

Future Challenges to Safety - PRC position paper

Rationale and background

A primary responsibility of the Air Traffic Management (ATM) system is to control safety risks, although in practice developments are often dominated by changes made to improve capacity, efficiency and cost of the system.

ATM safety has improved over the past decades for many reasons, including better equipment, more efficient operations and additional safety defences and mitigation tools. However, any further improvement of current safety performance, and even maintaining the current levels, will be extremely demanding due to numerous technological and institutional changes in the future and rising levels of traffic.

“ATM safety has improved over the past decades - but there are challenges ahead”

Moreover, recent political priorities and calls for action¹ raise several concerns and questions that would need to be addressed before they are officially accepted and implemented in any shape and form.

As safety in aviation and in ATM is a priority, the challenges for European ATM stakeholders with any new developments and changes in operational concepts are: to determine what (potential) safety aspects are of concern; how these can be measured; and, what analyses are needed to ensure acceptable safety levels.

Therefore, it is important to identify challenges to future ATM safety, and besides identifying how to assure the safety of the systems, processes and procedures, to also define methods and tool which would allow monitoring of the safety performance of the new system.

Safety analysts, experts and decision-takers have to carry out safety assessments of future operational concepts and changes, based on a large set of assumptions, statistically incomplete and sometimes maybe even biased evidence.

If future risks cannot be estimated with precision, it is questionable how safety can be ensured with traffic growth, operational and technological changes.

Being “safe” in the future system will be essential for survival in the industry. Safety however should not be looked in isolation anymore, but rather as the part of a very complex system. We would need to take the interdependencies between safety and other Key Performance Areas (KPAs) into account, as it will be difficult or even undesirable to analyse safety performance in isolation. So how should we measure future safety performance?

Being “safe” in the future system will be essential for survival

¹ Such as SES2+ Regulation on the implementation of the Single European Sky (recast) and Report of the Wise Persons Group on the future of the Single European Sky

“Future challenges to Safety” initiative

To address those important questions, it is important to identify challenges to future safety in a changing ATM environment (what to focus on?) and how to measure them (what are suitable methods and tools?).

Initiating a discussion with safety experts in EUROCONTROL Member States and other international organisations in early 2020 the Performance Review Commission (PRC) embarked on the challenging task to start a dialogue and ultimately development of the future safety performance framework.

In early 2020, safety experts were asked for their views on emerging safety challenges from the evolving ATM system. The objective was to collect a wide spectrum of expert views on future challenges to safety and how to identify and measure potential risks in a changing ATM environment.

Building on this initial exchange, the PRC held a Workshop on 29 June 2020 that deepened the discussion. The Workshop was a starting point in defining safety performance objectives/focus areas for the future ATM system. The Workshop itself served as a platform to collect intelligence about “what do we know” and “what is available”.

More information on the PRC workshop is available online @:
https://ansperformance.eu/study/prc_ws_2020_06_saf/

PRC proposed way forward

The Workshop input together with stakeholder inputs provided beforehand (surveys, interviews) are seen as a first step toward building a safety performance framework for

the future that will include views about the future safety system and how to measure its performance.

Overall, this is an extremely complex undertaking but nonetheless a vital prerequisite for the measurement of safety performance in the future ATM environment.

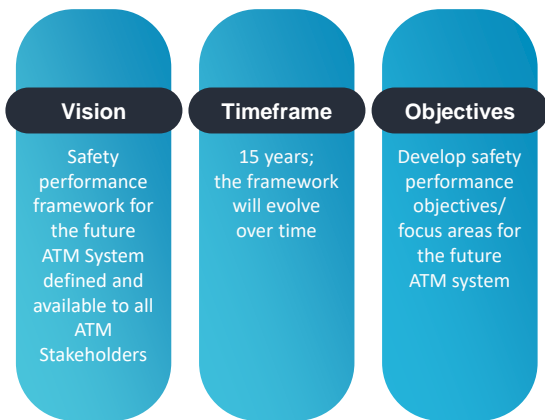
“There is a need for a safety performance framework that can address risks in the changing ATM environment”

Ultimately, the goal is to develop a safety performance framework that would support the implementation of changes (new concepts, technologies, and processes) in the future ATM environment. It should be seen as a contribution to better understanding of the possible changes to the ATM system and their possible impact on safety.

This document present the first attempt to summarize all intelligence received and to identify safety performance Focus Areas, around which possible work partnerships should take place.

Future Safety Roadmap

The development of safety performance framework for the future should be seen as a long-term project, not just to cover all relevant changes to the system that could potentially influence aviation safety, but also in order to reach the maturity needed to produce performance measurement that could be used on a Network level. The horizon for such changes is considered to be between 5 to 15 years.



Taking into consideration necessity for various inputs to be used, as well as work partnerships needed to achieve the common goal and expected outcome (i.e. defining the safety performance framework for the future ATM system) this initiative indeed presents a complex and demanding mission.

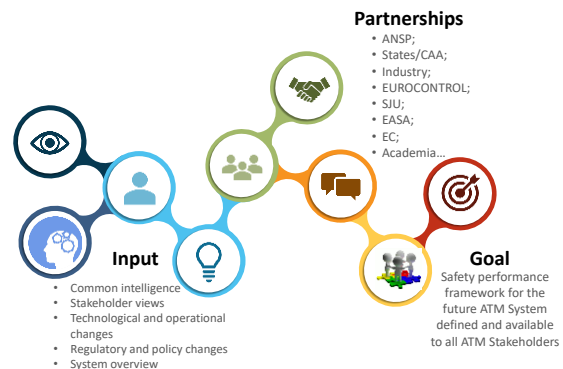
The main **goals** of the Challenges to Safety initiative are:

- a. to keep safety at a high level and to improve safety performance overall, where possible;
- b. to have a pro-active approach to develop a framework in which safety challenges are thought of in advance and are implemented in an analytical approach;

Moreover, as far as the **scope** of the Challenges to Safety is concerned, this framework should be based on a holistic approach (by integrating functional, human, technical, organisational and societal dimensions), leading to an overall view on safety, based on hazards and risks, and paying attention to interdependencies. It should be based on new developments within the ATM system, but also developments in airspace use (including new entrants) and future use of airports. As the objective is to develop the safety performance framework for the future, it is necessary to understand the future aviation system. That goes beyond ATM.

The future performance framework has to be systemic to capture all the players, including

spatial dynamics (e.g. local, regional, network levels). It should not be limited to the Network, or State level, as the information to be analysed and monitored will come from the Air Navigation Service Providers (ANSPs) (i.e. direct safety performance delivery). The ANSPs will be the customer for part of the framework, however the framework should encompass the overall system.



PRC proposed Safety Focus Areas

Changes affecting the future ATM and aviation system overall can fall in two distinct categories:

- physical, functional, operational, and procedural changes (regardless whether they are progressive or fast introducing) that stakeholders plan for the ATM/aviation system with the intention of improving capacity, safety, efficiency and/or cost- efficiency; and
- unintentional technological innovation, shifting operational tasks, subtle changes in organisations or actors in the system, and contextual factors external to ATM/aviation itself that can nonetheless influence the robustness of the support systems upon which operational safety depends.

Changes are not strictly limited to the future. They may have begun in the past and only finish at some point in the future. They may

also have begun now and continue into the future, or they might be not yet in place, and will begin at some point in future. Lastly, changes affecting future of ATM/aviation safety can come from within the system or from events and circumstances outside.

However, besides categorising changes by its nature (i.e. Intentional or unintentional), the changes can be divided as per their position (function) within the system:

- Changes related to the changes in work environment (including organisational and societal dimensions) and characteristics of work performed;
- Changes related to human performance and human-machine interaction;
- Changes related to operational, and procedural changes in the future; and
- Changes related to changes in technology and equipment (implementation of new technologies, solutions, equipment and tools).
- Based on all input received prior to and during the Workshop the main identified topics and safety concerns were possible to fit into one of the above mentioned system categories. Based on this scheme and in order to consolidate future safety performance framework development and define work streams, several broad

thematic areas, i.e. safety **Focus Areas** are proposed:

- **Environment** (e.g. including increased traffic, new entrants, institutional changes,); should provide a common understanding of what the future system is and how it will look like, what is considered 'safe' in the future environment, as well as what are the boundaries of the future system we are trying to measure;
- **Operations** (e.g. changes in operations and procedures); introduction of new technologies and equipment will possibly lead to changes in operations and procedure, these will have to be clearly defined and their impact on safety described and possibly assessed;
- **Technology and equipment** (e.g. including increased automation, the introduction of the ATM data service provider (ADSP), big data, digitalization, cyber security); introduction of various new technologies and equipment into the future ATM system will lead to changes and challenges which will have to be clearly defined and their impact on safety described and evaluated;
- **Human** in the new system (e.g. roles and responsibilities, workload); the modernisation of European ATM will inevitably lead to a new organisation of the work and workplace.



The proposed future ATM changes will have an impact on the people delivering the ATM services and the “human” role in the system. The identification of the future role of the human in delivering safety and how ATM safety can be protected is essential.

- **Interdependencies** (as transversal category, considers system thinking); the nature of future changes to the ATM system are entirely dependable on intractable systems. A consequence is the creation of additional and new complexity in the ATM system and up-and-coming properties that defy a priori knowledge of system behaviour. Definition and analysis of future safety performance framework must take into consideration interdependencies in the new ATM/aviation system. An overall framework or process for balancing safety against other key performance parameters (most notably capacity and cost) is required to be in place.

Further work will have to look closer at these Focus Areas individually and try to identify additional challenges that effect future ATM safety performance. Both types of changes, intentional and unintentional, will have to be carefully defined and their impact on safety described.

Measurements and Tools

From the safety performance perspective, besides getting more insight into future changes and the relationship of these changes with safety, future work will also have to look at the development of new methodologies, tools and performance indicators that could monitoring of performance at different levels (micro, mezzo, macro).

Within each Focus Area, after the key challenges are properly identified and a set of

key questions answered, the tools and methods, including definition and development of safety performance indicators (SPIs) will have to be made. SPIs will be a means to improve safety performance, as they will contribute to set a more informative and better quality (defined to future environment and conditions) safety picture due to better performance indicator monitoring across the Network.

Besides proposing new SPIs, critical review the effectiveness of existing safety indicators will have to be made, with an aim to see how (if at all) these indicators contributed to safety performance in the past. Moreover, this critically review should answer what safety dimensions are captured through existing SPIs and how does each contribute to safety performance improvement. Based on these findings, it would be possible to identify safety dimensions that still need to be improved and propose corresponding indicators.

Considering complexity of the future ATM system, it is probable that multiple sets of performance indicators, which could give different information about the system, and different stakeholder needs, will be needed.



PRC position

This **PRC position paper** provides initial guidelines on how to approach development of the future performance framework that is needed to support measurement of safety performance for various stakeholders in the ATM system. More specifically, it represents the first attempt to summarize all intelligence received during initial stages of “Future Challenges to Safety” initiative and to identify safety performance Focus Areas, around which possible work partnerships should take place.

Five Focus Areas have been proposed (Environment, Operations, Technology, human and Interdependencies) that can ultimately describe the major categories of challenges facing safety performance of the ATM system. Each of the proposed Focus Areas will be a separate Work Package that will have to be further developed, which will include identification of additional challenges within each area, impacts those changes might have on safety, as well as proposals for methodologies, tools, data collection process, and indicators needed to measure future safety performance within the new environment.

All Work Packages will develop exact timeline, milestones and deliverables for its course. The overall work envelope for development of performance framework for the future can be spread in the different time frames, such as: short (0-3 years), medium (3-7 years), and long (7-15 years).

Nevertheless, it is possible that separate Work Packages will have milestones that span over two or more timeframes due to its complexity and uncertainty of elements to be considered.

As mentioned at the beginning, this initiative is an extremely complex undertaking however, it is vital prerequisite for the measurement of safety performance in the future ATM environment.

During the first months of 2021, the PRC will seek to engage in partnership with different Stakeholders willing to work and cooperate on each Focus Area. A detailed work plan for each Work Package including their timelines, precise objectives and scope, and expected outcomes will be defined upon arrangement of separate partnerships. If a holistic approach is considered, dialogue with airports, airlines, States, new entrants, and even Academia, not just ANSPs, will have to be established to define the safety performance framework of the future. Moreover, due to complexity of the work, it is envisaged and of utmost importance that each Work Package include different partners including Academia, SJU, EASA, ANSPs, airlines and airport, depending on the work requirements.

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