Preparing A Safety Case for ULR City Pair (AKL-ORD-AKL) Regulatory Approval

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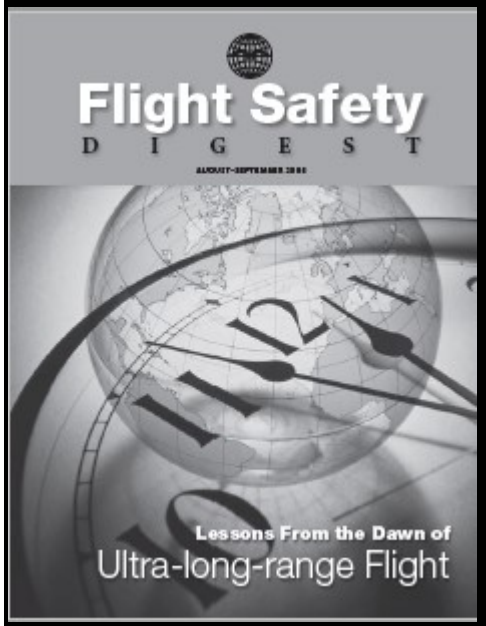
Information Sources



- Output and Recommendations from FSF ULR Workshops
  https://www.flightsafety.org/fsd/fsd_aug-sept05.pdf
- NASA TM-2006-213484 *The Effects of ULR Flights on the Alertness and Performance of Aviators*
  https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20060024526.pdf
- Regulatory requirements for ULR
  - Singapore (CAAS AOC Requirements for ULR)
  - UAE (CAAP 14)
- ICAO Guidance Doc 9966
- IFALPA Guidance for ULR Ops
- Airline ULR Operations EK QR SQ

Timeline of Significant Events

- First stakeholders meeting — 30 Oct 2017
  - *Provided historic background to FSF ULR Workshops Main Issues & Ensuing Recommendations*
  - *Tabled NZALPA Discussion Document (collated ULR-related information)*
  - *Led to later formation of ULR Steering Committee* — 9 Jul 2018
- Public Announcement - Route & Schedule — 28 Mar 2018
- Liaison Meetings with NZCAA / Massey University — Jul / Oct 2018
- Documented Safety Case submitted — 13 Aug 2018
- Regulatory Approval — 22 Nov 2018
- First ULR City Pair Operation AKL-ORD-AKL — 30 Nov 2018

Safety Case Development

- Liaison with Sleep Wake Research Centre at Massey University - Wellington and NZCAA
- Normal FRM processes for hazard identification and risk assessment (ICAO Doc 9966 - 2011 Edition)
- Separate Formal Company Operational Risk Management Plan
- Request for Special Scheduling Agreement (SSA)

Operational Risk Management Plan (RMP)

- Examined risks that included tour of duty planning (AKL-ORD-AKL), rostering, and management of operational disruptions within the live roster

- Determined **not to accept**:
  - any decrease in the current level of safety;
  - any identified risks with a post-treatment residual risk assessed as high or very high

- None of the potential risks identified were considered outside the airlines risk appetite with all post-treatment residual risk assessed as low

Documents Supporting Safety Case

Overview & Policy

- Overview of ULR Safety Case
- Air NZ FRM Programme Outline
- Air New Zealand ULR Policy & relevant FRM policies
- Air New Zealand Operational Risk Management Plan for AKL-ORD-AKL ULR City Pair

Identified Hazards & Proposed Mitigations

- NZALPA Request for Special Scheduling Agreement (SSA)
  - Agreed Contractual Provisions & Crew Scheduling Rules for all ULR Ops
  - Special Scheduling Agreement (SSA) specific to ULR City Pair (AKL/ORD /AKL)
  - SAFE Modelling predictions for ULR schedule and contingent situations for both Northern Winter & Summer schedules
- Cabin Crew SSA AKL-ORD-AKL
- Cabin Crew Rest Break Considerations AKL-ORD-AKL

Supporting Data

SAFE Bio-mathematical Modelling

- Acclimatisation predictions for ORD layover
- Predictive modelling of scheduled operation and various contingent scenarios

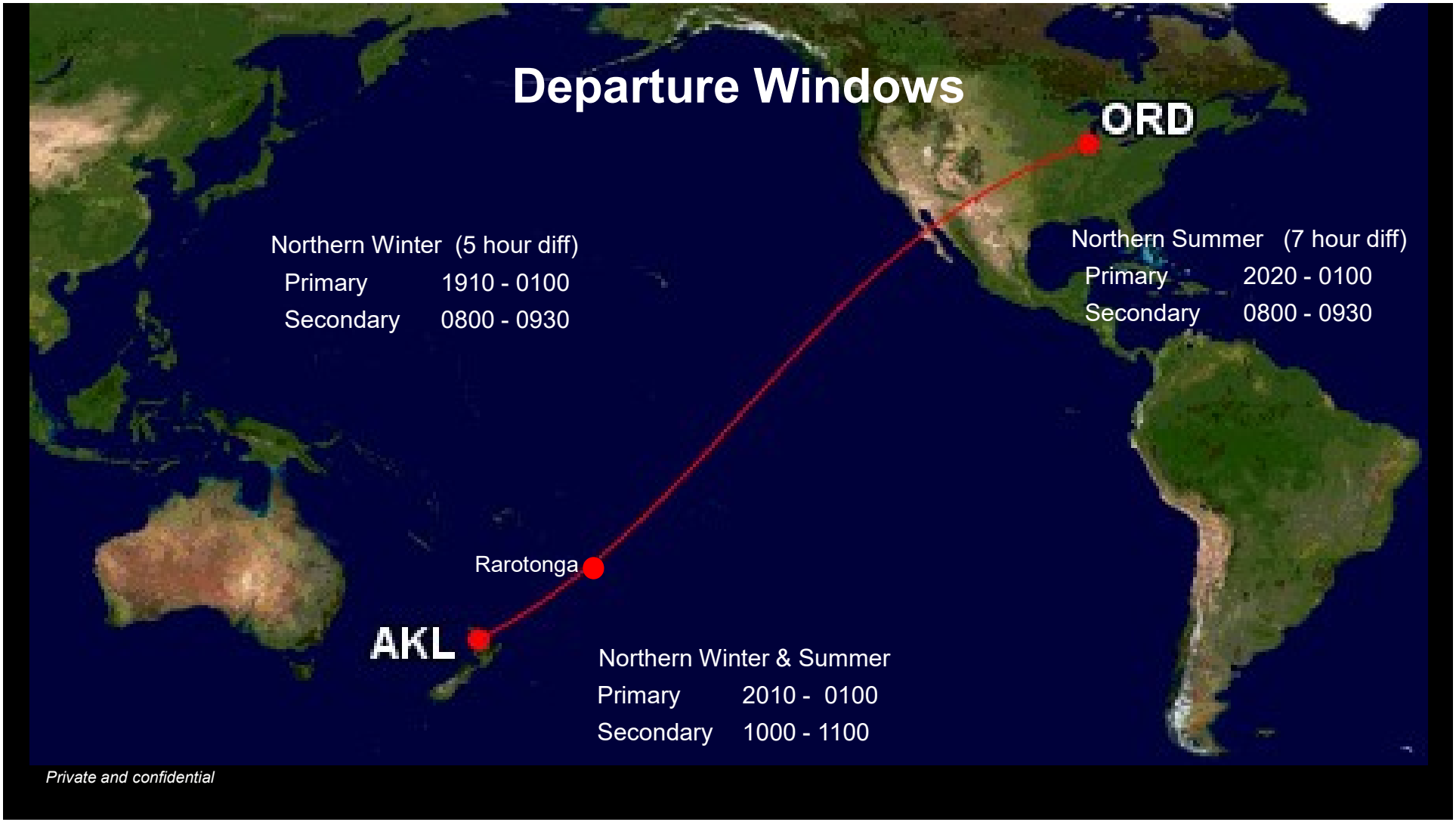
Flight Crew

- Top Of Descent SP & KSS ratings & Performance Test - existing non-ULR routes
- Rolling 12 month average monthly fatigue reports /1000 FDPs
- Inflight Rest Break Schedules
- SWRC Review of Inflight Rest Breaks AKL-IAH-AKL & AKL-ORD-AKL
- Guidance to Flight Crewmembers for the ULR City Pair

Cabin Crew

- Top Of Descent SP & KSS ratings & Performance Test - previous studies
- Inflight Rest – Modelled predictions
- Guidance for Cabin Crewmembers


Schedule Details
ORD
AKL – ORD N. Winter & Summer
Depart AKL 2010 local
Arrive ORD 1610 / 1810 local
1110 NZ
Flight Time 15:00
Duty Time 16:45
ORD - AKL N.Winter Summer
Depart ORD 1910 2110
Arrive AKL 0640 local 0640
Flight Time 16:30
Duty Time 18:15
AKL
Scheduled departures - Wed Thu and Sun
with 2/3 night ORD layover (cabin crew) &
4/5 day layovers (flight crew)



ULR Crew Complement & Rest Requirements

Crew Complement:

• Pilots	*2 Captains & 2 F/O /	1 Captain , 2 First Officers, 1 Second Officer
• Cabin Crew	2 additional ex AKL; and 1 additional ex ORD to normal crewing requirements	

** For first 2 roster periods of new ULR City Pair (or agreed longer period)*

Rest Requirements:

• Pre ULR Rest	2 Days off to include 2 local nights
• Inflight (Pilots)	2 rest periods with one period 4 hours to optimise circadian night
• Layover	Normally 48 hours to include 2 local nights
• Post ULR	96 hours to include 4 local nights

Biomathematical Modelling (SAFE)

- A Comparison of AKL-IAH-AKL (non ULR) & AKL-ORD-AKL (ULR) schedules
- AKL – ORD Scheduled Operations
- Crew Layover ORD & Acclimatisation / circadian shift during layover
- ORD – AKL Scheduled Operations
- Off Schedule Operations AKL-ORD and ORD-AKL (Primary & Secondary Windows)
- Modelled Specific Contingent Situations AKL-ORD & ORD-AKL
- Modelled for both Northern Winter and Summer Timetables

Route Schedule & Performance Comparison
AKL - IAH / AKL – ORD (N. Winter)

OUTBOUND SECTOR (NON-ULR)

FOUR EQUAL IN-FLIGHT REST PERIODS

	Report	Dep (L)	Arr (L) / NZ	Flt Time	Total Sleep Ldg Crew	**SAFE** Ldg Crew	**Predicted SP** Relief Crew
AKL - IAH	**1815**	**1930**	**1405 / 0905**	**13:35**	**2:20**	**4.26**	**3.99**
AKL – ORD	**1855**	**2010**	**1610 / 1110**	**15:00**	**2:34**	**4.0**	**3.83**

Top of Descent Alertness Evaluation AKL – IAH (All flight Crew) Mean 4.097 (n=72)

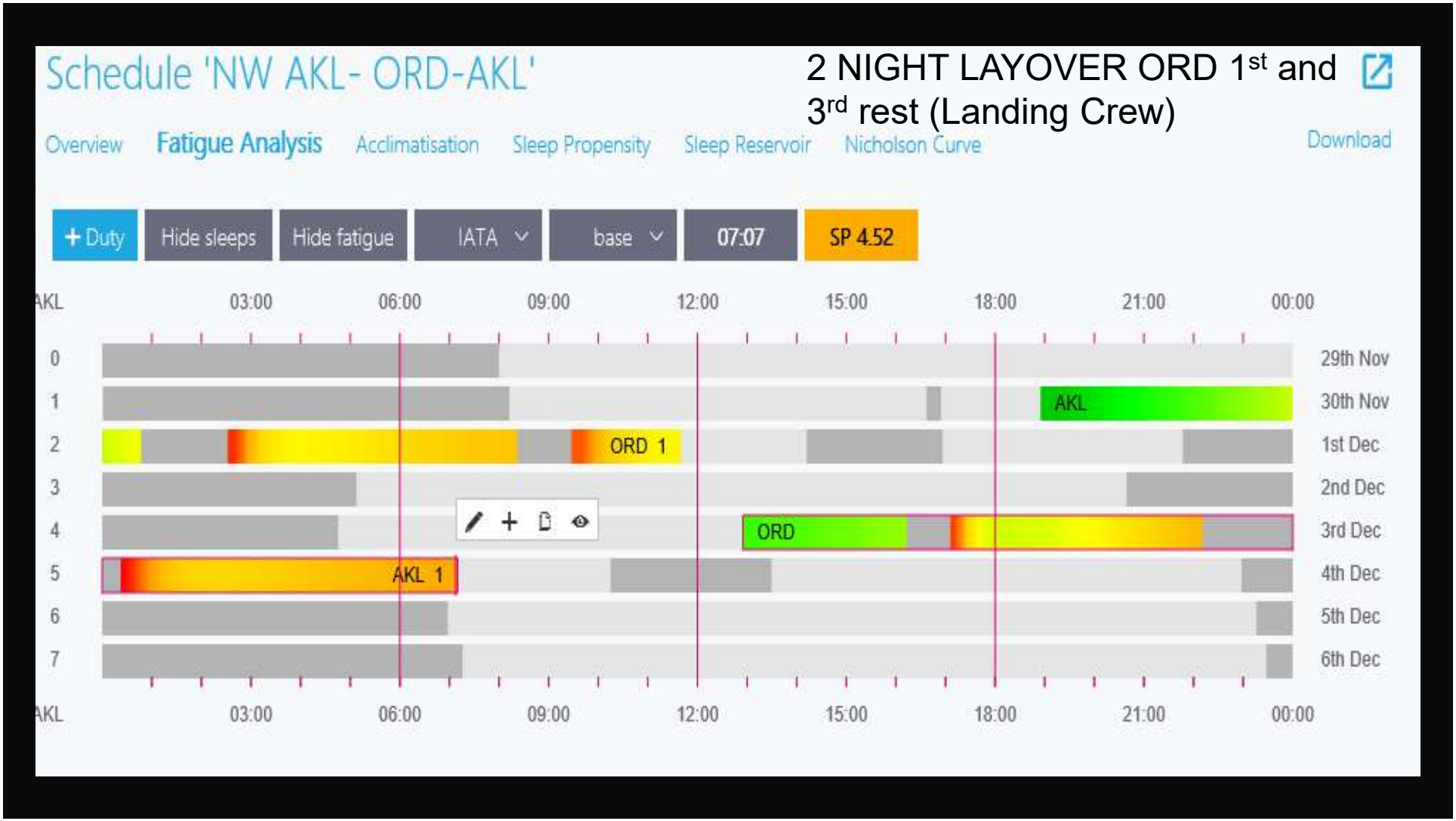
Route Schedule & Performance Comparison
IAH - AKL / ORD – AKL (N. Winter)

INBOUND SECTOR FOLLOWING 2-NIGHT LAYOVER

FOUR EQUAL IN-FLIGHT REST PERIODS

	Report	Dep (L)	Arr (L)	Flt Time	Total Sleep Ldg Crew	SAFE Predicted SP Ldg Crew	Relief Crew
IAH - AKL (Non-ULR)	**1820**	**1920**	**0530**	**15:10**	**2:33**	**4.62**	**4.5**
ORD - AKL (ULR)	**1810**	**1910**	**0640**	**16:30**	**3:11**	**4.43**	**4.65**

Top of Descent Alertness Evaluation IAH - AKL (all flight crew) **Mean** **4.7128** **(n=94)**


Schedule 'NW AKL- ORD-AKL'
2 NIGHT LAYOVER ORD 1st and 3rd rest (Landing Crew)
Overview
Fatigue Analysis
Acclimatisation
Sleep Propensity
Sleep Reservoir
Nicholson Curve
Download
+ Duty
Hide sleeps
Hide fatigue
IATA
base
07:07
SP 4.52
AKL
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
0
1
2
3
4
5
6
7
29th Nov
30th Nov
1st Dec
2nd Dec
3rd Dec
4th Dec
5th Dec
6th Dec
ORD 1
AKL
ORD
AKL 1

MODELLING PREDICTIONS AKL – ORD (NW & NS)

AKL – ORD SWRC Recommendation 2:30 / 4:00 / 4:00 / 2:30 (Optimised Rest During Circadian Night)

Report 1855; Blox AKL 2010; 1st Rest Commences 2110; Last Rest Ends 1010 (all times NZ);

Blox ORD 1110 (NZ) / 1610 local

Total Inflight Rest 13:00 Flight time 15:00

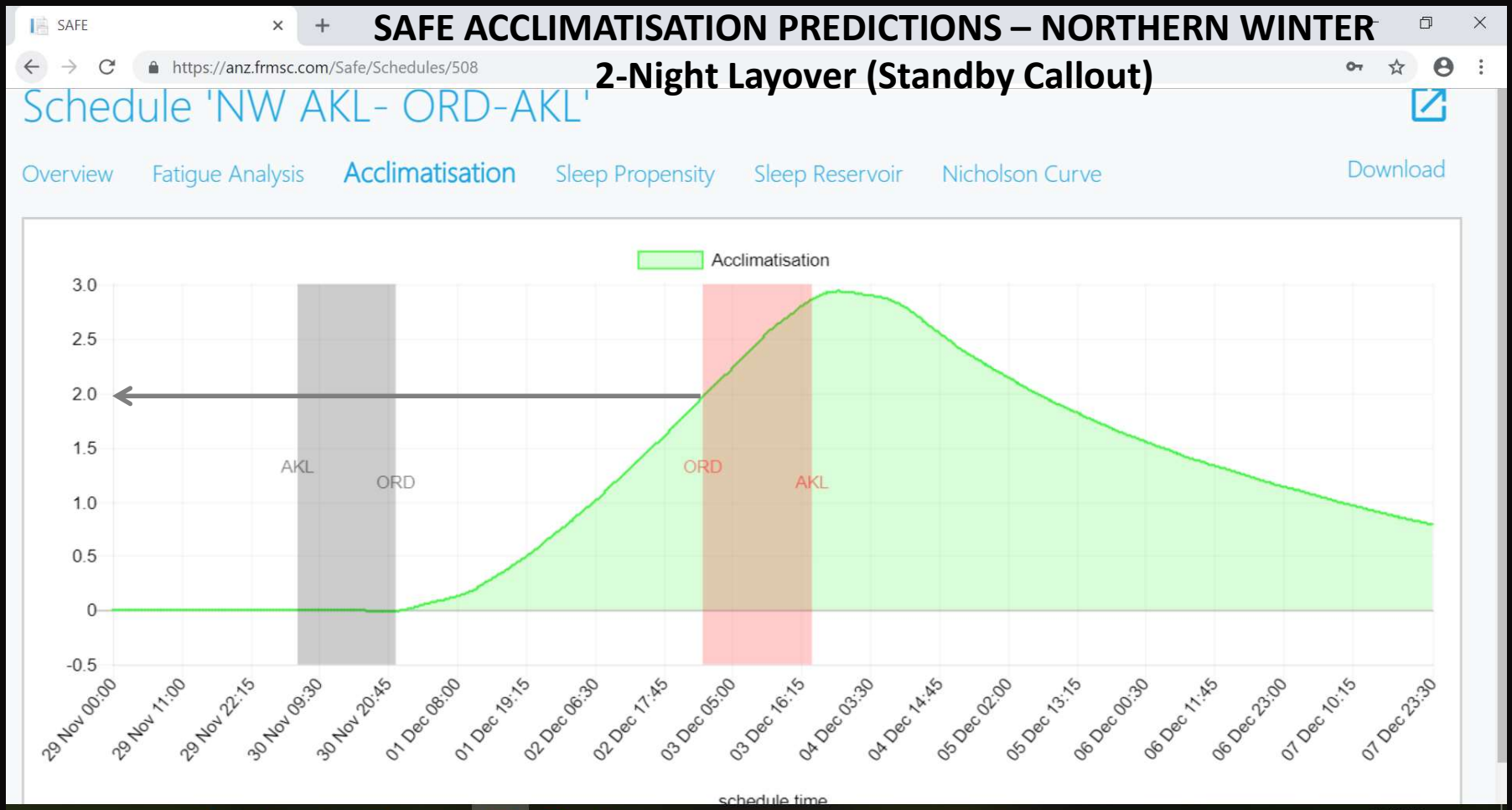
	Rest / Duration (NZ Time)	Body Clock	Predicted Sleep & Duration	SP InFlt	SP Blox ORD	SP Blox +1:30*
First Rest	2110-2340 (2+30)	2110-2340	2154-2255 1+01	4.32	3.96	3.91
Second Rest	2340-0340 (4+00)	2340-0340	0047-0232 1+45	4.29	3.90	3.78
Third Rest	0340-0740 (4+00)	0340-0740	0455-0624 1+29	4.32	3.96	3.91
Fourth rest	0740-1010 (2+30)	0740-1010	0822-0927 1+05	4.29	3.90	3.78

Predicted total sleep obtained **1st & 3rd 2+30** **2nd & 4th 2+50**

*Allows for holding at destination and then divert to alternate - Duty time 18:15

SAFE ACCLIMATISATION PREDICTIONS – NORTHERN WINTER

2-Night Layover (Standby Callout)



MODELLING PREDICTIONS ORD – AKL
2 Night Layover NW

(Applicable to crews when called out from standby to operate)

ORD – AKL SWRC Recommendation **3:00 / 3:00 / 4:15 / 4:15 (Optimised Rest During Circadian Night)**
Crew calls 1540* Transport 1640* Report 1810* (all times local) *Modelling based on 1:00 report to blox

Blox ORD 1910 (1410 NZ) 1st Rest Commence 1510 (NZ) 4th Rest End 0540 (NZ) On Blox AKL 0640

Total Inflight Rest 14+30

	Rest /Duration (NZ Time)	**Est Body Clock**	Predicted Sleep & Duration	SP Inflight	SP AKL	Blox +1:30*
First Rest	1510-1810 (3+00)	1710-2010	1613-1706 0+53	4.46	4.46	
Second Rest	1810-2110 (3+00)	2010-2310	1911-2008 0+57	5.01	4.56	
Third Rest	2110-0125 (4+15)	2310-0325	2211-0023 2+12	4.46	4.46	4.52
Fourth Rest	0125-0540 (4+15)	0325-0740	0231-0433 2+02	5.01	4.56	4.50

Total Sleep predicted: 1st & 3rd 3+05 2nd & 4th 2+59

*Allows for 30 mins hold and 1-hour diversion to CHC

SAFE Acclimatisation Predictions
Northern Winter (5 hour time change)

Layover Length	Acclimatisation (hours) toward ORD	In-flight Rest Periods	Default SP Blox AKL
2 nights	2	1&3	4.47
		2&4	4.63
3 nights	3.2	1&3	4.32
		2&4	4.37
4 nights	4.1	1&3	4.11
		2&4	4.11
5 nights	4.7	1&3	4.06
		2&4	4.07

4 & 5 night layover – crews considered fully acclimatised

2 & 3 night layover – standby callout – partial acclimatisation *(About 2 hours eastward from NZ)*

Modelling Predictions Summarised ORD-AKL

(Northern Winter – Landing Crew 1st & 3rd Rests)

Scenario		Inflight	Blox AKL	Blox Dest +90 mins
Normal Schedule Dep 1910	(2-night)	4.46	4.46	4.52
Dep End of Primary Window 0100	(2-night)	4.38	4.16	4.30
Dep Sec Window 0800 / 0930	(2-night)		4.50 / 4.63	
	(4-night)		4.25 / 4.20	
Contingent Scenario		4.89	4.42-20hrs	4.44-22hrs

Departure delayed 1:45 hours -No sleep during delay → 20 hours at end duty AKL

Normal Report & Extended Delay	4.83	4.48 Blox	4.47-22hrs

(Depart at 0100 4 Pilot Ops to RAR with no sleep during delay following 2-night layover)

Validation Report (SWRC)

- Final Report to client (Air NZ) at the end of Study - expected November 2019
- Summary document summarising findings to all flight crew
- Will compare TOD SPIs (KSS, SP & PVT) to TOD SPIs from other ULR flights (e.g. SIN-LAX-SIN)
- Flight crew sleep prior to ULR ops, inflight, during layover and post ULR duty
- Document subjective measures (sleep & fatigue) and objective performance measures on both ULR sectors and how these measures change across these city pair flights
- SWRC Massey University will seek to publish in deidentified format in public domain at later stage

Current / Future Situation

- Successful operations to date with periodic 90-day reporting to NZCAA as required by conditional approval for the first 12 months of operation
- Flight Crew Data collection continues
- Cabin crew validation commenced July 2019
- Increased Frequency of operations - 5 per week Dec 19 / Jan20
- Future potential for other ULR operations ?

Questions?