.**
2. Record report date/time only for the first sector of a duty period.
3. Record pre-flight fatigue level just after you walk on to the aircraft. PTO for fatigue level categories.
4. Record post-flight fatigue level just before you walk off the aircraft.
5. If you are operating, record the number of crew (pilots/FEs), including yourself, as follows: 2P or 4P or 3P/1F etc. If you are in the simulator, record SIM. If you are passengering, record PAX.
6. Please make any relevant comments (e.g. regarding disruptions, alterations, delays, diversions, unusual pre- and post-flight travel times, etc.).

Week:

5

Study ID:

p2007\_10

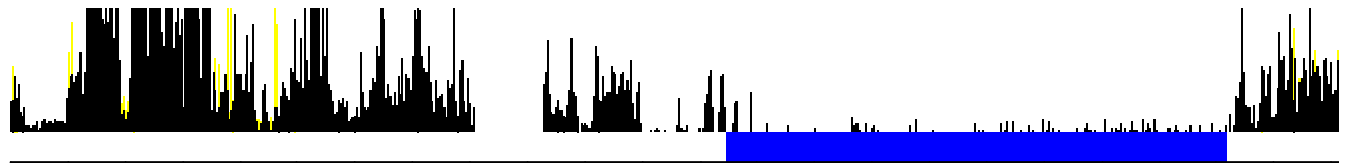
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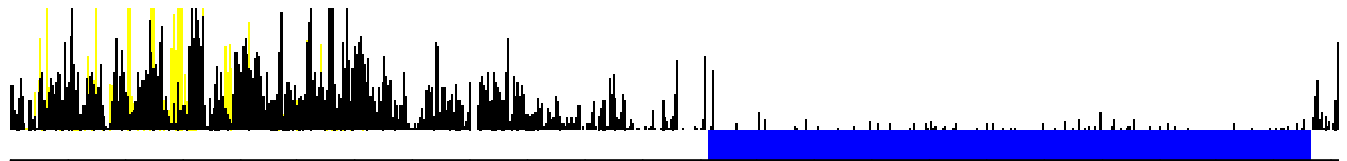
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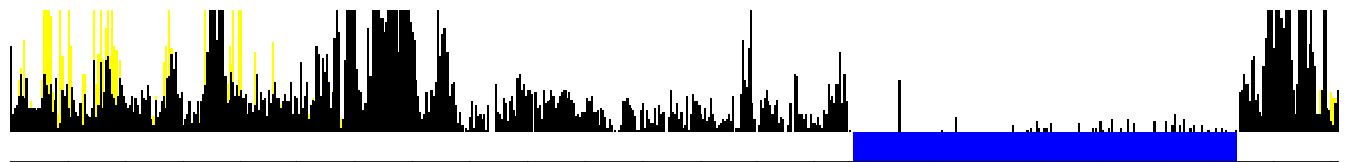
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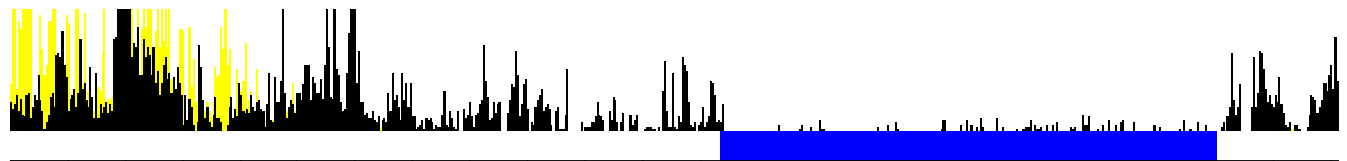
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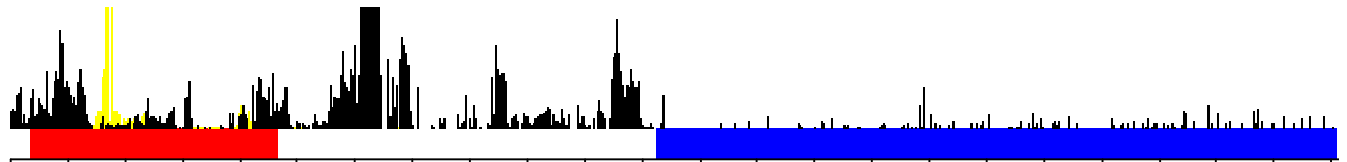
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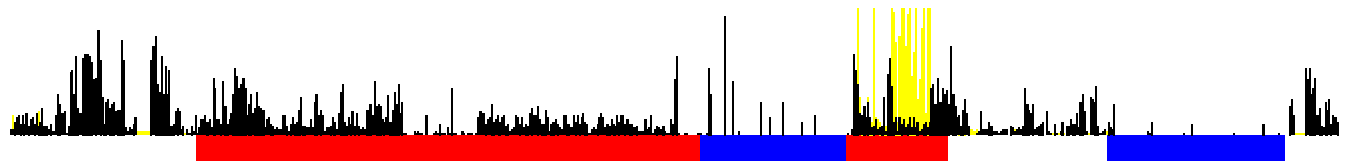
18/Jul/2001



19/Jul/2001



20/Jul/2001



UTC Time

00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

# Current Progress

3,967 days of sleep/wake data

5,615 sleep episodes

1,272 duty periods

146 aircrew: 60 Captains

43 First Officers

41 Second Officers

2 Flight Engineers

Fleet: 93 x 747-400

8 x 747 Classic

41 x 767

4 x 737



# Northern Flights



London (43)

Frankfurt (17)

Rome (4)

Paris (12)

Johannesburg (7)

# Western Flights



New York (8)

Washington DC (1)

Los Angeles (61)

Hawaii (2)

Argentina (12)

New Zealand (6)

# Eastern Flights

# Study 1, phase 2

## Circadian Adaptation

What is the magnitude and speed  
of circadian adaptation  
to trans-meridian flight?

# Methods

## Participants.

volunteers from 737, 767, 747 fleets  
captains, 1<sup>st</sup> officers, 2<sup>nd</sup> officers

## Measures.

activity monitors, sleep diaries, duty  
diaries

+ simple reaction time

+ salivary melatonin

## Procedure.

volunteers collect data for at least 15 days

# Simple Reaction Time

Assessed using:

## 1. Psychomotor Vigilance Task (PVT)

advantages: valid & reliable

disadvantages: 10 minutes & expensive

## 2. Palm Pilot

advantages: 5 minutes & inexpensive

disadvantages: validations not published

Testing occurs before, during, after flight

# Salivary Melatonin

## Purpose.

Hormone produced by the brain.

Production is low during the daytime and high at night-time.

Timing of the evening increase in melatonin production gives an indication of 'body clock' time.

Monitoring melatonin production each day indicates whether 'body clock' time is changing.

## Method.

Participants collect saliva samples for 4 days before and 4 days after international trips.

Samples are tested for the hormone melatonin.

# Study 2

## Simulator Scenarios

What are the effects of fatigue on the performance, efficiency and safety of pilots (in flight simulators).

# Methodology

Flight crew attend a simulator session at low, moderate, or high fatigue

Attend simulator session after returning from international flight

Paired crew assignment (crew performance)

2-hour simulator sessions (city pairs)

Trained observers

# Five Skill Dimensions

- 1) Situation Assessment
- 2) Memory (short-term & long-term)
- 3) Mental Simulation Ability
- 4) Performance Insight
- 5) Crew Communication

# Simulator Scenarios

Devise realistic examples of each of the  
5 basic skill dimensions

Create scenarios which contain  
situations that test the 5 skills

# Trained Observer Method

Targets 3 key aspects of performance:

1. External (to the cockpit) threats to safety  
e.g. adverse weather or terrain
2. Non-technical skills  
i.e. Crew Resource Management (CRM)  
e.g. communication, situational awareness
3. Errors committed by flight crews

# Errors

Types of errors

Error Management

Error Outcome

# Results So Far

- International Layovers
- In-flight Sleep

# For More Information

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