



**Australian Government**  
**Civil Aviation Safety Authority**

HUMAN FACTORS SECTION

**Special Fatigue Audit: Jetstar**

**DATE:** 10 May 2010

**TO:** Grant Howard, Southern Operations Air Transport

**INFO:** Ross Dennerstein, Southern Operations Air Transport  
Mark Sinclair, Safety Analysis Education & Promotion

**FROM:** Ben Cook, Human Factors Section

**SUBJECT:** Human Factors Input to Jetstar Special Audit

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**1. Background**

In accordance with a request from Executive Manager (EM) Operations, a special audit was conducted on Jetstar from 7-9 April 2010 at the Jetstar head office in Melbourne. The scope of the audit was in accordance with the file reference EF10/2358. The aim of the onsite visit was to gain an improved understanding of flight crew fatigue management, particularly Darwin based flight crew, and to collect evidence to conduct further review of Jetstar flight crew rosters.

The CASA Human Factors audit is more strategic at this time i.e. reviewing the system from a higher level to determine whether appropriate processes exist to identify and manage fatigue risk. Broadly, the aim was to determine whether Jetstar may be exposed to unacceptable fatigue risks, and if identified, to provide Jetstar opportunity to address those risks. In addition to providing fatigue subject matter expertise (SME) to other members of the audit team, CASA Human Factors has conducted a more detailed review of Darwin based flight crew rosters.

Evidence from interview and post review of the requested documentation highlight a focus on using existing systems and/or loose interpretations of rules to favour operational outcomes, which have not been appropriately balanced with pro-active safety assurance processes. While the system does have a number of mature and well developed safety processes (as evident from review of safety documentation) there remain a number of potential fatigue risks that require further pro-active analysis. This may be symptomatic of other parts of the Jetstar system, particularly given the aggressive expansion of Jetstar operations within the present market. In general, the majority of personnel interviewed appear genuinely intent on maintaining the balance between commercial imperatives and safety assurance and



this may be a timely opportunity for Jetstar to review existing practices to ensure an appropriate balance is being achieved.

At this stage the audit has not involved compliance checks of the Jetstar rostering system (Rocade) and/or comparison against the CAO 48.0 exemption. Furthermore, due to the last minute provision of actual rosters on 7 May 2010, further analysis of the evidence collected is warranted. Jetstar may have additional supporting material, which has not yet been provided to the audit team to further address some of the Human Factors Section findings. However, in the absence of further information there remains sufficient evidence from interviews and the documents analysed to make a number of conclusions.

A summary of the personnel interviewed and documents reviewed are attached at Annex A.

## 2. Key Findings from CASA Human Factors

- No evidence has been provided to date to demonstrate appropriate strategic assessment of fatigue risk. A report titled '*Risk Assessment & Management Plan – Darwin – Denpasar A320 Service*' as completed in September 2008 was provided to the audit team but this just captured the broad process and workshop attendees. Reference to the details of the risk assessment and associated risk reduction actions were not provided.
- There was no evidence of pro-active fatigue risk assessment when the new Darwin base was established e.g. review of the implications of the new Darwin rostering patterns prior to commencement, consideration of fatigue risk for Darwin commuters etc. The establishment of this base involved significant changes to rosters and establishment of back of the clock flights between Darwin and other international ports.
- Evidence from interview and review of documentation highlights a reactive system for managing fatigue with a heavy reliance on the CAO 48.0 exemption. The system is too reliant on incidents to occur and for reports from flight crew to determine whether there is an unacceptable fatigue risk.
- A scientific review of Darwin based flight crew rosters (Annex B and C) indicates there are predicted levels of fatigue risk that require further review by Jetstar. While the CASA findings are not definitive, in the absence of sufficient pro-active fatigue risk assessment practices by Jetstar, there may be unacceptable fatigue risks that are not being identified and managed.
- There was minimal evidence of compliance checks in relation to flight and duty times, pilot logbooks, Rocade etc as part of safety assurance processes. Furthermore, it was mentioned during interview that checks were conducted on flight crew overtime to ensure flight crew were not too focused on financial incentives (e.g. an extra shift on a day off) to the detriment of fatigue management. No evidence was provided of such checks.
- The present system has been managed with a strong emphasis on achieving operational outcomes with insufficient consideration given to potential fatigue risk. This was evident in a number of loose interpretations and applications of



rostering practices (e.g. use of international call signs on domestic routes, use of two standby times within roster patterns) and was further supported by the feedback obtained from operational personnel.

- Furthermore, the company policy to pay for some flight crew to commute between other cities and Darwin has the potential to significantly increase fatigue risk, particularly with the larger commuting distance e.g. Melbourne to Darwin. This process could be considered a work around to dead heading, which normally involves the crew being paid to pre position for a flight. While not illegal, it is a further demonstration of how to maximise the system to meet operational needs.
- From discussion with some personnel, further evidence of operational priorities taking precedence over strict compliance with the rules involves the adjustment of turn around times prior to duties commencing to ensure the planned hours within a duty period comply with the limits within CAO 48.0. This ensures the flight can depart, after which an extension of duty (up to two hours) can be requested.
- There remains significant operational pressure for flight crew to accept extensions of duty. This, combined with financial incentives for certain duties, warrants development of further pro-active processes to ensure individuals are appropriately managing their fatigue risk. While reliance on flight crew to be well rested and fit for duty, the system can implement further pro-active safety assurance measures to monitor flight crew actions and support flight crew decision making if already fatigued.
- Based on feedback from operational personnel it is not considered Jetstar management has created a culture of open and honest reporting of fatigue risk. There remains reluctance from a number of flight crew to report fatigue risk and/or to say no to an extension of duty based on the perceived punitive nature of taking such actions. Open and honest feedback from operational personnel is one of the key processes required to identify and manage fatigue risk.
- An ancillary finding is the potential for unacceptable fatigue risk for cabin crew and it is believed this should be a future CASA audit. A Jetstar report related to cabin crew fatigue states *'The absence of a Fatigue Management for cabin crew renders cabin crew dangerously exposed to unsafe rostering and work practices and means that levels of fatigue cannot be controlled and risk managed'*. It also says *'Current cabin crew rostering practice has very few limitations to minimise fatigue'* and *'There is little information and training for cabin crew to establish what is expected of crew who are suffering the effects of fatigue'*. While this is not covered under a specific CASA regulation, fatigue remains a workplace hazard that must be managed in accordance with the company's safety management system (SMS).
- Recommend Jetstar be provided sufficient time (suggest 3-6 months) to develop appropriate pro-active processes to identify, manage and monitor fatigue risk from both a strategic and tactical level. Based on the significantly greater evidence of processes favouring operational and commercial imperatives over safety assurance of fatigue risk, if not achieved to an



acceptable standard it is recommended the CAO 48.0 exemption should be withdrawn.

### 3. Scientific Review of Planned and Actual Rosters

During review of the day of operations roster system a number of planned and actual rosters were provided for randomly selected, Darwin based flight crew. They were reviewed from a scientific basis using an advanced biomathematical modelling tool, System for Aircrew Fatigue Evaluation (SAFE). SAFE has been scientifically validated within operational aviation settings, whereas other contemporary fatigue models such as FAID, as used by Jetstar, have not.

Recent consultation by CASA Human Factors with a number of fatigue experts, review of fatigue risk management safety cases from around the globe and completion of a report titled '*Biomathematical Fatigue Modelling in Civil Aviation Fatigue Risk Management: Application Guidance*', determined SAFE to be the most suitable predictive tool for performing this review. CASA utilises a number of contemporary biomathematical models, which are selected by considering the strengths and limitations of the model and the nature of the operational environment under review. It must be noted that no biomathematical modelling tool alone can accurately determine fatigue risk.

It was found that Jetstar uses FAID to perform retrospective review of an individual's levels of fatigue (e.g. post incident) and this is not an appropriate use of the FAID tool. From an investigative perspective, such review requires the ability to review actual sleep of the individual in the previous 72 hours, which more advanced biomathematical models have the capacity for input.

Sufficient evidence exists to warrant further consideration of the impact of fatigue within current Jetstar rosters and rostering practices as based on this review (see Annex B and C).

### 4. Conclusion

A review of a number of Jetstar rosters determined sufficient predictive fatigue risk exists which requires further analysis by Jetstar. This combined with a number of loose interpretations of rules, a potential focus on operational outcomes with insufficient regard to potential fatigue risk warrants the development of enhanced pro-active fatigue management processes.

It is recommended Jetstar be provided with appropriate time (3-6 months) to refine its risk assessment processes specific to fatigue prior to further review by CASA. It is proposed that CASA Human Factors continues to randomly review a number of planned and actual rosters during this period.

Ben Cook  
Manager, Human Factors

#### Annexes:

- A. Summary of personnel interviewed and documents reviewed
- B. Review of actual pilot roster
- C. Predictive analysis of Darwin-Singapore operations



**Annex A: Summary of Personnel Interviewed & Documents Reviewed**

The following Jetstar personnel were interviewed as part of the audit:

- Farshad Yaghmai, Manager Crewing & Operations
- Donna Giles, Manager Crew Resources
- Russell Quantock, Crew Planner
- Sasha Miokovic, JOCC Manager Dispatch
- Chris Davies, General Manager Operations Delivery
- Matthew Bell, Manager Flight Operations Resources
- Wayne Richards, Manager Safety Systems
- Mark Rindfleish, Chief Pilot
- Various Darwin based flight crew

Requests for further documentation:

Item	Material Requested	Rec'd	Requested From:
1	ASC minutes (1April-31December 2009) – <i>Rec'd 3 months</i>	Partly	Wayne Richards
2	FSSC minutes (1April-31December 2009)-	Yes	Wayne Richards
3	Pilot OSCARS from the last 12 months – <i>Only as summarised in 2 above</i>	Partly	Wayne Richards
4	Risk assessment/register for establishment of Darwin base – <i>not received</i>	YES	Wayne Richards
5	Planned and Actual Rosters - Darwin based, 5 pilots (1Dec09-31Mar10)	Yes	Donna Giles
6	Evidence of spot audit of pilot overtime hours-	Partly	Chris Davies
7	Breakdown of Darwin based pilots (total numbers, home city)	Partly	Russell Quantock
8	Details from last 12 months of any pilot extension of duties	Yes	Fashad Yaghmai
9	Names of pilots in last 12 months that have not extended duty	"Not kept"	Fashad Yaghmai
10	Actual Rosters Darwin based, 5 pilots (1Dec09-31Mar10)-See 5	Yes	Fashad Yaghmai
11	Evidence of compliance audits of ROCADE/flight duty times	QA methods	Donna Giles



12	DRW based pilots average monthly flight and duty records	Yes	Chris Davies
13	Evidence of policy statement (FSO?) regarding extension of duty inc other related CAO 48EX.	Yes	Mark Rindfleish
14	Staff travel details/history for DRW base pilot commutes.	Yes	Matt Bell
15	Friendly commuter policy	Yes	Matt Bell
16	Policy that crewing cannot require a pilot to extend duty	"Not documented"	
17	OM8 - FSOs (not requested) supplied	Yes	Sasha Miokovic
18	Cabin safety working group inc fatigue reporting	Not req	
19	RD phone interviews with DRW pilots – (admin arrangements).	Local	Mark Rindfleish

\* Denotes evidence suitable for SMS capability assessment in upcoming AOC Audit.



**Annex B: Review of actual pilot roster**

During interview five Darwin based pilots were randomly selected and their planned and actual rosters obtained for the period 1 December 2009 to 31 March 2010. In many cases the extensive corporate experience and rostering practices of Donna Giles and Russell Quantock has resulted in a large number of rosters planned that adhere to good fatigue science with the potential to appropriately manage fatigue risk. During interview their practical understanding of the rostering system, what works and what does not, was impressive.

There were a number of roster patterns identified from actual rosters that present the potential for unacceptable fatigue risk. One such pattern is reviewed in more detail (see next page). Pertinent information as follows:

- Actual Roster for flight crew member from 1-19 March 2010.
- Analysed using the SAFE modelling tool.
- Standby time was not included within the analysis.
- The colour coded sections (green to orange) of the model represent duty.
- The grey sections represent estimated sleep. Actual sleep for individuals can be entered into the model but in this case the group average predictions from the research underpinning SAFE are shown.

**Results:**

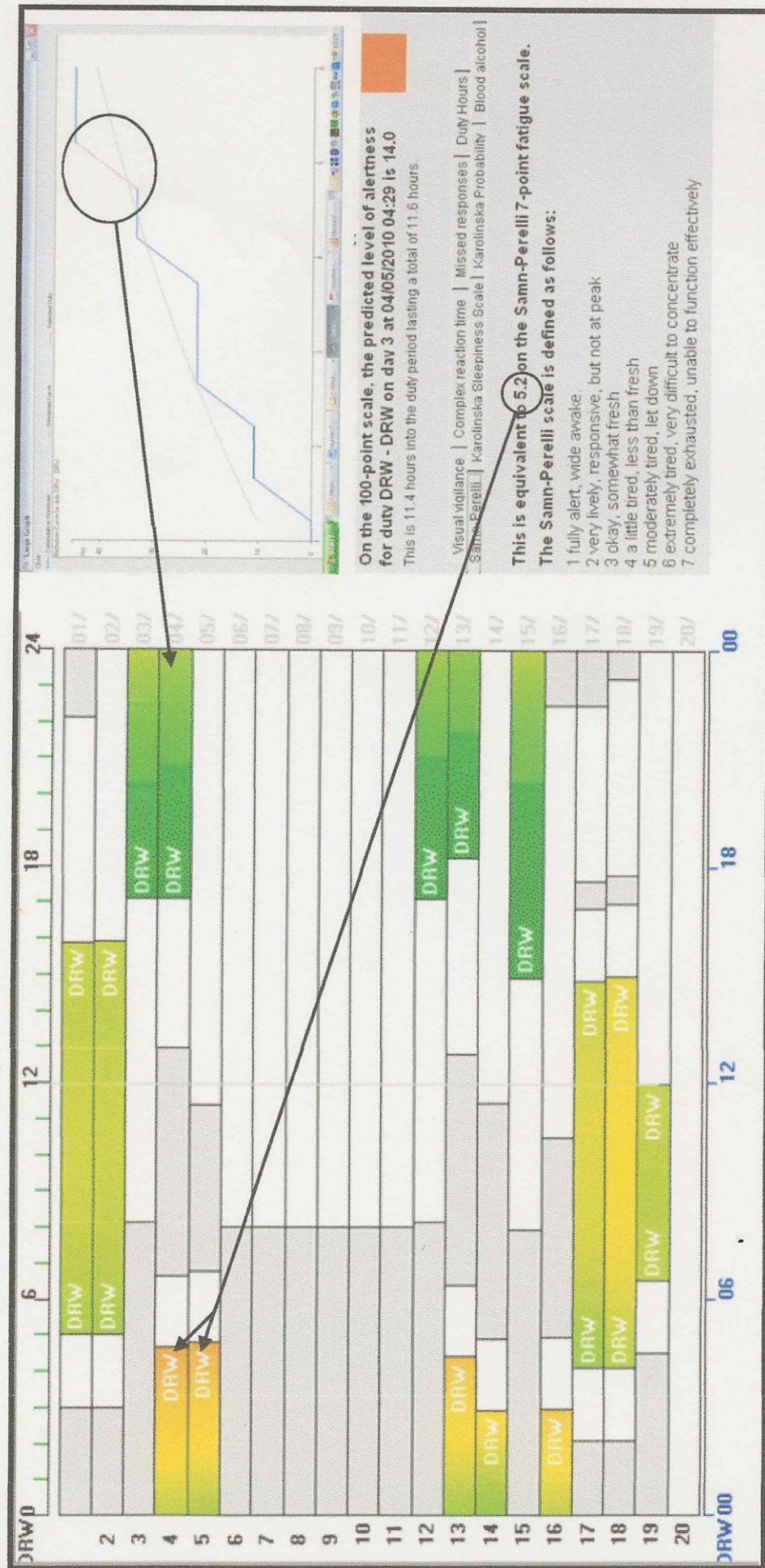
With regard to the best practice use of modelling tools combined with consideration to the latest fatigue science, the following conclusions are made:

- Best operational practice when using the SAFE predictive tools warrants further risk assessment when Samn-Perelli scores are five or above.
- On days four and five predicted scores are 5.2. This requires further proactive consideration to determine whether actual fatigue risk is acceptable.

Further explanation of the model outputs is provided on page 10.



# SAFE analysis of actual flight crew roster (1-19 March 2010)








The SAFE model provides guidance related to workload and the model itself and the table below is a summary of results for the roster. The scales as follow:

- Light Grey: analysis not performed
- Blue: no problems found for this duty
- Orange: minor problem identified (model only)
- Red: more serious problem/transgression.

The workload column assesses predicted cumulative workload associated with the schedule against research data for a generalised aviation population. The model analysis provides a summary of rostering and highlights those with potential for high levels of fatigue-associated risk. Results as follow:

Duties	Summary	Alertness	Workload
			Workload      Model
01/05/2010	DRW		 DRW
02/05/2010	DRW		 DRW
03/05/2010	DRW		 DRW
04/05/2010	DRW		 DRW
12/05/2010	DRW		  DRW
13/05/2010	DRW		  DRW
15/05/2010	DRW		  DRW
17/05/2010	DRW		  DRW
18/05/2010	DRW		  DRW
19/05/2010	DRW		  DRW
Total			 5  4  3

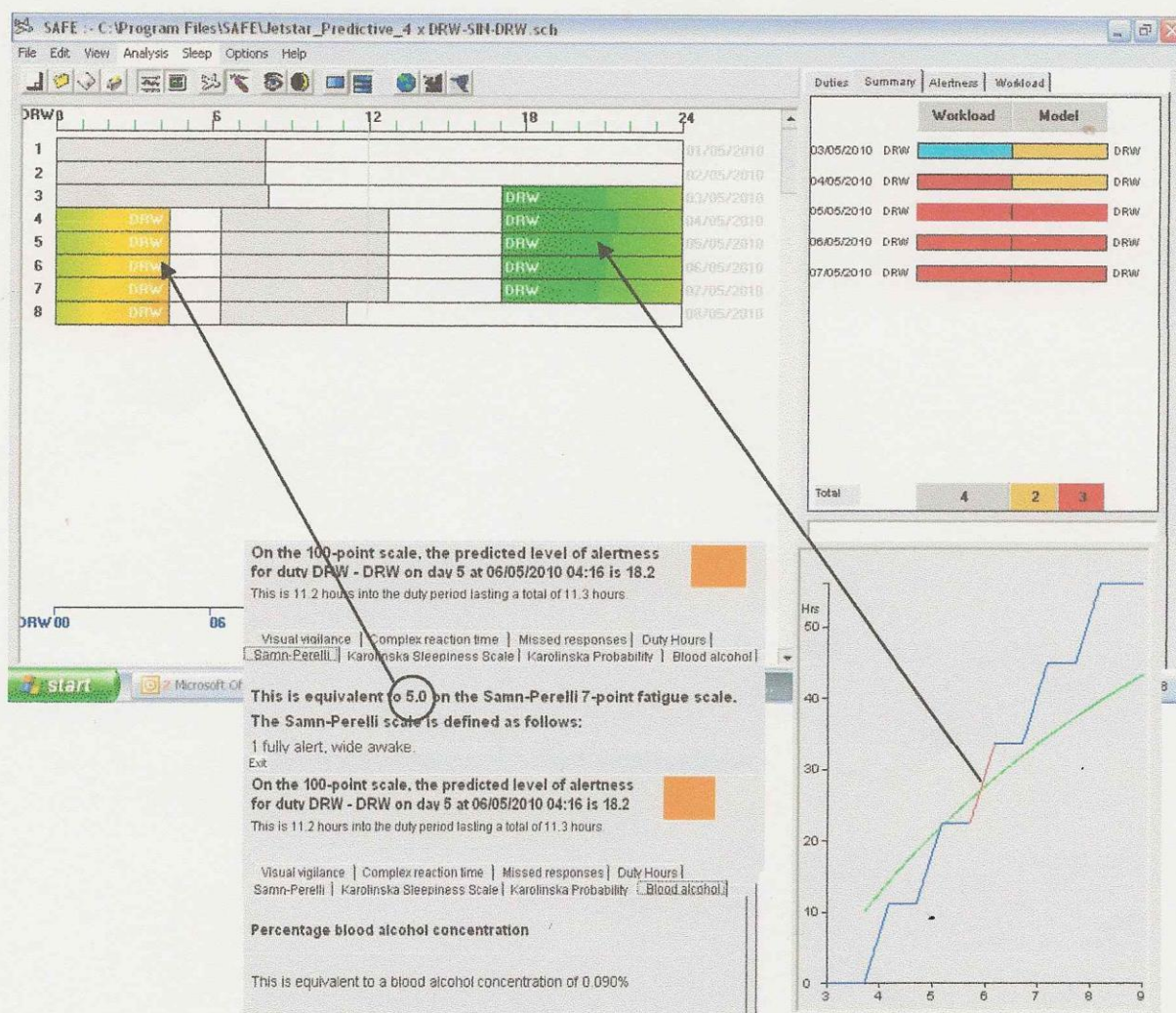
Use of the SAFE model identifies a number of areas requiring further pro-active analysis of fatigue risk, which to date has not been detected or managed by the present system. In particular, the forth day of this schedule may be exposed to unacceptable cumulative workload.



## Annex C: Predictive analysis of Darwin-Singapore operations

While rostering personnel (Donna Giles and Russell Quantock) stated best practice is not to roster more than two back of the clock operations, sometimes three, strict adherence to existing exemptions and other rules governing rostering allow up to five to occur.

The following is a hypothetically planned roster for a number of Darwin-Singapore-Darwin flights, as based on planned times from the rosters provided for review. It highlights the fatigue risk that flight crew could be exposed and provides support to the good operational understanding of fatigue risk by Donna Giles and Russell Quantock. Given the results below are specific to three Singapore-Darwin-Singapore duties with no extensions, it further raises concerns regarding the extensions of duty, particularly Singapore-Darwin-Singapore, as reflected in the following analysis:



The above information combined with a known history of extensions of duty further increases the likelihood of unacceptable fatigue risk. It also supports the ability to be legally compliant with the CAO 48.0 exemption but not necessarily safe with regard to fatigue risk. The table on the next page provides a summary of extensions over the period December 2009 to March 2010. In the worst case scenario, an extension of 80 minutes was authorised for a Darwin-Singapore-Darwin flight.



Date	Aircraft	Flight Details	Duty Hours	Extension (mins)
19-Dec-09	A321	JQ61-62 Drw-Sin-Drw	1201	1
21-Dec-09	A320	JQ2673-2674-2515-2516 Sin-Pen-Sin-Bkk-Sin	1217	17
22-Dec-09	A330	JQ35 Syd-Mel-Dps	1329	29
22-Dec-09	A321	JQ61-62 Drw-Sin-Drw	1240	40
23-Dec-09	A321/320	JQ58-57 Drw-Cns-Drw	1352	52
29-Dec-09	A320	JQ74-73 Drw-Syd-Drw	1402	2
31-Dec-09	A321	JQ61-62 Drw-Sin-Drw	1205	5
01-Jan-10	A330	JQ19 Syd-Ool-Kix	1459	59
05-Jan-10	A330	JQ35 Syd-Mel-Dps	1317	17
05-Jan-10	A320	JQ166-171 Chc-Mel-Chc	1324	24
06-Jan-10	A321	JQ444-421-424-447 Mel-Ool-Syd-Ool-Mel	1212	12
08-Jan-10	A320	JQ263-262-279-276-250 Akl-Wlg-Akl-Zqn-Akl-Chc-Akl	1327	87
08-Jan-10	A320	JQ2673-2674-2515-2516 Sin-Pen-Sin-Bkk-Sin	1206	6
09-Jan-10	A320	JQ61-62 Drw-Sin-Drw	1320	80
12-Jan-10	A330	JQ28 HKT-SYD	1326	26
13-Jan-10	A330	JQ411- 37 Mel-Syd-Dps	1405	5
14-Jan-10	A320	JQ842-843-525-528 Syd-Hti-Syd-Syd-Mel-Syd	1224	24
15-Jan-10	A320	JQ61-62 Drw-Sin-Drw	1232	32
15-Jan-10	A321/320	JQ444-421-424-449 Mel-Ool-Syd-Ool-Mel	1218	18
16-Jan-10	A321	JQ61-62 Drw-Sin-Drw	1217	17
18-Jan-10	A321	JQ57 - 58 Drw-Sin-Drw	1311	11
18-Jan-10	A321	JQ61-62 Drw-Sin-Drw	1206	6
26-Jan-10	A320	JQ929-874-874-932 Cns-Bne-Rok-Bne-Cns	1213	13
26-Jan-10	A321	JQ944-947 Mel-Cns-Mel	1306	66
26-Jan-10	A321	JQ952-955 Syd-Cns-Syd	1243	43
27-Jan-10	A321	JQ57 - 58 Drw-Sin-Drw	1339	39
29-Jan-10	A320	JQ2673-2674-2515-2516 Sin-Pen-Sin-Bkk-Sin	1238	38
31-Jan-10	A321	JQ57 - 58 Drw-Sin-Drw	1305	5
31-Jan-10	A321	JQ61-62 Drw-Sin-Drw	1201	1
02-Feb-10	A320	JQ61-62 Drw-Sin-Drw	1248	48
04-Feb-10	A321	JQ61-62 Drw-Sin-Drw	1202	2
05-Feb-10	A320	JQ842-843-525-528 Syd-Hti-Syd-Syd-Mel-Syd	1249	49
07-Feb-10	A320	JQ929-932 Cns-Bne-Cns	1355	115
08-Feb-10	A320	JQ978-979 Cns-Per-Cns	1239	39
10-Feb-10	A320	JQ436-435-709-708 Mel-Ool-Mel-Hba-Mel	1306	66
12-Feb-10	A320	JQ842-843-525-528 Syd-Hti-Syd-Syd-Mel-Syd	1213	13
13-Feb-10	A320	JQ988 - 989 Syd-Per-Syd	1204	4
15-Feb-10	A320	JQ721-720-747-748	1202	2
23-Feb-10	A321	JQ61-62 Drw-Sin-Drw	1205	5
25-Feb-10	A321	JQ57 - 58 Drw-Sin-Drw	1317	17
27-Feb-10	A321	JQ57 - 58 Drw-Sin-Drw	1301	1
01-Mar-10	A320	JQ2673-2674-2515-2516 Sin-Pen-Sin-Bkk-Sin	1331	31
06-Mar-10	A320	JQ502 - 507 707 - 704 Mel-Syd-Mel-Hba-Mel	1213	13
06-Mar-10	A320	JQ703-702-794-795 Mel-Hba-Mel-Mcy-Mel	1316	86
07-Mar-10	A320	JQ166-171 Chc-Mel-Chc	1303	3
11-Mar-10	A320	JQ82-81 Drw-Bne-Drw	1418	78
11-Mar-10	A320	JQ480-882-883 Ntl-Bne-Mky-Bne	1221	21
15-Mar-10	A320	JQ842-843-525-528 Syd-Hti-Syd-Syd-Mel-Syd	1216	16
17-Mar-10	A320	JQ61-62 Drw-Sin-Drw	1206	6
23-Mar-10	A320	JQ436-435-709-708 Mel-Ool-Mel-Hba-Mel	1250	50
23-Mar-10	A320	JQ703-702-794-795 Mel-Hba-Mel-Mcy-Mel	1240	40



23-Mar-10	A321	JQ988 - 989 Syd-Per-Syd	1224	24
25-Mar-10	A320	JQ2673-2674-2515-2516 Sin-Pen-Sin-Bkk-Sin	1330	30
27-Mar-10	A320	JQ263-262-279-276-250 Akl-Wlg-Akl-Zqn-Akl-Chc-Akl	1207	7
29-Mar-10	A320	JQ709-710-711-712 Mel-Hba-Mel-Hba-Mel	1305	5
30-Mar-10	A320	JQ842-843-525-528 Syd-Hti-Syd-Syd-Mel-Syd	1203	3
30-Mar-10	A320	JQ603-630-633-612	1207	7
31-Mar-10	A321	JQ61-62 Drw-Sin-Drw	1205	5
31-Mar-10	A320	JQ842-843-525-528 Syd-Hti-Syd-Syd-Mel-Syd	1208	8
01-Apr-10	A320	JQ988 - 989 Syd-Per-Syd	1234	34
03-Apr-10	A320	JQ842-843-525-528 Syd-Hti-Syd-Syd-Mel-Syd	1202	2

This further supports the requirement to be pro-active to assure fatigue risks are acceptable within the operational environment. Further information regarding this analysis is available from CASA Human Factors.