Fatigue Risk Management (FRM) within SR Technics Ltd.

SM ICG, Roma May, 2016

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SR Technics at a glance

Overview service portfolio

Airframes

- Line, base and heavy maintenance of Airbus fleets
- modification solutions for Airbus and Boeing fleets

Components

on Airbus and Boeing fleets

- Management of entire component MRO program
- Ratable inventory management

Engines

- CFM 56-5B/5C/7B (more than 1,500 engine shop visits in total)
- PW4000-94“/100“ (over 2,200 shop visits in total)
- Piece part repair

Wide range of integrated solutions combining MRO activities
Component and engine finance, sale and leaseback
Engineering services

Fleet technical management
Technical training

SR Technics provides the full spectrum of MRO services to its customers and is well positioned for the long term

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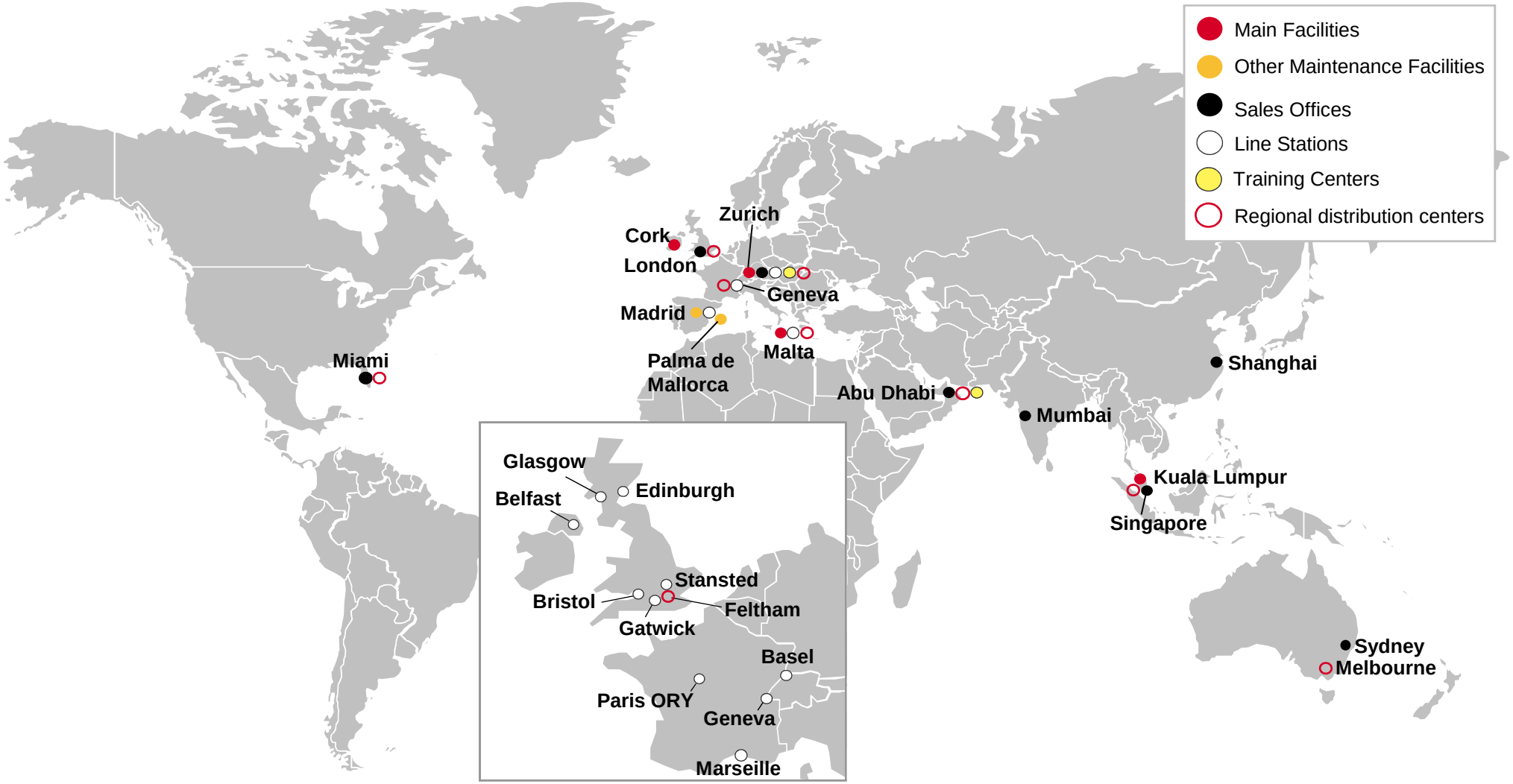
SR Technics at a glance

Full service provider – geographic footprint



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SMS Implemented at SR Technics

Integrated system used to analyze our risk based performance

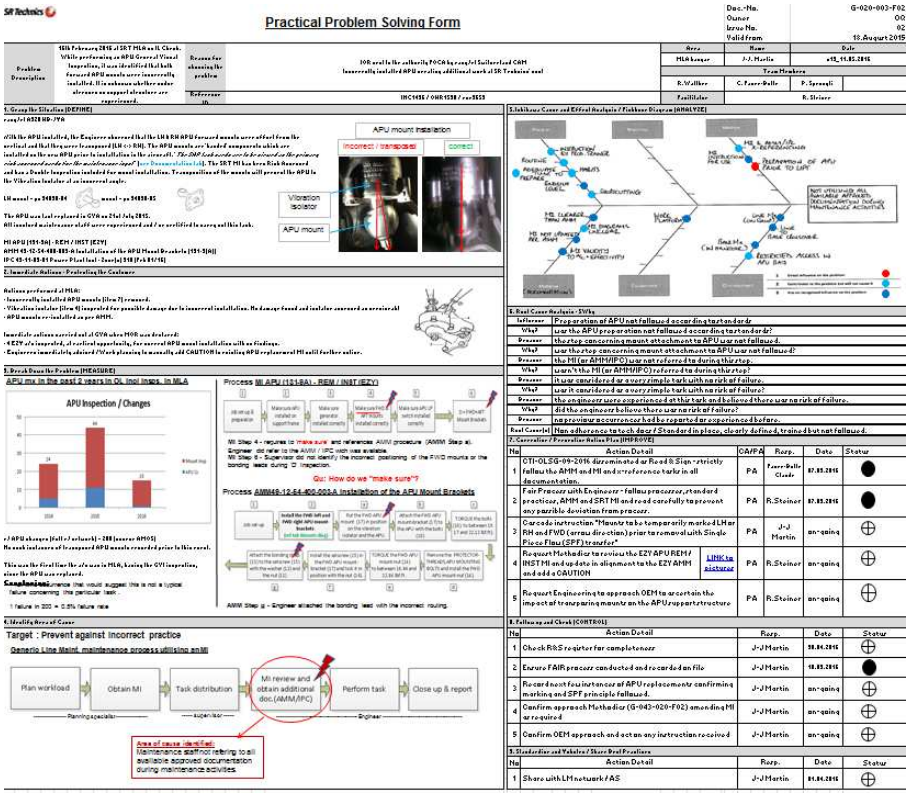
Audit findings / observations
Occurrence & hazard reports
Accidents Potential risks Waste

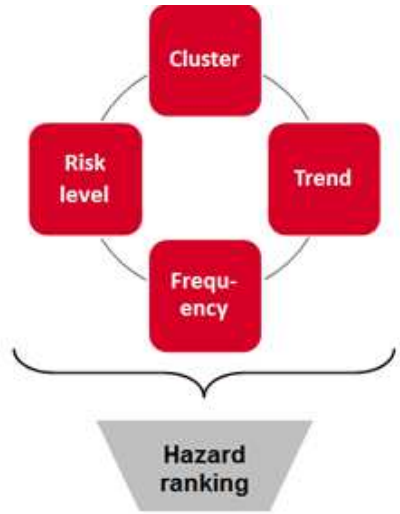
Root cause analysis depending on risk level

Based on: **- DEMAC**
- HFACS

Corrective and preventive actions
IT solutions

In total up to 2500 events per year of which up to 20% will be analyzed in detail





Goal of the Analysis:

Identify critical processes, process steps:

1. Work according Processes/Manuals
   - Compliance with Standards
2. Competence, Training and Awareness
   - Missing Awareness on how to handle fatigue

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Human Factors Focus

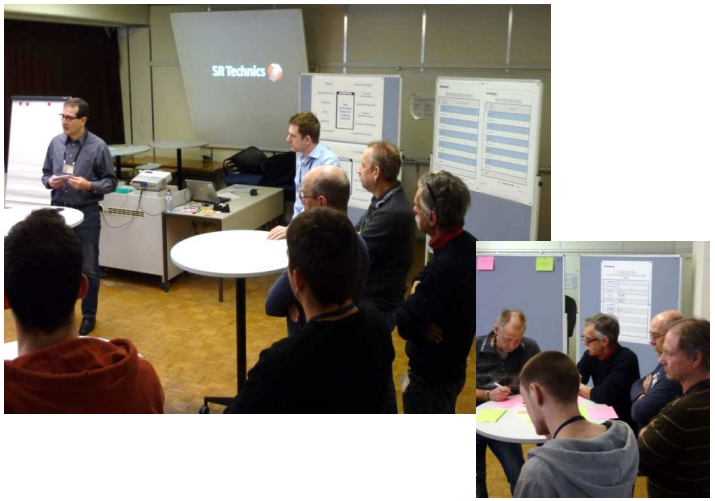
Communication and training – from WBT to classroom

Based on Safety Data Analysis:

- Human Factors are identified still as a key influence to the risk exposure of the processes
- New approaches are required
- Interval of interactive classroom training is yearly

Old approach = WBT

New approach = <u>interactive</u> classroom training



Combination of :

- Refresher of the **STOP** campaign
- Safety Management Systems
- Human Factor
- Occupational Health & Safety training
- Hands on / practical training as required based on analysis over last 12 month

Conclusion out of the feedback provided by the staff pointed to:

To improve Human Factors: «Fatigue Risk Management» elements must be considered and applied!

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FRM assessment from CRM experience in Flight Operations

Based on the experience made with Crew Resource Management (CRM) at Flight Operation during the Swissair time, SR Technics initiated an in-depth assessment of the behavior in «Fatigue Risk Management (FRM)» within the Maintenance Organization environment.

Since SR Technics no longer has qualified CRM/ FRM specialists, support from the University was deemed necessary and cooperation with the School of Engineering of Zurich (ZHAW) has initiated.

Zürcher Hochschule
für Angewandte Wissenschaften

zh
aw

School of
Engineering

ZAV Zentrum für Aviatik

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Working Environment

Comparison Flight Operations/ Maintenance Operations

Similarities between
Flight Operations/Maintenance Operations:

- Extended working hours
- Disturbance of the circadian rhythm time, resulting in decreased sleep quality and quantity

Differences between
Flight Operations/Maintenance Operations :

- More physical activities during work
- More exposure to health related environmental conditions (noise, air Pollution etc.)
- Different module of the shift system
- Different conditions for rest breaks

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Boundary Conditions

Boundary Conditions in Aircraft maintenance must be acknowledged and accepted

Aircraft maintenance is rendering services for an operator or customer.
The requirements of the customers must be respected and followed.
Such boundary conditions include:

- **Availability of the aircraft for maintenance work**
- **Aircraft type to maintain (required access due to size, complexity of work to be done)**
- **Environmental conditions to perform the work (work performed in hangar or on tarmac),**
- **Required changes of working shifts at short notice (based on work advancement)**

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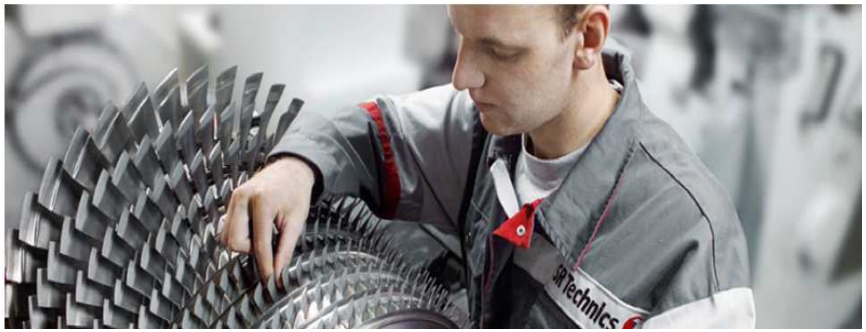
FRM data monitoring - Framework

Physical Data Monitoring Project with ZHAW started in September 2015

IDENTIFIED TEST AREAS & WORKING SHIFTS:

- Aircraft Services (3 shifts)
  Pure Maintenance Operations Environment

- Engine Services (2 shifts)
  «Factory like» Operations Environment



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Scope of data gathering & monitoring

The scope of the physical data monitoring included:

- **Long term study design** with 9 participants for:
  (4 Engine Services & 5 Aircraft Services)
  - Measurement of activity (via Ready-Band)
  - Measurement of mental fatigue or accident risk through Alertness Score (tablet based reaction test)
  - Cognitive performance*
  - Diary

- **Employee Survey** with 216 participants & **Environmental Measurements** for:
  (70 Engine Services & 146 Aircraft Services)
  - Condition at the workplace of shift workers*
  - Temperature*
  - Cognitive performance*
  - Observations at the workplace
    (ventilation, breakrooms, noise, etc.)

*(subjective & objective measurement)

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Results of data analysis

The **Physical Activity measurement** combined with **Environmental measurements** and **Survey's data** have brought to the following results:

- **Shift Patterns:** identified as Risk Factor, if not taking into account decreased cognitive abilities during end of night shift (e.g. Change from night to early shift)
- **Light Conditions:** is as potential disturbing/tiring factor if not tailored to the specific working activities (e.g. detailed vision required)
- **Lack of Awareness and Attentiveness:** related to Fatigue Mechanisms of human body (Employees circadian rhythm)
- **Air Quality:** "air pollution" identified as disturbing factor by the employees
- **Noise:** identified as disturbing factor
- **Temperature:** considered a disturbing factor especially in hot and cold seasons (Influences on the employee's performance)

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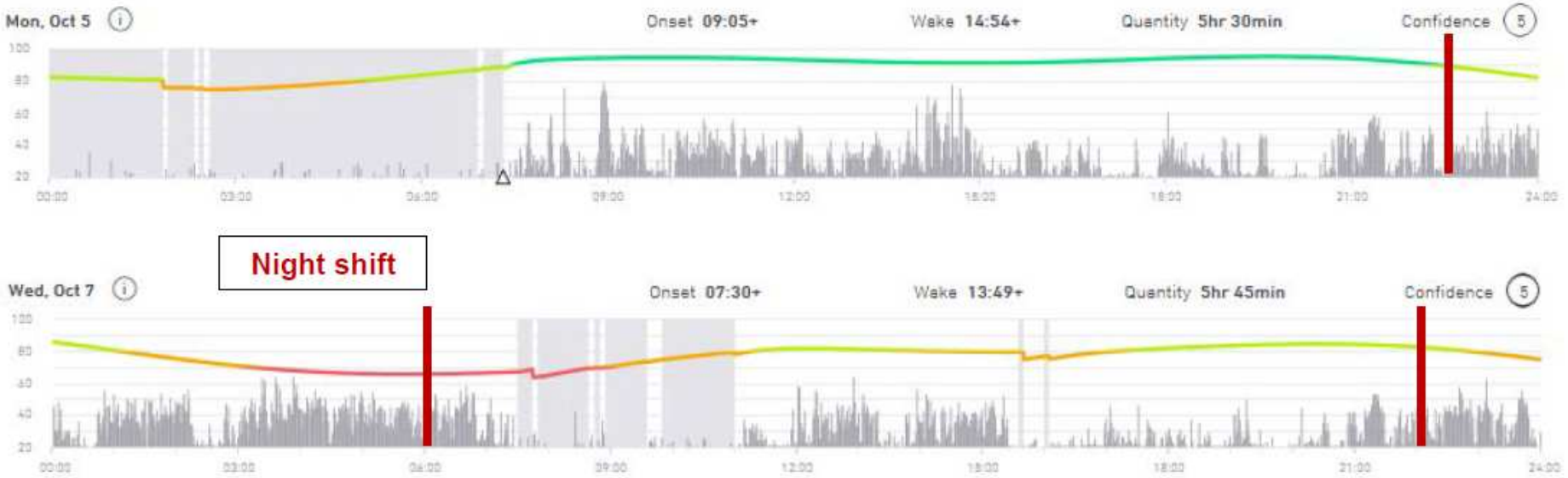
First Resolution for FRM Mitigation: Shift Plan (1/2)



Mental effectiveness zone	Percentage of time you spent in each	Reaction time slowed by	Blood alcohol equivalence	Risk of accident or serious error
90 - 100	93.2	5%	0%	Very Low
80 - 90	5.8	18%	0%	Low
70 - 80	1.0	34%	0.05%	Elevated
60 - 70	0.0	55%	> 0.08%	High
0 - 60	0.0	100%	> 0.11%	Very High

Old Pattern						
Days	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
	N	E	L	N	E	L

New Pattern						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Days	E	L	E	L	E	L
Days	N	N	N	N	N	N

N	Night Shift
E	Early Shift
L	Late Shift

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First Resolution for FRM Mitigation: Shift Plan (2/2)

Considerations:

- Based on the analyzed data some employees have shown less stress then others to work during night shifts
- Other employees suffer the change from night to early shifts

Solution:

- Adopt a shift plan to allow staff to voluntary opt to work in night shifts, thus releasing the remaining employees from the night shift
- The shift plan no longer considers the change from night to early shifts

Old Pattern						
Days	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
	N	E	L	N	E	L

N	Night Shift
E	Early Shift
L	Late Shift

New Pattern						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Days	E	L	E	L	E	L
Days	N	N	N	N	N	N

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Second Resolution for FRM Mitigation: Lighting

Considerations:

Based on the analyzed data, Light Conditions are, as identified, a potential disturbing/tiring factor

Solution:

Introduction of LED work lights to improve illumination, especially when detailed vision is required, to decrease the work fatigue.

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Third Resolution for FRM Mitigation: Air Ventilation

Considerations:

- Based on the analyzed data “air pollution” has been identified as disturbing factor by the employees

Solution:

- Introduction of new higher standards air ventilation systems is ongoing in those areas, identified by the data analyses, where the quality of the air is felt as disturbing factor and where it may decrease due to specific Maintenance Activities (e.g when APUs active or in painting areas etc.)

Conclusions

Next Steps:

A pragmatic approach requires to educate our staff how THEY ought to deal with FRM issues on a personal level. Combined with knowledge from operational experiences this would allow SRT to develop customized counter-measures.

- Need to involve staff to support / Improve FRM behavior
- Definition of specific FRM training for staff in order to support them to mitigate the fatigue stress
- Envision future collection of data also via internal reporting to support FRM development
- Further evaluate improvement in ergonomics and shift patterns as applicable based on aircraft availability for maintenance

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Thank you for your attention.

Questions?

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