



Proposal for safety and resilience validation of the new concepts

FARO project addresses the evaluation of the impact of new automation solutions on resilient performance and safety. To do this, it is necessary to know how the safety is provided and produced by the ATM system, before and after a change in the ATM system is deployed. FARO proposes a generic validation plan explaining how to evaluate the impact of new solutions on SAFETY and RESILIENCE (S&R) performance combining safety and resilience models outputs. The validation plan sets the basis for demonstration of usability that will be performed on preselected current and future concept use cases.

Validation context

FARO methodology and the technical approach will be validated through the following activities and exercises:

- ACT01:** Activity to assess the predictive capacity of the Safety Performance Functions;
- ACT02:** Activity to assess the validity of the Resilience Engineering approach, to assess resilient performance and the system conditions that shape resilient performance;
- ACT03:** Activity to assess the performance of the Natural Language Processing (NLP) models to identify hidden variables in LoS Reports;
- ACT04:** Activity to assess the performance of the Automatic Contribution Assessment models;
- EXE01:** Exercise to validate FARO approach (SEESAW) of safety and resilience (S&R) integration through Consultations with the Stakeholders to;
- EXE02:** Exercise to demonstrate proposed model for S&R integration and data-driven analysis to support the development of S&R Guidelines.

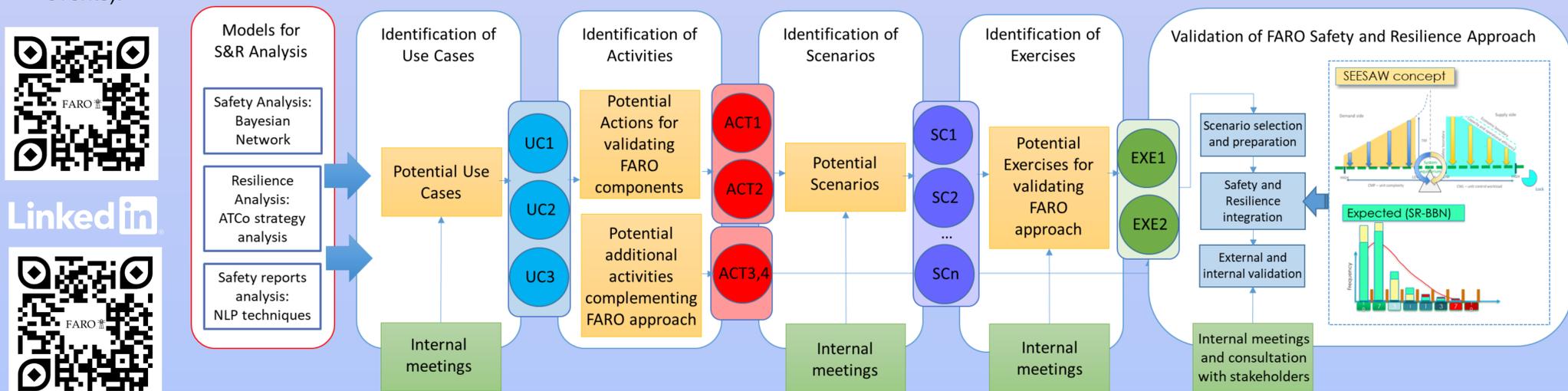
Use Cases

- Use Case 1 (UC1)**, related to the implementation of the Free Route Airspace in Santiago sector in Madrid ACC, and the impact that comes from the increase of complexity due to the multiplicity of potential conflicting points.
- Use Case 2 (UC2)**, detailing the split of a sector located in Barcelona ACC and the change of operational procedures derived from it, where the impact on safety and resilience comes from the irregular shape of the resulting sector, making transfer of flights more difficult, especially during bad weather conditions.
- Use Case 3 (UC3)**, the inclusion of Mode S Instrument Air Speed (IAS) in the label on the flight in the ATCo working position in Barcelona TMA, allowing a better speed monitoring, together with the awareness of non-compliance by the aircrews, expected to result in reduced non-stabilized approaches and go-arounds.
- Scenarios** are associated to one or more UCs and are selected to capture various traffic conditions (low-high traffic, severe weather and/or disruptive events).

Research Questions

- RQ1.** How can an organization leverage data to measure and predict safety events where these are characterized by a very low frequency of occurrence?
- RQ2.** Is the Bayesian Network suitable for providing a predictive capacity of safety?
- RQ3.** How can an organization identify the sources of adaptive capacity that enables adaptation (resilient performance baseline) from which may evolve when a design solution that assumes a high degree of human system integration is deployed and how can any changes that influence or effect resilient performance (be they positive or negative) be analyzed and brittleness be identified?
- RQ4.** How does an organization recognize where the operating point is at any one time and identify both the gradients and counter gradients?
- RQ5.** How can an organization analyze the impact of human-centered automation on safety and resilience performance in a systematic manner aided by data-driven techniques?
- RQ6.** How can an organization integrate quantitative safety assessment with qualitative resilience assessment?
- RQ7.** Does the SEESAW concept provide a common view on Safety and Resilience synergy?
- RQ8.** Are NLP techniques suitable to extract hidden topics and taxonomy factors from LoS reports?
- RQ9.** Is it possible to assess contribution a few minutes after an incident exploiting operational data, in order to help safety practitioners in prioritizing investigation for urgent matters (instead of waiting months for the complete investigation)?

Research Question	ACT01	ACT02	ACT03	ACT04	EXE01	EXE02
RQ1	Y					
RQ2	Y					Y
RQ3		Y			Y	
RQ4		Y				
RQ5	Y	Y			Y	Y
RQ6					Y	Y
RQ7					Y	
RQ8			Y			
RQ9				Y		



Based on validation results which will demonstrate the usability of a combined use of safety and the resilience models, the gaps in the safety and resilience approach will be identified and guidelines for safety and resilience prepared.

<https://faro-h2020.eu>

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