SafetyAzul

Segurança é o nosso primeiro valor.

Fatigue Risk Profiling at Azul

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Fatigue Risk Profiling at Azul

Who are we?

- Established in 2008

- 115 Destinations

- 143 Aircraft
  - 9 A330 - (5 A330NEO On-Order)
  - 38 A320/A321 NEO - (44 On-Order)
  - 63 E-Jet - (40 E-2 on order)
  - 33 ATR

- 822 Daily Flights

- #1 of Brazil's Take-Offs

- 13442 Employees
  - Flight Crew:
    - 1837 Pilots
    - 3500 Flight Attendants

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- **Problem:** how to create a fatigue risk matrix.

		Impact			
	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med Hi	High	High
Likely	Low	Low Med	Medium	Med Hi	High
Possible	Low	Low Med	Medium	Med Hi	Med Hi
Unlikely	Low	Low Med	Low Med	Medium	Med Hi
Very Unlikely	Low	Low	Low Med	Medium	Medium

Likelihood

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- **Objective:**
  - Create a fatigue risk matrix that:
    - Allows fatigue risks assessment as fast as possible.
    - Is scientifically based.
    - Reflects Azul's specific operational characteristics.
    - Gives precise SPIs.
    - Can be flexible to changing scenarios.

- **A few observations:**
  - There is no likelihood axis.
  - Profiling happens in two different phases:
    - Pairing level
    - Roster level
  - Needs to divided by fleet.
    - As of now we are perfecting the short-haul fleet analysis.

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Questions:

– What is fatigue?

– What criteria will measure it?

– What are the classifications and thresholds?

– How do we check efficiency?

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What is fatigue?

ICAO FRMS Task Force: 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.

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- **Scientific Studies and Papers:**
  - Sleep Debt
  - Wakefulness
  - Circadian Factors
  - Workload

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What is fatigue?

- **Main scientific studies and papers used:**
  - Rhodes and Gil (2002)
  - Dawson/Reid (1997)
  - Goode (2005)
  - Askertedt (1995, 1998)
  - Roth et al. (1994, 2004)
  - Gander (1998)
  - Spencer (2005)
  - Powell (2007)
  - Tritschler (2015)
  - A **lot of talking** with Dr. Hurcsh

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What is fatigue?

- **SAFTE-FAST outputs:**
  - Fatigue Hazard Area (Critical)
  - Effectiveness (Critical)
  - Sleep Reservoir
  - % below criterion (Crewing)

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What criterias will measure it?

- **Based on papers, methodologies and model:**
  - Sleep Debt
  - Wakefulness
  - Circadian Factors
  - Workload
  - SAFTE-FAST Outputs

- **Company Experience:**
  - Fatigue Reports
  - Fatigue Classes
  - LOSA
  - FOQA
  - Investigations
  - Special Airports

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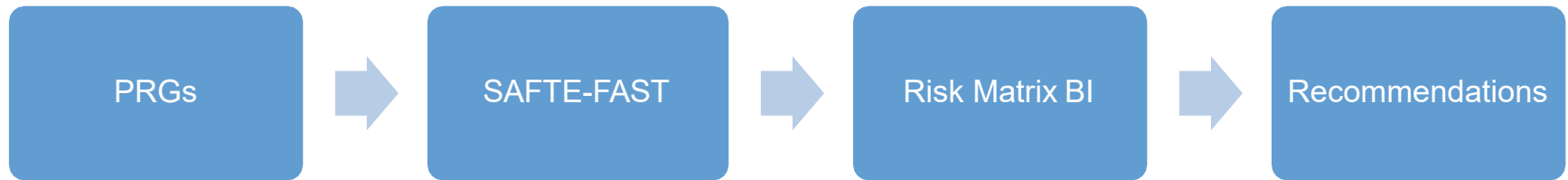What are the thresholds on the <u>pairing level</u>?

- – Observations:
  - Gives us a 100% likelihood of the pairing happening.
  - Provides a "sterile" environment for best case scenarios.
  - Allows full use of SAFTE-FAST model outputs.

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Process

PRGs → SAFTE-FAST → Risk Matrix BI → Recommendations

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- **What were one of the risks we identifed?**
  - The main driver for fatigue in the E190 fleet were early starts.
    - This was supported by the risk profiling and supported by the fatigue reports.

- **Actions?**
  - **Recommendation:** After the two consecutive early starts (00:00L-06:00L), the third check-in time has to be after 08:00L.

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What are the thresholds on the <u>roster level</u>?

– Observations:
  - Has to take into account days-off and rest opportunities.
  - Must take into account how medium risk pairings interact.
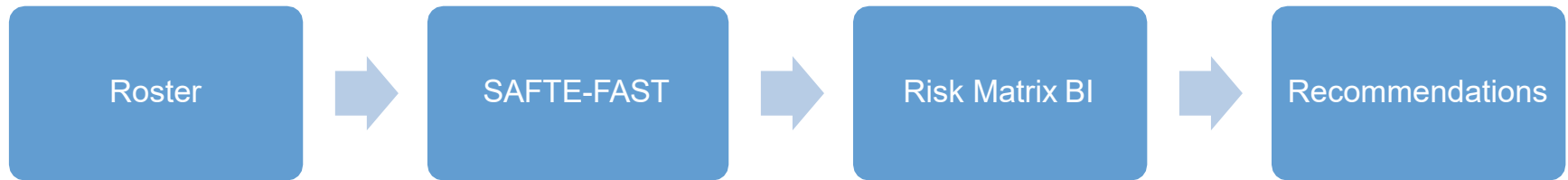 - Depends on feedback from reports and operational experience.

Next slide is a **work in progress**.
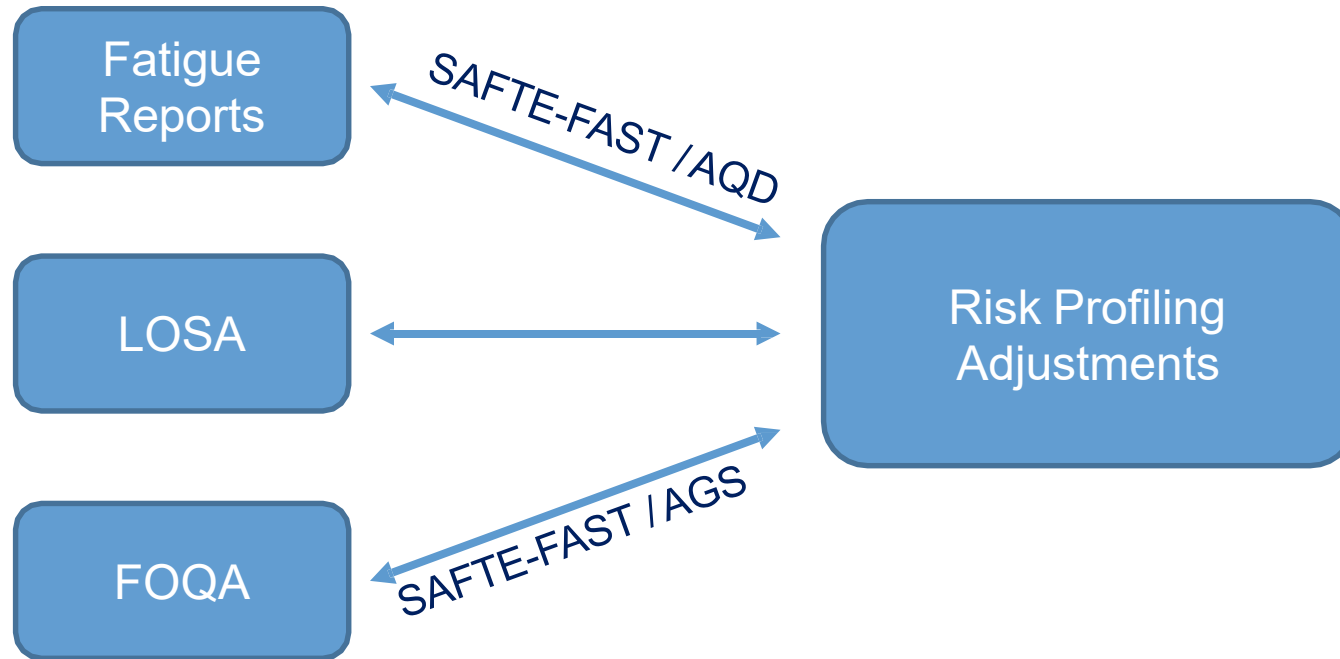
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Process

Roster → SAFTE-FAST → Risk Matrix BI → Recommendations

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Risk Matrix development and improvement process

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Risk Matrix development and improvement process

Fatigue Reports:

- SAMN-Perelli
- Effectiveness
- Descriptors

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Risk Matrix development and improvement process

LOSA

- Fatigue factors tracked:
  - Yawning
  - Forgetfulness
  - Inadvertent Sleep
  - Irritablility
  - Tunnel Vision
  - General fatigue remarks

- All these factors are cross-checked with threat and error data from the observations.

Foi observado alguma das seguintes situações? (Selecione todas as que ocorreram)

Bocejos Excessivos: ▼
Esquecimentos: ▼
Sono inadvertido: ▼
Irritabilidade: ▼
Visão de túnel: ▼

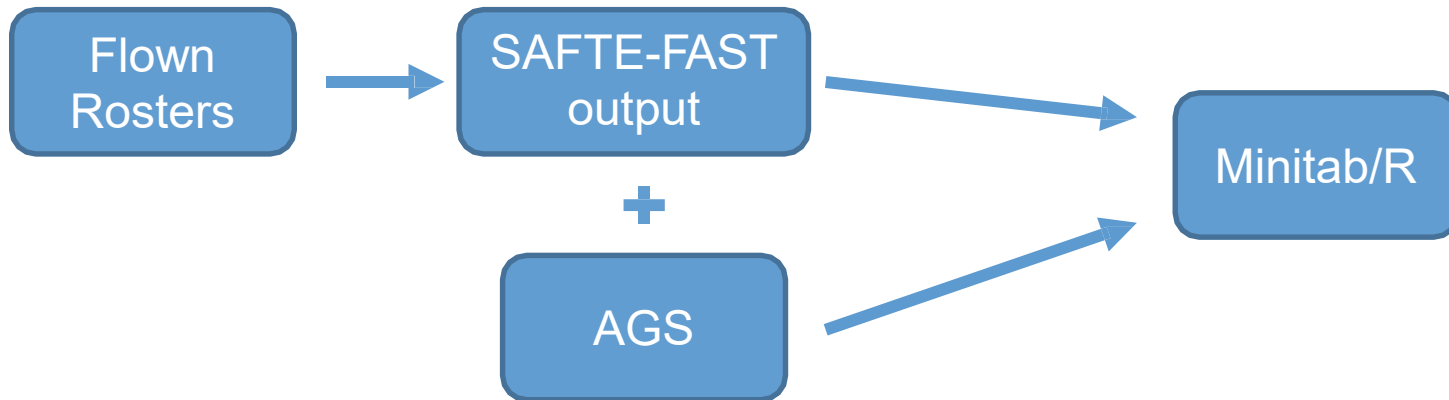Houve algum comentário da tripulação com relação a fadiga: ▼

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Risk Matrix development and improvement process

FOQA

```
┌──────────────┐      ┌──────────────┐
│    Flown     │ ───▶ │  SAFTE-FAST  │ ──────────┐
│   Rosters    │      │    output    │           ▼
└──────────────┘      └──────────────┘      ┌──────────────┐
                             +              │   Minitab/R  │
                      ┌──────────────┐      └──────────────┘
                      │     AGS      │ ──────────▲
                      └──────────────┘
```

Data integration points:
- Hour
- Date (Month)
- Airport (IATA)
- Flight id
- Badge id

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Next Steps

- Test and validate point system.
- Streamline FOQA integration process.
- Streamline LOSA integration process.
- Begin HFACS integration process.
- Automate statistical studies within the profiling.
- Build a more robust fatigue investigation form.
- Feed Risk Profiling into Machine Learning tools for rule development.

THANK YOU!
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