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DREAMS

Centre for Interdisciplinary Development and Research on Environment, Applied Management and Space
Centro Interdisciplinar de Desenvolvimento e Investigação em Ambiente, Gestão Aplicada e Espaço

Fatigue in a regional aircraft operator: the effect of multi-segment operations in alertness

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ICAO definition of Fatigue

A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety-related duties.

SYMPTOMS

CAUSES

CONSEQUENCES

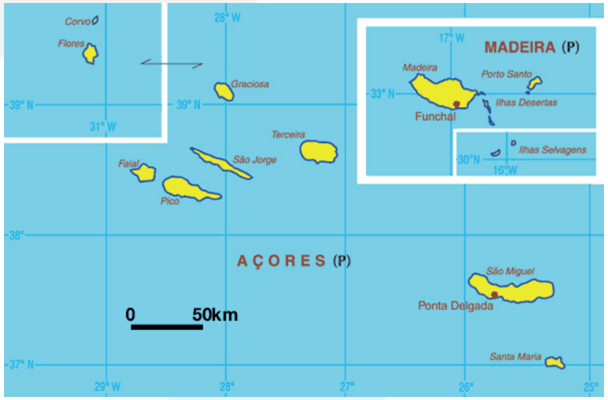
What is the impact in alertness of flying short multiple sectors during a single duty day in a potentially challenging enviroment?

- To identify the preeminence of the need to manage fatigue in air crew members
- To integrate fatigue hazards and its risk management in the framework of an existing SMS according to the new ICAO and European regulations
- To infer real risk already present in the airline through subjective fatigue queries
- To validate the chosen methods and processes so as to lead sustainable fatigue management implementation and maintenance

Research Context

- Regional Airline

- Island connections:
  - Short:00h15
  - Long: 02h00



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Methodology

- Literature review
  - Online scientific databases
- Questionnaire
  - Google forms
  - Based on Nasa's fatigue study in regional operators
  - Goals:
    - analyze demographics, personal and social habits
    - Evaluate fatigue and safety gaps

Methodology

- Diary:
  - Start and end times for the duty day;
  - Samn-Perelli Fatigue Scale (Samn & Perelli, 1982) and the Karolinska Sleepiness scale (Akerstedt & Gillberg, 1990);
  - NASA's TLX measurement, on a simplified version adapted to this study;
  - Assessment of further disruptions during the day.

- Questionnaire and diaries:
  - Available for one month;
  - Approved by the Airline's management and the Safety Department

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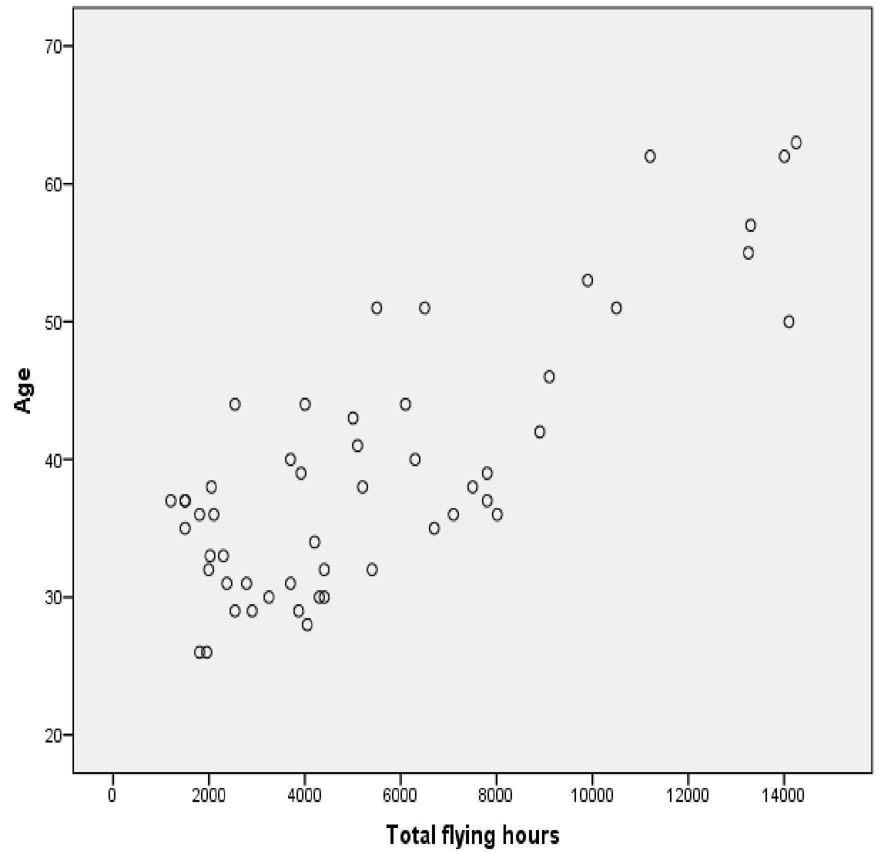
Universe

- 52 individuals – all male
- Average age 39.2 (±9,539)
  - 27 Captains:
    - mean age 44.2 (± 10,059)
    - Youngest: 30 years old
    - Oldest: 63 years old
  - 25 First Officers:
    - mean age 33.8
    - Youngest: 26 years old
    - Oldest: 44 years old



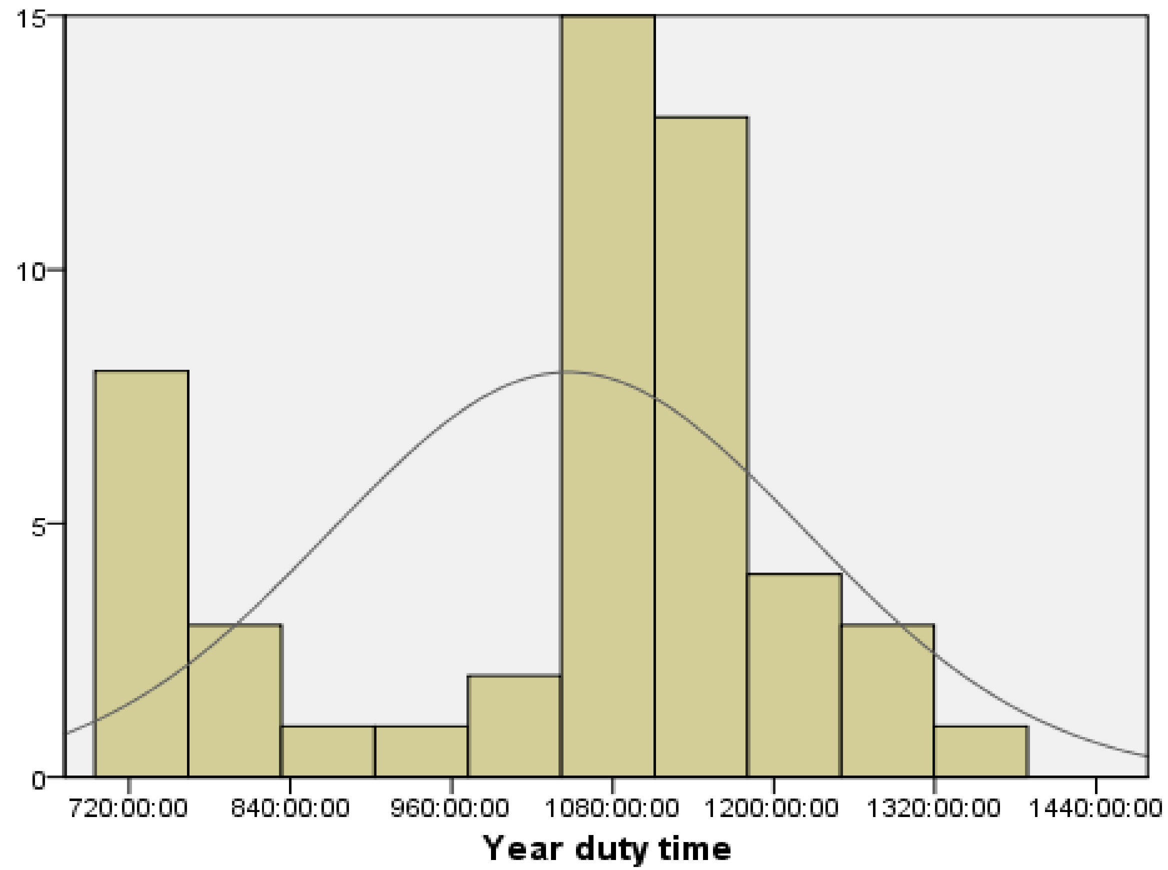
Results

Questionnaires

- 26 responses:
  - Representative sample (age and total flying hours)
  - Average age: 37 years old, [26;55], 50% bellow average
  - 70% married
  - More than 50% have up to 3 dependants
  - 50% have high school education (only 1 post-graduated)
  - 30% smokers
  - 85% practice exercise
  - 76.9% ingest caffeine daily
  - Diet is typical Portuguese/Mediterranean

Results

Analisys of planned schedules



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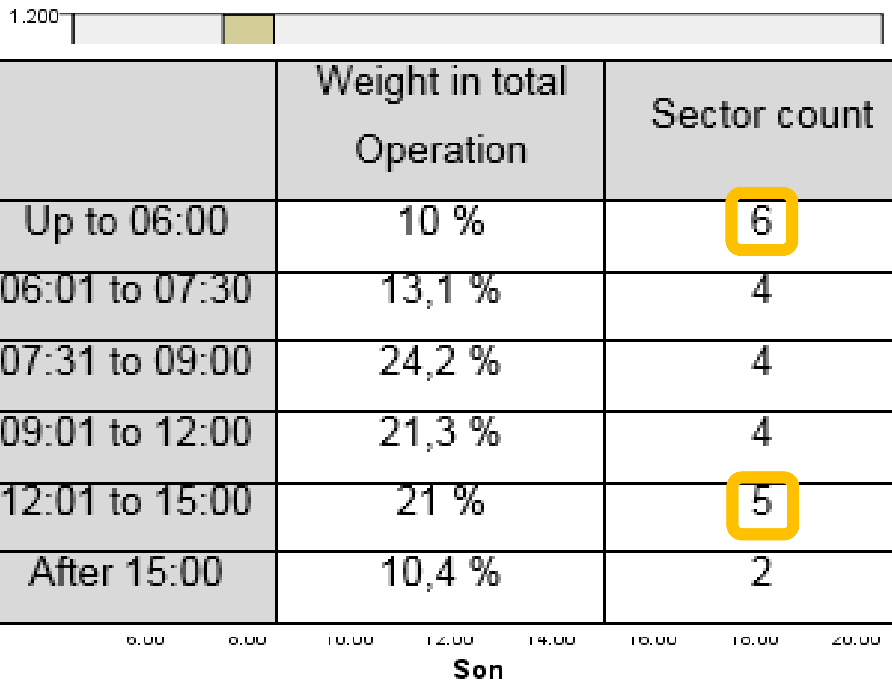
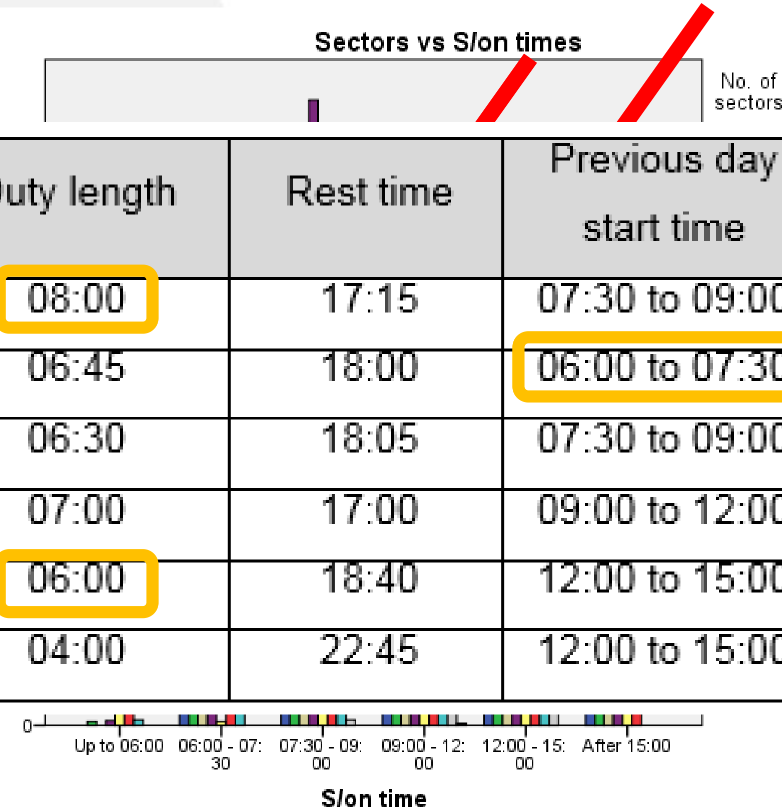
Results

Analisys of planned schedules





	Weight in total Operation	Sector count	Duty length	Rest time	Previous day start time
Up to 06:00	10 %	6	08:00	17:15	07:30 to 09:00
06:01 to 07:30	13,1 %	4	06:45	18:00	06:00 to 07:30
07:31 to 09:00	24,2 %	4	06:30	18:05	07:30 to 09:00
09:01 to 12:00	21,3 %	4	07:00	17:00	09:00 to 12:00
12:01 to 15:00	21 %	5	06:00	18:40	12:00 to 15:00
After 15:00	10,4 %	2	04:00	22:45	12:00 to 15:00

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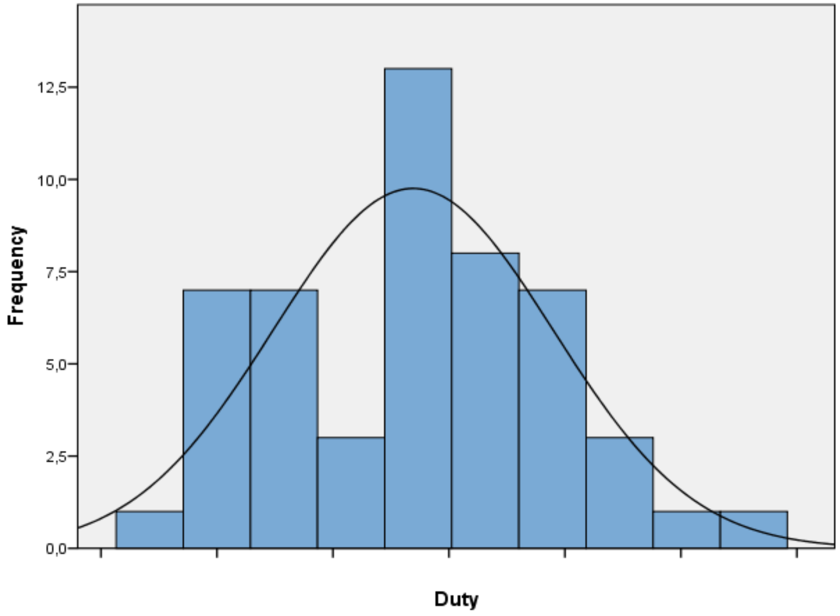
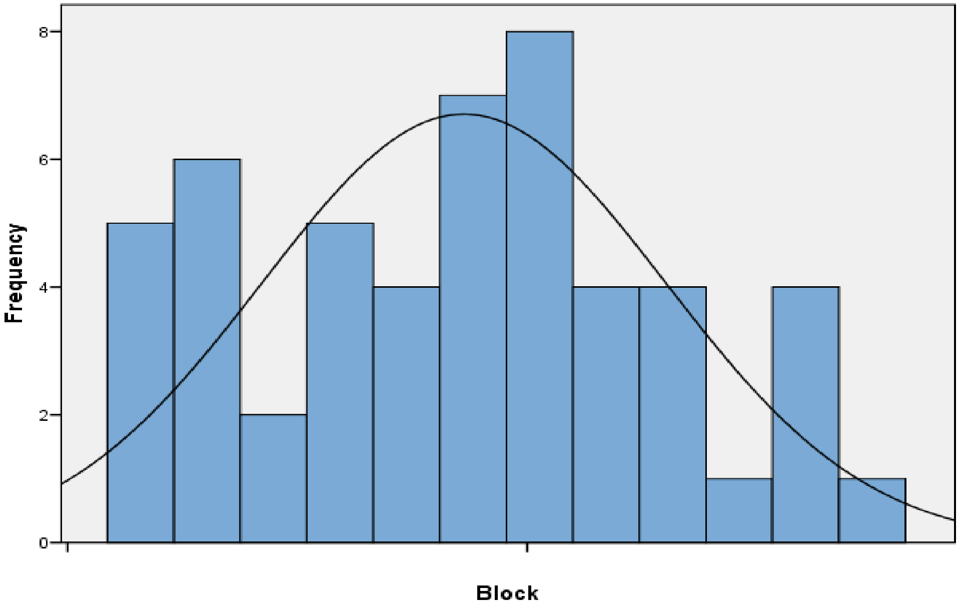
Results

Live trial

1 - Identify total times for the period and their distributions





	Average	Median	Minimum	Maximum
Duty	88:35 (+- 28:57)	88:00	27:09	159:31
Block	20:40 (+- 10:32)	22:00	02:05	42:03

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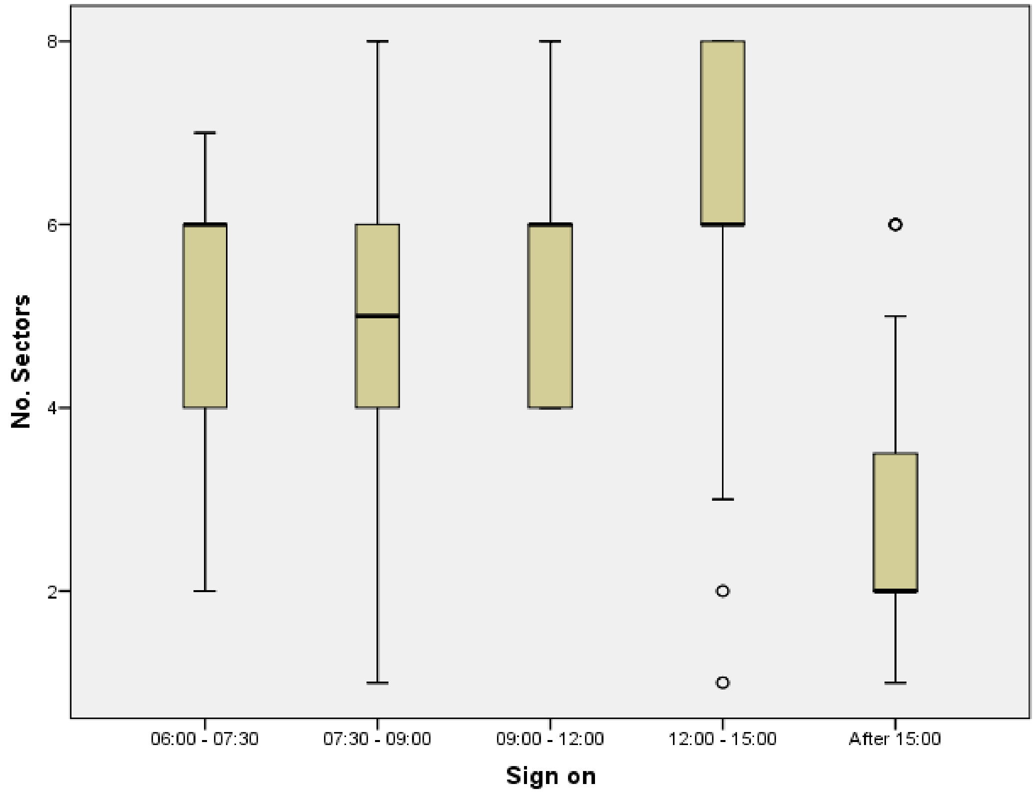
Results

Live trial

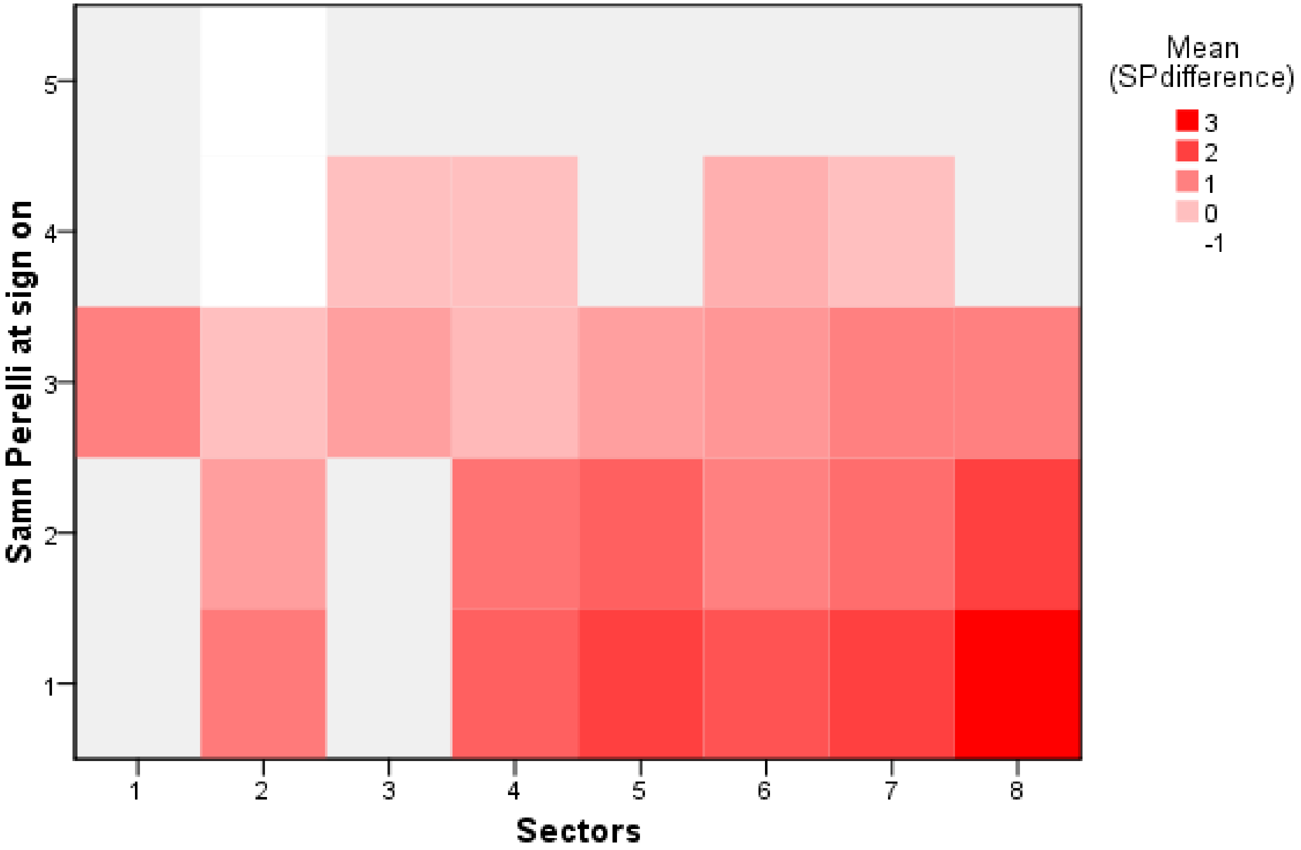
Segment the flights by reporting time

	ime	Top previous day reporting
06:00 to 07:30	0	06:00 – 07:30
07:31 to 09:00	0	06:00 – 07:30
09:01 to 12:00	5	09:00 – 12:00
12:01 to 15:00	5	09:00 – 12:00
After 15:00	0	09:00 – 12:00



Results

Live trial



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Conclusions

- Fatigue has a big impact in human performance and consequently in flight operations
- Early start time of the duty day has a negative influence in alertness
- Number of sectors flown further aggravates sleepiness and consequently a reduces alertness

Limitations

- Study performed in the winter months – operational discrepancy with year round reality
- Limited amount of time to colect data and infere more significant results
- Lack of fatigue studies with regional aircraft operators

Future directions

- Overview and control groups with higher block and duty hours

- Monitor early hour starts due to the potential risks associated with circadian disruption and sleep debt

- Further validate and monitor the impact of high workload in flight operations

- Perform a year round study to encompass the different variations in the operational context


The End