



SAPIENZA
UNIVERSITÀ DI ROMA

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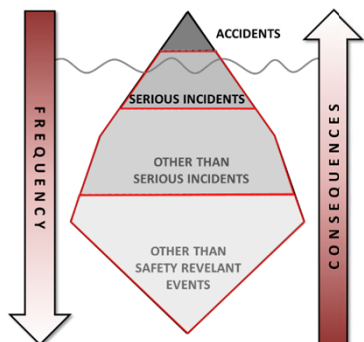
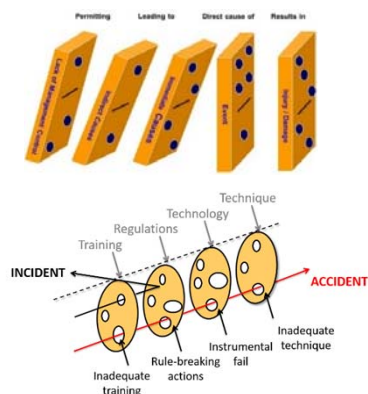
Fifth SESAR Innovation Days

YOUNG SCIENTIST AWARD

3rd December 2015

*Risk Management and Resilience Engineering
to enhance Air Traffic Management system safety*

WHERE DO I STARTED



ESARRs



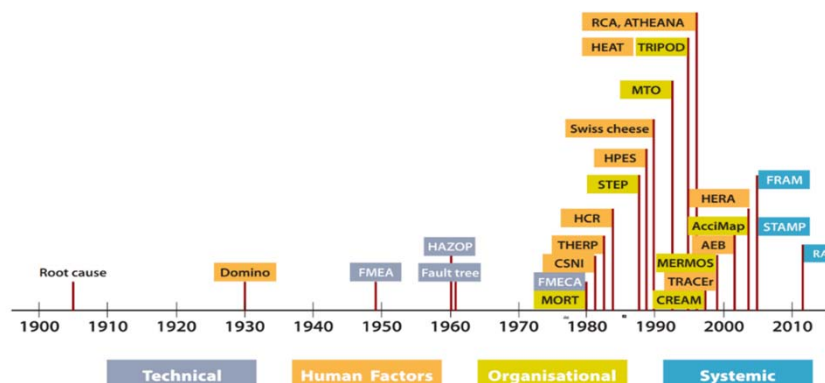
SMARTER and HOLISTIC
SAFETY INDICATORS

SAFETY - I
avoiding that
things go
wrong



WHERE DO I STARTED

In order to manage complex interactions of the ATM system, it is necessary to focus on **SYSTEMIC MODELS**



SAFETY-II
performance
variability rather
than bimodality



WHERE I WOULD LIKE TO GO

SAFETY-I + SAFETY-II

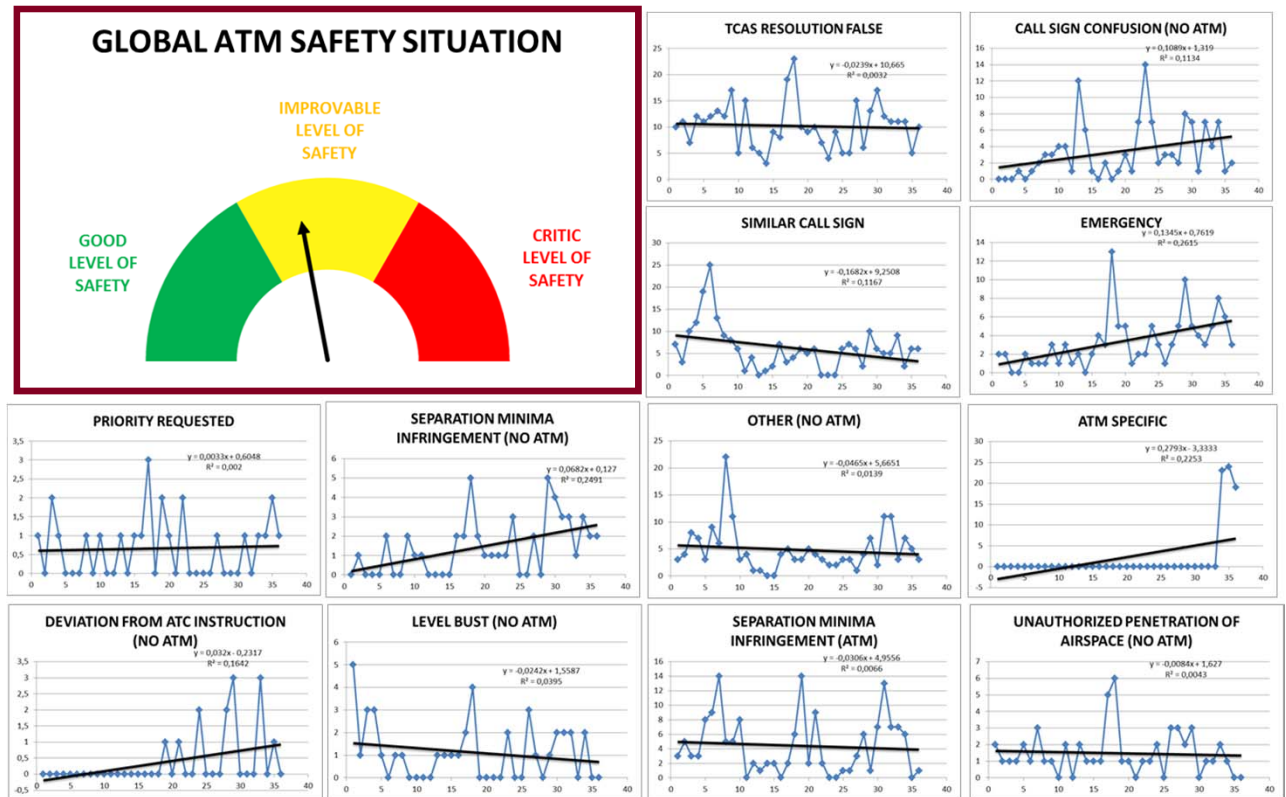
Is it really possible?



SAFETY-I: APF SAFETY INDICATORS



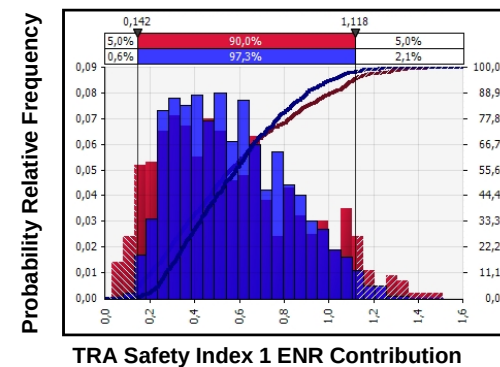
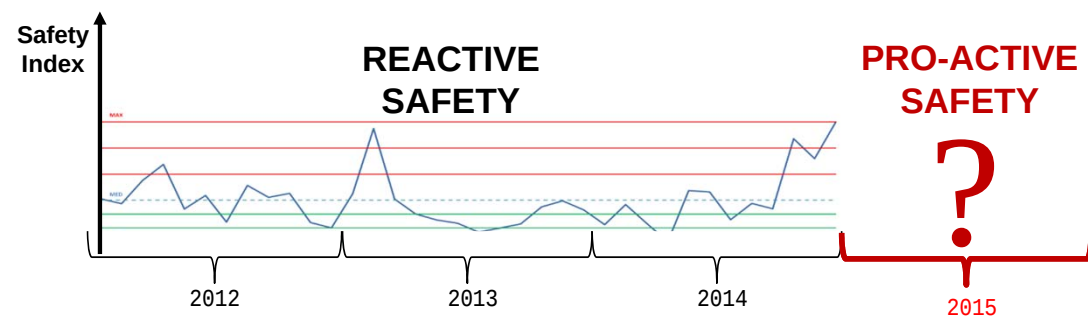
ESARRs' reporting structure + ANSP reporting database



SAFETY-I: EVOLVING APF SAFETY INDICATORS (HOW?)

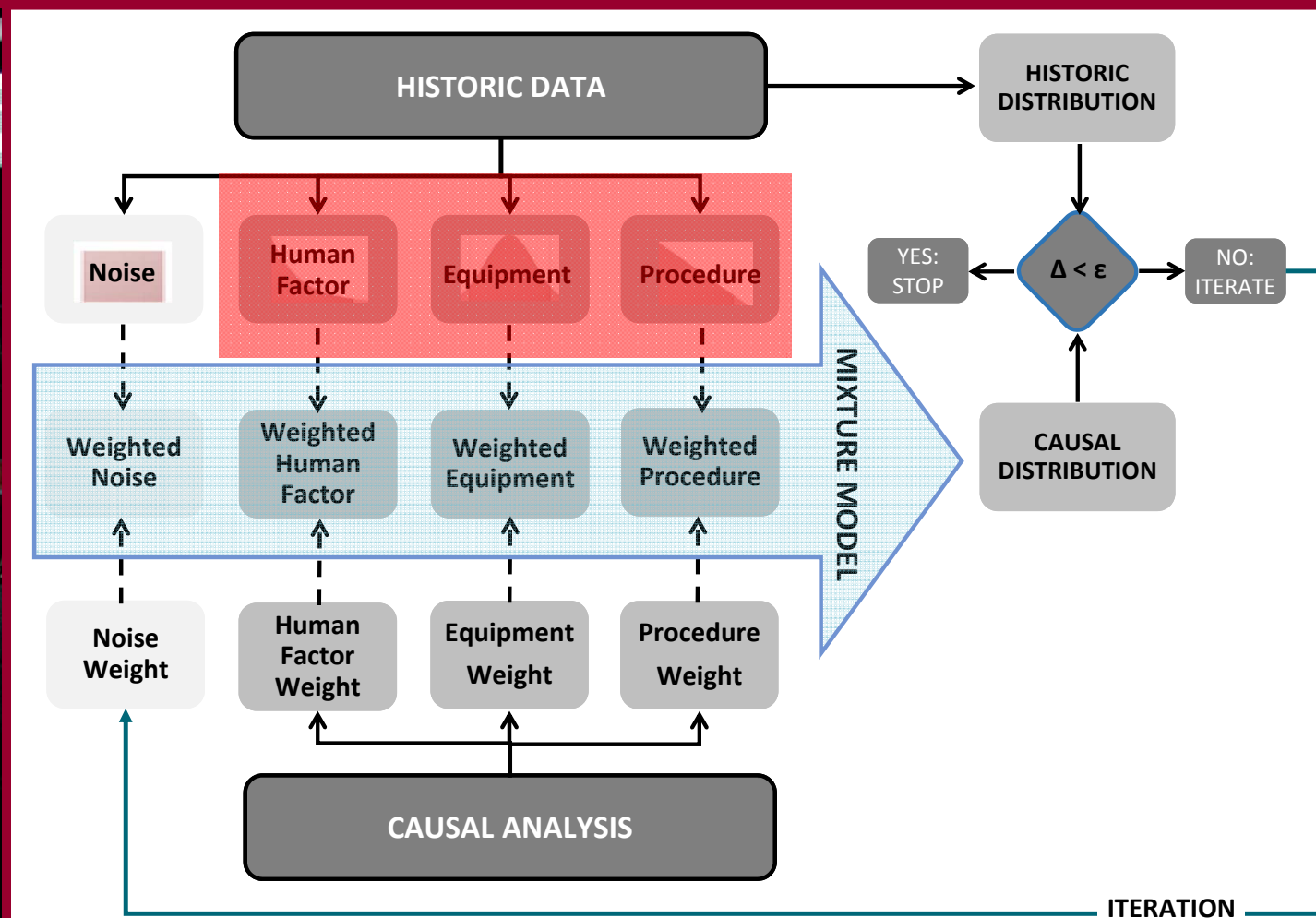


Is it possible to **evolve** APF Safety Index in order to
forecast safety levels of ATM system?



CAUSAL FIT

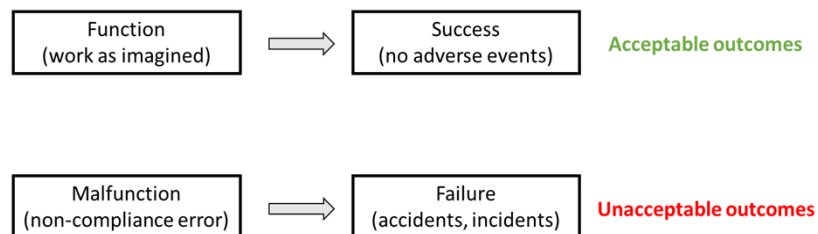
SAFETY-I: EVOLVING APF SAFETY INDICATORS (CAUSAL FIT)



ANOTHER POINT OF VIEW...

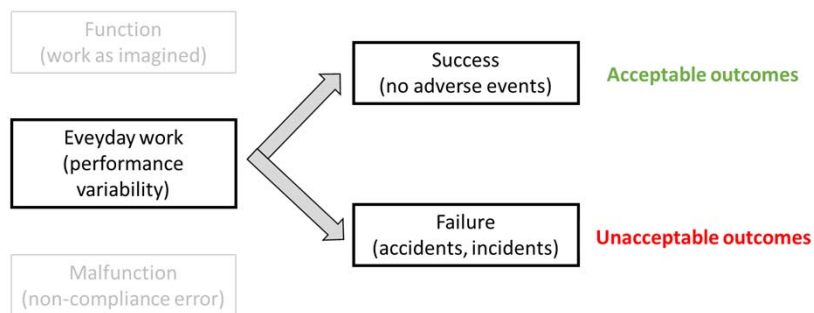


SAFETY-I



For **tractable** systems, it is correct to assume a **bimodal view** of work and activities.

SAFETY-II



For **intractable** systems, the systemic methods, based on **Resilience Engineering**, acknowledge that acceptable outcomes and unacceptable outcomes have a common basis, namely **everyday performance adjustment**.

RESILIENCE ENGINEERING (just «two» words)

«Resilience is the ability of the ATM system (people-procedures-equipment) to **adjust its functioning prior to, during, or following changes and disturbances**, so that it can sustain required operations under both expected and unexpected conditions» (Hollnagel, 2011).

Resilience as tolerating disturbance without collapsing into qualitatively different state



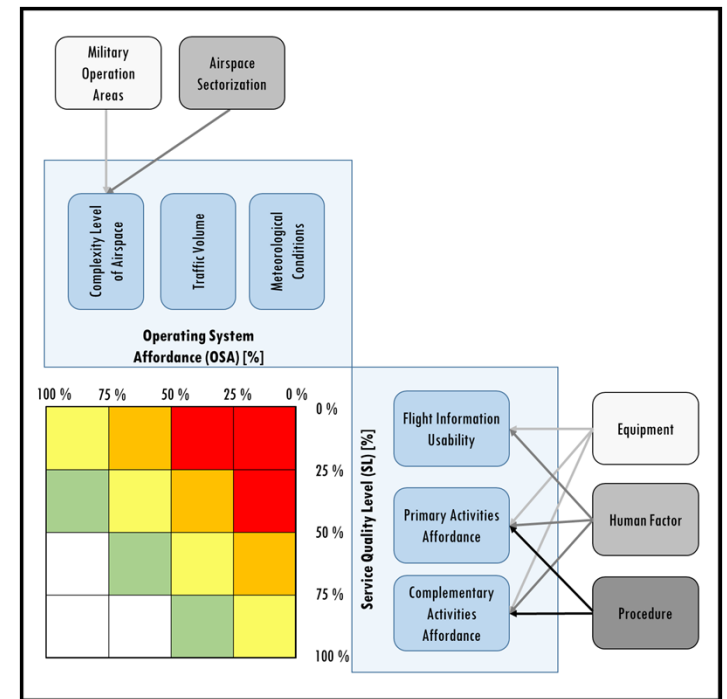
SAFETY-II: MODELING RISK (PHASE 1)



Risk Assessment Tool

The matrix expresses the risk state of the ATM system.

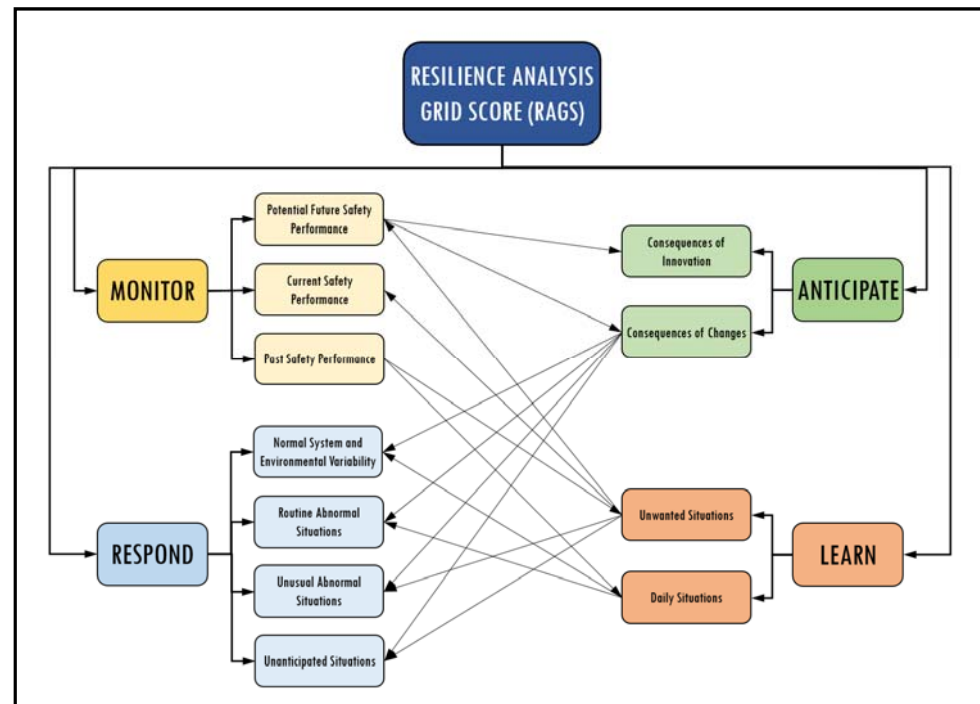
The **lower the OSA** and the **lower the SL**, the higher the risk.



SAFETY-II: MODELING RESILIENCE (PHASE 2)



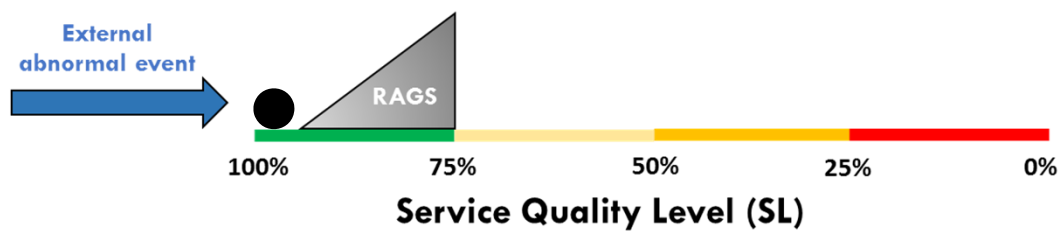
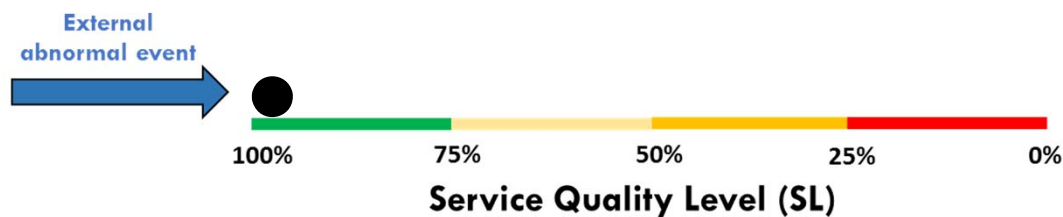
Analytic Resilience Analysis Grid



The AN-RAG expresses the resilience of the ATM system under specified conditions.

The **higher the RAGS, the higher the resilience capabilities** of the system.

SAFETY-I + SAFETY-II: SAFETY for the SYSTEM



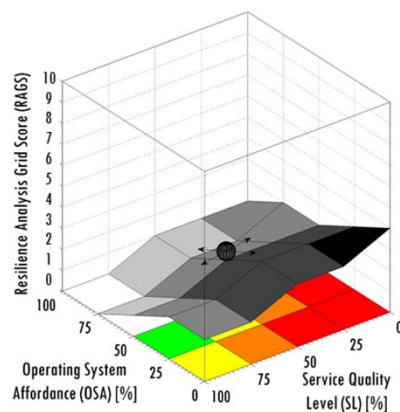
RAG-RAT helps the decision-makers to:

- Assess the actual resilience profile of the ATM system
- Decide the priority for mitigating actions at organization level
- Use Monte Carlo to simulate future risk states of the system based on unpredictable events

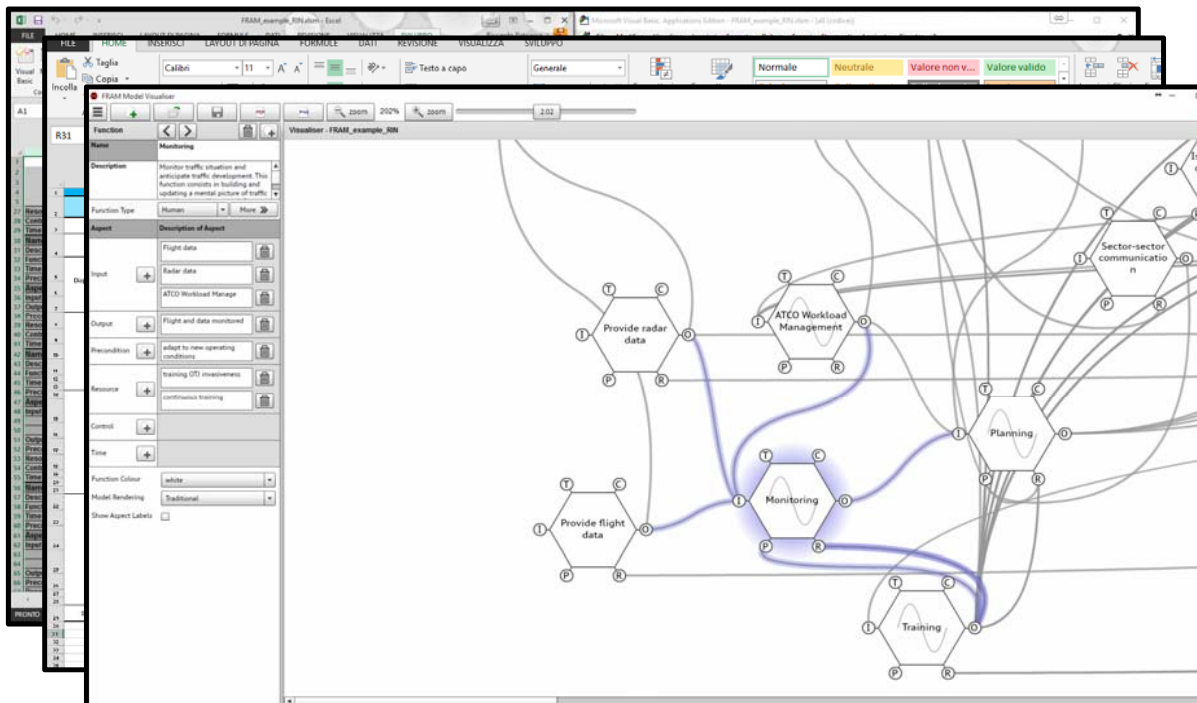


Operating System Affordance (OSA) [%]				
100 %	75 %	50 %	25 %	0 %
RAGS 2.5	RAGS 3.5	RAGS 3.7	RAGS 3.7	0 %
RAGS 2.0	RAGS 2.5	RAGS 3.5	RAGS 3.7	25 %
RAGS 1.3	RAGS 2.0	RAGS 2.5	RAGS 3.5	50 %
RAGS 1.3	RAGS 1.3	RAGS 2.0	RAGS 2.5	75 %
				100 %

Service Quality Level (SL) [%]



SAFETY-I + SAFETY-II: SAFETY for the PROCESS



QFRAM Quantitative Functional Resonance Analysis Method

The QFRAM outcomes will be used as inputs for the RAG-RAT external abnormal events profile. The higher the value, the bigger the event strength.



MY PROGRESS

SAFETY-I

99 %

40 %

30 %

My MSc Thesis
24 March 2014

I start researching at Sapienza
1 April 2014

My PhD officially starts!
1 November 2014

PhD 2° year begins!
1 November 2015
TODAY!

SAFETY-I+II

Safety performance assessment of the Air Traffic Management system
RESEARCH IN TRANSPORTATION BUSINESS & MANAGEMENT
UNDER REVIEW

I'm a PhD!
end 2017

AND SYSTEM SAFETY
WORKING PAPER

And then?

RAG-RAT: Assess resilience and risks in
Linking process and organization resilience by quantitative functional resonance in dynamic system evolution
RELIABILITY ENGINEERING AND SYSTEM SAFETY
WORKING PAPER

THANK YOU! (you may clap your hands now!!!)

[illegible]

KEEP IN TOUCH

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