Network Manager
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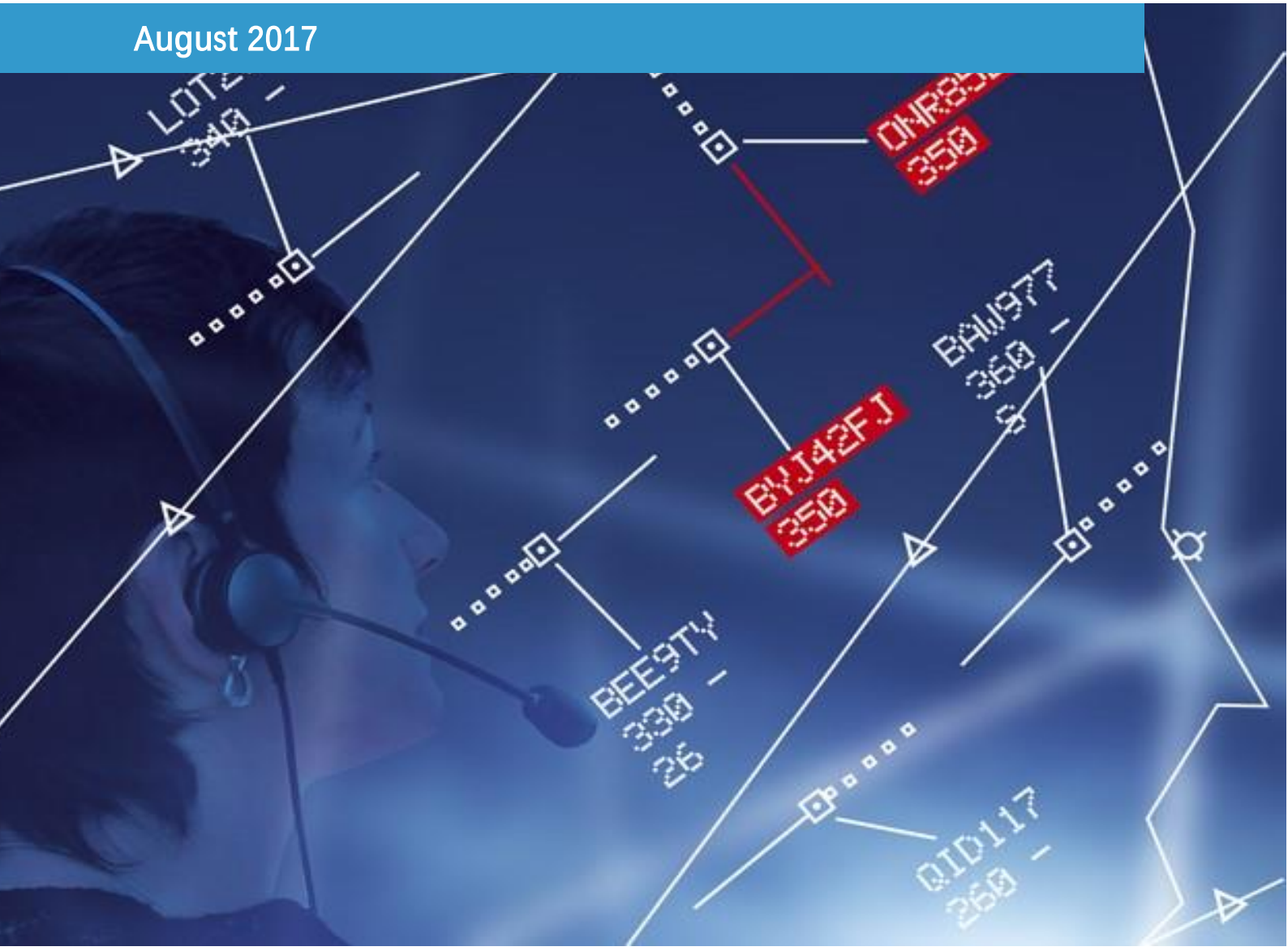
EUROCONTROL

Safety Nets

A guide for ensuring effectiveness

August 2017



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OVERVIEW

Safety nets form an integral part of the ATM system, so much so that they can sometimes be taken for granted; however, as the environment within which they operate evolves, safety nets need to be continuously improved to remain effective. This requires sustained efforts to optimise and improve them, as well as commitment from the wider organisation.

This Guide, first produced in 2011, has been reissued following the update of the EUROCONTROL guidelines on safety nets published in January 2017. It provides additional context complementing the information provided in the guidelines. Particular focus is given to the action areas for effective safety nets and the safety nets life cycle. More details on the contents of this Guide are provided below.

An introduction to safety nets

Safety nets help prevent imminent or actual hazardous situations from developing into major incidents or even accidents. This section describes the different types of safety nets available, how they interact, and what benefits they provide. It also highlights the dangers of taking safety nets for granted and explains why they should be continuously improved. Details are given on the latest EUROCONTROL safety nets guidelines and where to find more information.

Action areas for effectively implementing safety nets

Safety nets should not be seen as technical systems working in isolation. Without an appropriate framework supporting them, they cannot operate effectively. This section details the action areas needed to set up that framework: policy, organisational clarity, training requirements, procedures and system capabilities. It also illustrates how they each contribute uniquely to the effective implementation of safety nets.

The safety net life cycle

Safety nets are only effective if defined properly, implemented correctly, optimised completely and operated effectively. These steps are known as the safety net life cycle. This section moves beyond the action areas for safety nets to look at practical implementation, providing pointers to helpful resources along the way.

Safety net guidelines

For decades EUROCONTROL has been producing guidelines to support ANSPs with the implementation of safety nets. The latest edition of the guidelines, referred to as the *Level 3* documentation, was released in January 2017. This section provides an overview of the contents of the guidelines and highlights its key messages, both those re-emphasised as well as new ones.

Where to find futher information

Additional information can be found on the EUROCONTROL website (http://www.eurocontrol.int/safety-nets) or requested by email (safety-nets@eurocontrol.int).

AN INTRODUCTION TO SAFETY NETS

This section describes the different types of safety nets available, how they interact, and what benefits they provide. It also highlights the dangers of taking safety nets for granted and explains why they should be continuously improved. Details on the latest EUROCONTROL safety nets guidelines and links on where to find more information are given on pages 7 and 8.

What are safety nets?

Even the safest systems fail. Safety nets help prevent imminent or actual hazardous situations from developing into major incidents or even accidents. In doing so, they provide additional safety barriers in the overall system. In addition, they help keep the societal outcome of aviation operations within acceptable limits.

In Professor James Reason's Swiss cheese model, safety nets are the last system safety defences against accidents. They are intended to provide timely alerts to air traffic controllers or pilots of an increased risk to flight safety. As the impact of accidents in aviation is high, multiple system safety defences are provided, including redundant safety nets.

Safety nets are either ground-based or airborne:

- Ground-based safety nets are an integral part of the ATM system. Primarily using ATS surveillance data, they provide warning times of up to two minutes. Upon receiving an alert, air traffic controllers are expected to immediately assess the situation and take appropriate action.
- Airborne safety nets provide alerts and resolution advisories directly to the pilots. Warning times are generally shorter, up to about 40 seconds. Pilots are expected to immediately take appropriate avoiding action.

Airborne safety nets are covered only in terms of their interactions with ground systems. Safety nets for surface movements are beyond the scope of this Guide.

Further information on the terms and definitions used in the guidelines as well as an explanation of acronyms can be found in the ANNEXES of this Guide.

Why are they needed?

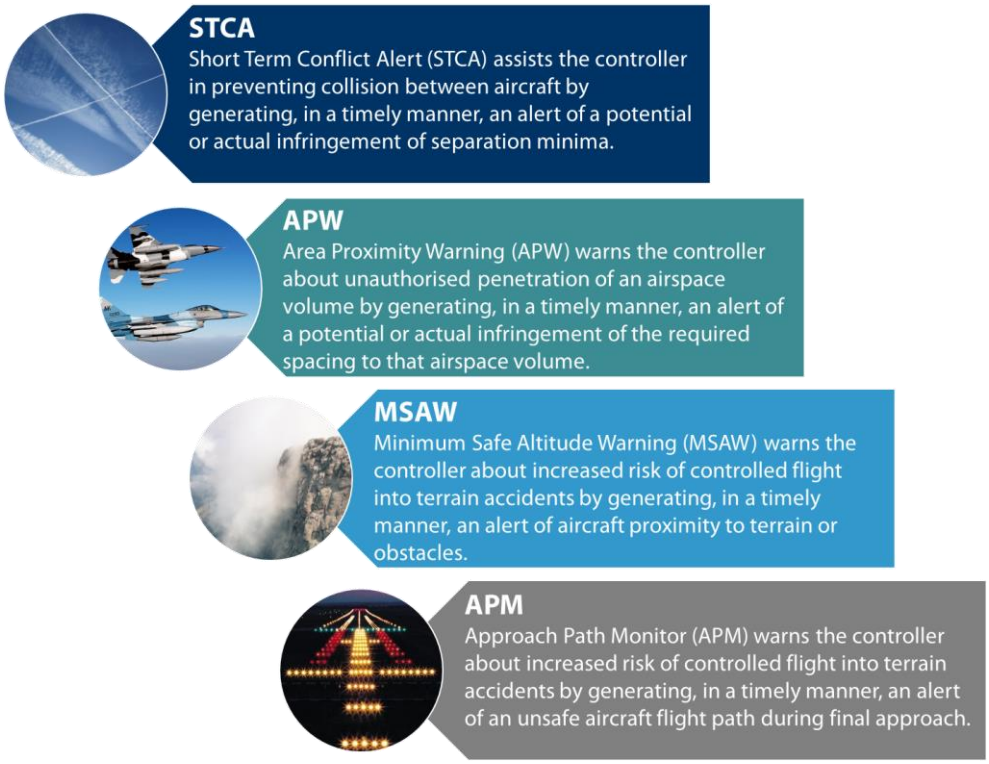
Whether ground based or airborne, safety nets have an important role to play in aviation, where safety is paramount. Under the Chicago "Convention on Civil Aviation", States are required to provide a safe Air Traffic Service (ATS) within their defined airspace. Although requiring sophisticated technical infrastructure and automation, the provision of ATS is a human-centred activity and will remain so for many years.

Air traffic controllers must acquire situational awareness and build a mental model of the airspace and traffic pattern. To control the situation and make decisions, the air traffic controller has to establish a plan, which includes strategies and tactics to handle traffic flows and conflicts. While executing the plan, the air traffic controller must deal with errors, exceptions, changes, emergencies and distractions. Without an alert by a safety net, hazardous situations can remain undetected by air traffic controllers and pilots.

Safety nets should not change the normal way of working of air traffic controllers or pilots. Safety nets are there to provide an additional safety margin on top of the inherently safe provision of ATS and aviation operations. They have been demonstrated to deliver additional risk reduction of up to a factor of ten if implemented and operated appropriately.

Which ground based safety nets must be implemented?

Depending on the specific airspace, up to four ground-based safety nets must be implemented for airborne phases of flight. These are covered in this Guide and listed below.



It is important that air traffic controllers and pilots are aware of how safety nets interact. Contrary to expectations, ground-based and airborne safety nets do not always alert in sequence. For some situations, in particular in the case of sudden or unexpected manoeuvres, they will alert at about the same time or in an unexpected order.

What is the relationship between ground based and airborne safety nets?

Ground-based and airborne safety nets operate independently, often within the same airspace. The ground-based safety nets STCA and APW work alongside their airborne equivalent Airborne Collision Avoidance System (ACAS), also known as Traffic alert & Collision Avoidance System (TCAS). STCA directly assists in preventing collision between aircraft whilst APW does so indirectly by predicting or detecting violations of traffic segregation rules. Both MSAW and APM assist in preventing controlled flight into terrain accidents, and should work in concert with their airborne equivalent (Enhanced) Ground Proximity Warning System ((E)GPWS), also known as Terrain Awareness and Warning System (TAWS).

Where and when?

Implementation of safety nets is driven by Objectives contained in the ATM Master Plan (previously ESSIP documents). These Objectives refer to EUROCONTROL Specifications, which contain minimum requirements for their development, configuration and use.

Safety net	ATM MP Objective	Planned implementation completion date	Achieved implementation date (80% of ECAC states)	Projected completion date for implementation in all ECAC states	Status
STCA	ATC02.2	January 2013	December 2014	December 2020	
APW	ATC02.8	December 2016	In progress	TBC	
MSAW		December 2016	In progress	TBC	
APM		December 2016	In progress	TBC	

Objective ATC02.8 merges previous ESSIP Objectives for APW, MSAW and APM (ATC02.5, ATC02.6 and ATC02.7 respectively). This is to reflect the traceability to a single Operational Improvement Step (as described in the ATM Master Plan).

The Objectives ATC02 apply to civilian service providers. Military ATC units are invited to consider implementation of STCA, APW, MSAW and APM when providing control service.

"A true sign of commitment to safety would be that safety, and hence safety nets, are improved before capacity is increased." – ANSP Safety Manager during Safety Team briefing

"Several ATS providers report significant reductions in the number of incidents observed after introducing or improving STCA in particular." – EUROCONTROL Safety Nets expert

Why continuously improve?

No system is perfect, and safety nets are no exception. Even though they may be satisfactorily tuned, changes in the environment in which they operate will impact on their performance. Safety nets must therefore be continuously improved to ensure that they remain effective. The key types of change can be summarised as follows:

Air traffic growth: in its 7-year forecast from 2017-2023, EUROCONTROL expects average IFR traffic to increase by 14%. However, widely-differing rates of growth are observed across States, driven by different trend in economic growth and changes in tourism demand as well as route choices.

ATM changes: The redesign of airspace, for example through the introduction of Free Route Airspace or Flexible Use of Airspace, must be considered in the development of safety nets. New routes and types of operations put additional constraints on safety nets which must be mitigated throughout the life cycle of the system.

Shared ANSP experiences: Significant practical experience has been gained by a multitude of ANSPs since safety nets were first implemented. Sharing the lessons learnt and recommendations in implementing safety nets can benefit all stakeholders.

What responsibilities do ATS providers have?

According to the conditions of their certification, ATS Providers are obliged to provide a safe Air Traffic Service (ATS) within their allocated area of responsibility. First and foremost, ATS Providers have to assure themselves that all obligations are satisfied. Regardless of whether there is an ATS contribution to an incident or accident, ATS providers have a societal responsibility to do what is reasonably practicable to prevent them. Safety is the raison-d'être of ATS.

As a matter of principle, compliance with EUROCONTROL guidelines is always voluntary. They reflect recognised good practices and, as such, provide a sound basis for enhancing the high levels of safety of ATS provision.

What are the EUROCONTROL guidelines on safety nets?

EUROCONTROL first produced safety net guidelines in 1998 to support ANSPs with the implementation of ground based safety nets. These documents were subsequently updated through the establishment of a task force (now known as the Safety nets Performance Improvement Network - SPIN). The most recent *Level 3* documentation was released in January 2017.

The *Level 3* material is a series of documents specifying the minimum requirements and providing guidance for the definition, implementation, optimisation and operation of safety nets. It covers the four traditional ground safety nets: STCA, MSAW, APM and APW. These guidelines are intended to facilitate the harmonisation of safety nets by providing lessons learnt and implementation examples. They build on the previous two editions by incorporating recommendations on a number of topics including the use of Selected Flight Level (SFL), multi-hypotheses for STCA and interfacing APW for the Flexible Use of Airspace (FUA) concept.

Where to find further information?

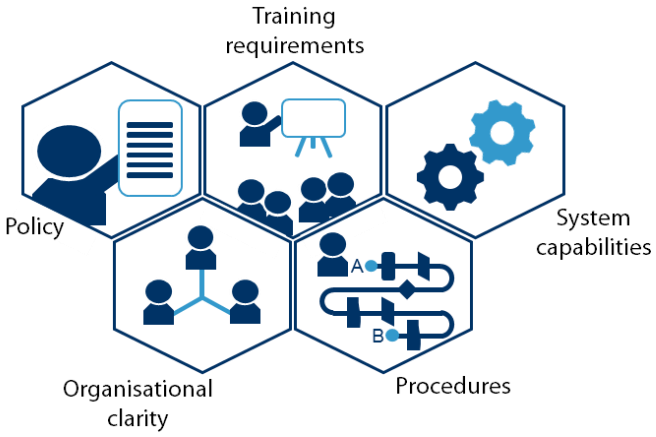
All four sets of *Level 3* documentation adopt a common, harmonised structure and are available for each safety net on the EUROCONTROL website:

- Part I describes the safety net concept of operations and requirements;
- Part II contains overall guidance for the various stages of the safety nets life cycle;
- Part III provides a generic implementation example and detailed guidance for optimisation and testing of that safety net.

An Awareness Package can also be downloaded from the website, for use as a training or presentation aid. It includes a "Master Presentation" which provides access to additional resources.

ACTION AREAS FOR EFFECTIVELY IMPLEMENTING SAFETY NETS

Safety nets should not be seen as technical systems working in isolation. Without an appropriate framework supporting them, they cannot operate effectively. This section details the action areas needed to set up that framework and illustrates how they each contribute uniquely to the effective implementation of safety nets.



All for one and one for all

Safety nets rely on action areas, each contributing in a unique way to effective implementation.

As illustrated in the figure above, these action areas are: policy, organisational clarity, training requirements, procedures and system capabilities.

- The policy describes the purpose and use of safety nets.
- Organisational clarity assigns roles and responsibilities for safety nets.
- Training ensures controllers are familiar and comfortable working with safety nets.
- Procedures define how safety nets should be operated, maintained and optimised.
- System capabilities define the technical functionalities that the safety nets need to exhibit.

The remainder of this section provides additional detail on each action area, concluding with a reminder of the *safety culture ladder* that illustrates how policy links with training, procedures, system capabilities and organisational clarity to shape the overall framework.

Policy

The importance of safety nets must be recognised by the senior management of ATS providers and by National Supervisory Authorities. Too often, safety net implementation or improvement projects have been initiated following major incidents or accidents. This reactive approach has not always been sustained and has then resulted in partially or even completely ineffective safety nets.

By contrast, a proactive attitude towards safety nets and their continuous improvement, founded in a mature safety culture, leads to effective safety nets.

Explicit local policies are needed for each safety net. They should detail how the safety net shall be used to ensure it is consistent with its operational concept and the safety management system applied. This is to avoid ambiguity about the role and purpose of the safety net, and lead to effective safety nets that are fostered by everybody in the organisation concerned.

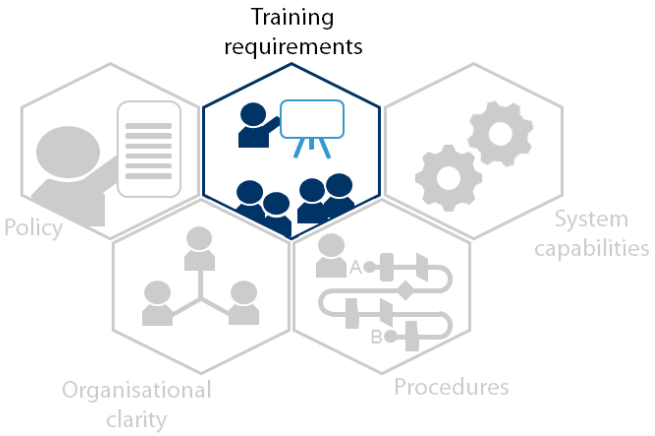
Policies must be backed by senior management, who can commit the necessary resources and drive organisational change. Safety nets are complex systems; expertise in that domain should be valued and retained.

Policies should also be widely communicated within the organisation so that all concerned staff are aware of them.

Organisational clarity

Improving safety nets is a team effort, which involves balancing operational needs with safety considerations and engineering constraints. Too often in the past, safety nets have been introduced in a technology-driven manner. This approach tends to result in partial or complete rejection of safety nets by air traffic controllers.

Roles and responsibilities for all aspects of safety nets must be clear, with one or more staff having explicit accountability for the overall management of each safety net. This creates the conditions for successful teamwork to perform the required actions in the other areas: training, procedures and system capabilities.

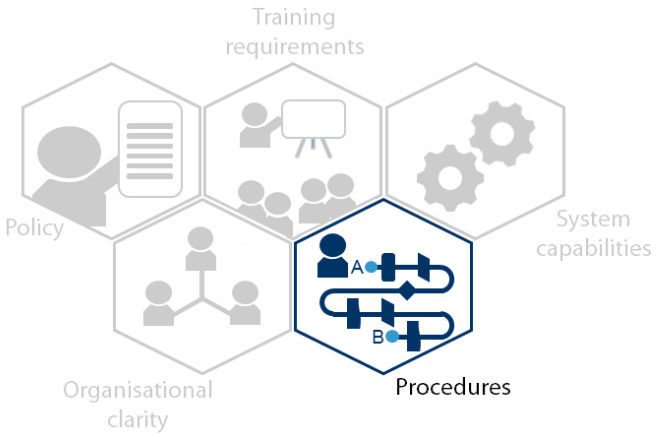


Training requirements

Safety nets are becoming more complex, and so is the environment in which they operate; training is essential to ensure controllers are fully familiar and comfortable working with them. Training also helps generate trust in the system. It prepares controllers for detecting abnormal behaviours (for example nuisance alerts) and to react appropriately.

Training should be provided on a regular basis to maintain staff competency. Any changes to the system that have an operational impact should also be followed by training.

In addition to controllers, technical and management staff also benefit from specific training sessions to raise their awareness about safety nets and explain how they contribute to the Safety Management System.



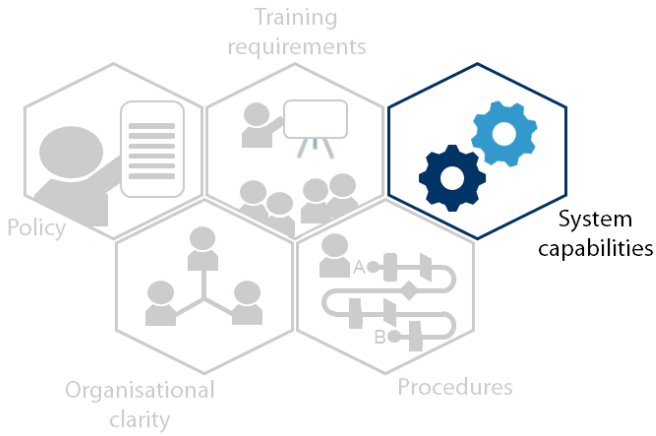
Procedures

Safety nets are supported by a set of procedures explaining how they should be used and maintained. These also form the basis for training activities.

Operational procedures detail which types of flights the safety net can take into account to generate alerts, which volumes of airspace are covered by the tool, how alerts are displayed, what parameters are used to trigger alerts and expected warning times, as well as inhibition conditions. They must also detail how controllers are expected to react when an alert is generated.

Similarly, technical procedures, for example detailing the processes for periodic maintenance or analysing safety net performance, must be available. Here, procedures can be based on available standards and guidelines to ensure best engineering practices are implemented.

It is worth noting that both types of procedure interact with each other. Operational procedures are adapted based on the performance of the system while technical procedures rely on operational data to drive technical changes.



System capabilities

Safety nets must have appropriate technical functionalities to ensure they are adapted to the environment they are operated in. In addition, significant tuning is needed to ensure the safety nets perform efficiently.

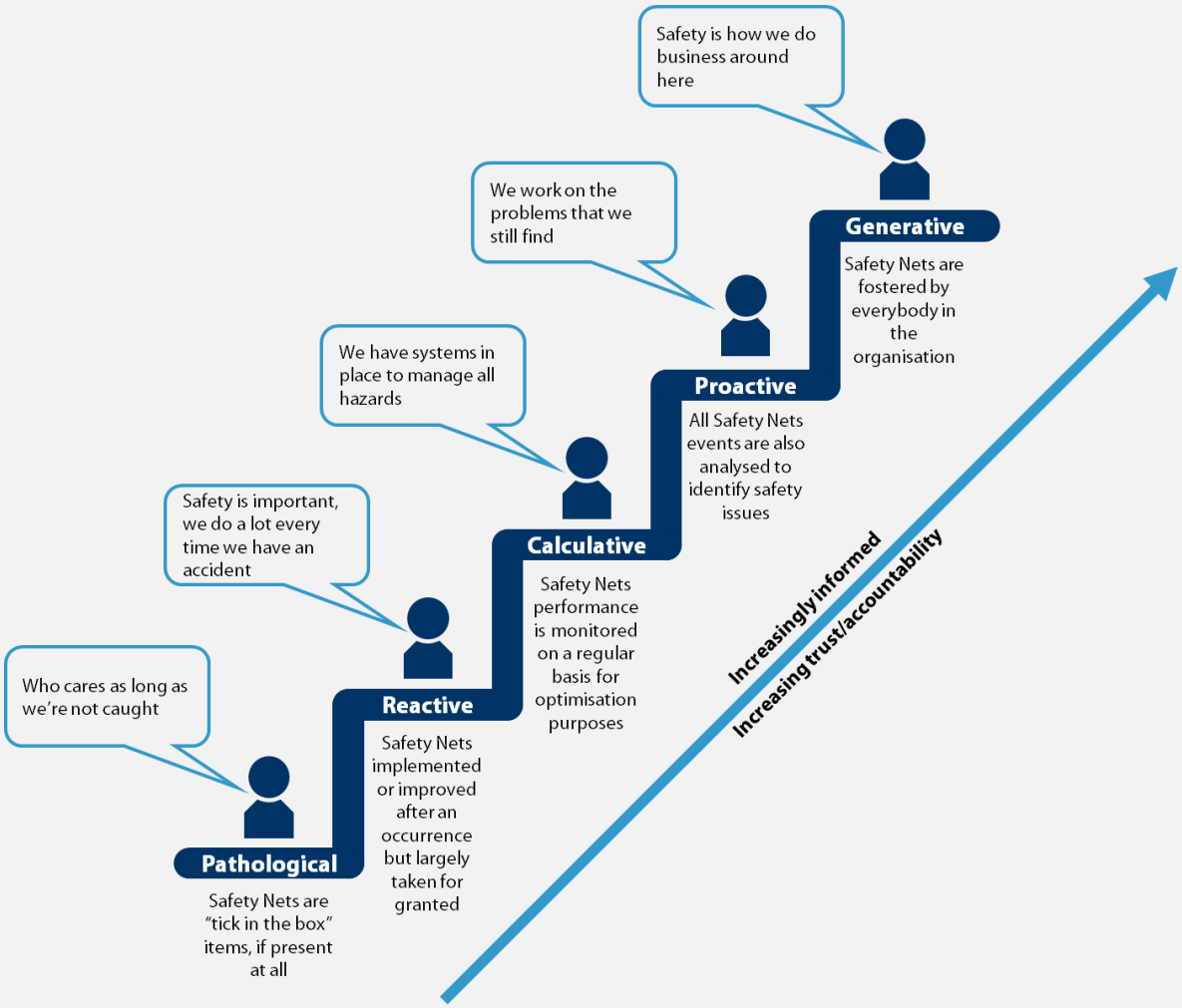
Appropriate safety net parameter values should be set to maximise alerting performance. This should consider the use of Cleared, Selected and Block Flight Levels, as well as safety nets filter parameters.

Optimisation concepts and procedures should be deployed. This should consider scenario categorisation and performance indicators to characterise the effectiveness of the safety net in order to improve the warning time.

The *Level 3* guidelines explore these areas in detail. It provides both implementation and optimisation examples for STCA, MSAW, APM and APW. This includes recommendations on data recording and test scenarios.

Additionally, safety net improvements can only take place if an adequate infrastructure is in place to support their developments. Equipment such as testing rigs or simulation tools give engineers the opportunity to tune the system before it is introduced in operations.

Safety nets capabilities have a direct influence on the training requirements and procedures developed to support the system. These two action areas have to be updated in case system functionality evolves.



Where are you on the safety ladder?

The Safety Culture of an organisation can be described in terms of an evolutionary ladder. Each level has distinct characteristics and is a progression on the one before. The range runs from the Pathological, through the Reactive to the Calculative and then on to Proactive and the final stage, Generative.

Pathological is where people do not really care about Safety and are only driven by regulatory compliance or not getting caught. By contrast, Generative organisations set very high standards and attempt to exceed them rather than be satisfied with compliance.

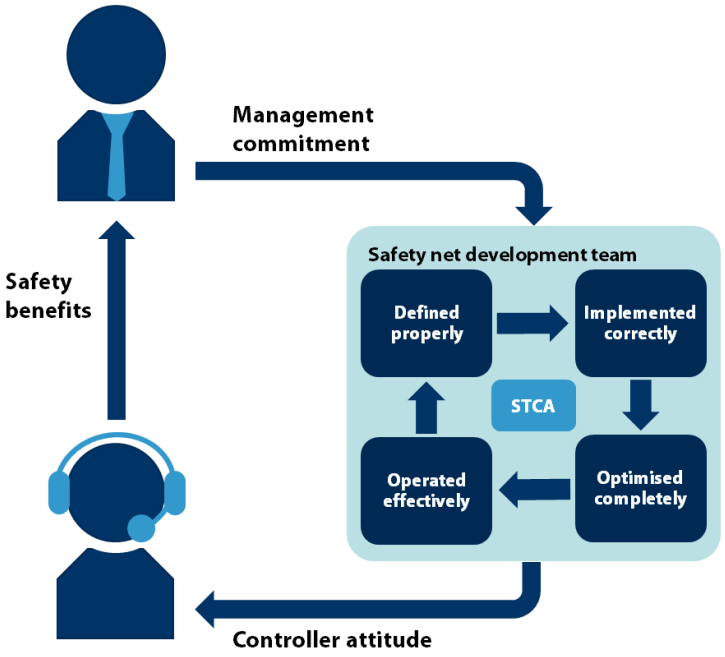
At the lowest rung of the ladder, safety nets are taken for granted. Air traffic controllers consider them useless and fear that they serve as a "snitch" for management. On the highest rung of the ladder the reverse is true: air traffic controllers, the safety nets support team and management are committed and engaged in ensuring the continuing effectiveness of safety nets.

ANSPs displaying a Generative approach are brutally honest about failure, but use it to improve, not to blame. They do not expect to get it right; they just expect to get better. Management knows what is really going on, because the workforce is willing to tell them and trusts them not to over-react on hearing bad news.

ANSPs should monitor their position on the safety culture ladder as part of their efforts to continuously improve their use of safety nets.

THE SAFETY NET LIFE CYCLE

Safety nets are only effective if defined properly, implemented correctly, optimised completely and operated effectively. These steps are known as the safety net life cycle. This section moves beyond the action areas for safety nets to look at practical implementation, providing pointers to helpful resources along the way.



A structured, total life cycle approach

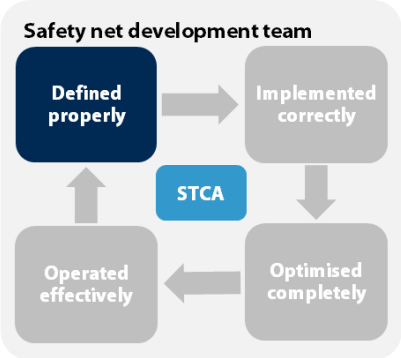
The graphic above illustrates a structured, total life cycle approach for ensuring the effectiveness of STCA. The same approach is recommended for APW, MSAW and APM.

Driven by enduring management commitment, a team starts work on defining, implementing, optimising and then operating the safety net. But, most importantly, it does not stop there.

Experience gained during operations along with continuing changes to the operational environment (such as traffic increase, more complex airspace and new concepts for safety nets) mean that the life cycle phases need to be repeated.

The result of this focussed effort is an on-going, positive attitude towards the safety net by air traffic controllers. This, in turn, leads to tangible safety benefits. This life cycle approach is described in more detail in the following pages.

Defining safety nets



Once a safety net implementation or improvement project has been planned and kicked off, the first phase in the life cycle is "definition".

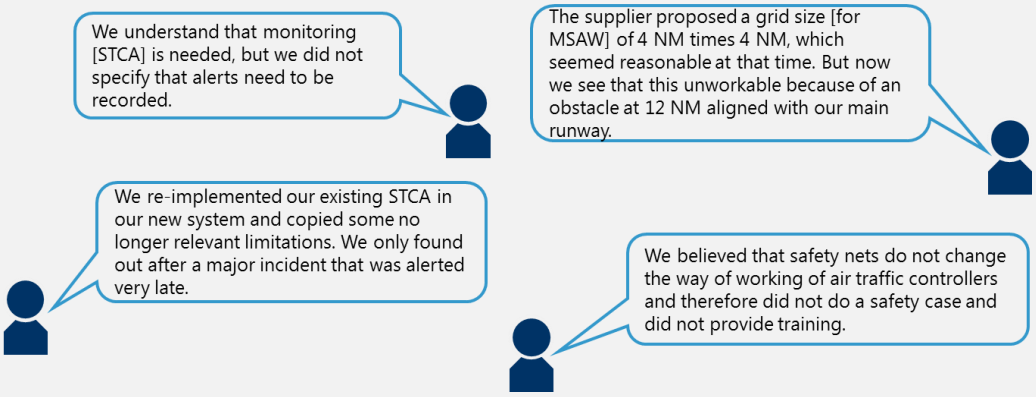
It is good practice in any project to spend sufficient time and resources in this phase. At this point mistakes can be corrected simply by a document revision. In later phases the cost of correcting mistakes will increase exponentially and may even be impossible to correct.

It is particularly important to grasp fully the complexity of the current and future operational environment in which the safety nets are intended to work. Familiarisation with the Reference Systems described in the guidelines will help. Similarly, representation in fora such as Safety nets Performance Improvement Network (SPIN) can be exploited by building on the experience and even the products and practices of other organisations.

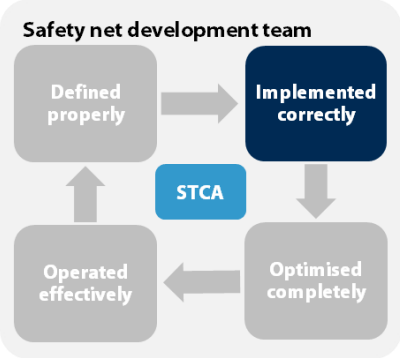
Safety Assurance is needed throughout the project and should start at the beginning of this phase. If following the recommended EUROCONTROL Safety Assurance Methodology (SAM), the first task will be to construct an initial safety argument. This argument is then used to draft the safety plan. Reusable versions of both are included in the documentation packages.

The key activity in this phase is capturing the operational requirements. Because of the need to take local factors fully into account, no generic operational requirements are included in the guidelines. Instead, a detailed checklist is included, which covers aspects to address.

The importance of thoroughly defining safety nets



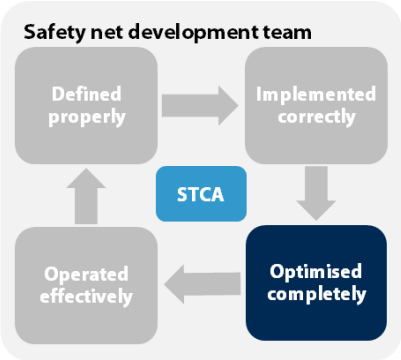
Implementing safety nets



The detailed activities in the implementation phase depend very much on the outcome of a make-or-buy decision and the related standard practices of the organisations concerned. In many cases the implementation of safety nets will be an integral part of a complete ATS system implementation. Irrespective of the implementation model, it is imperative that fitness-for purpose is ensured through appropriate verification activities (reviews, inspections, tests, etc.) throughout this phase.

Seemingly trivial choices will have to be made, for example the number of distinct airspace volumes for which parameters can be defined; but informed decisions are needed because changes at a later stage will be expensive.

Optimising safety nets

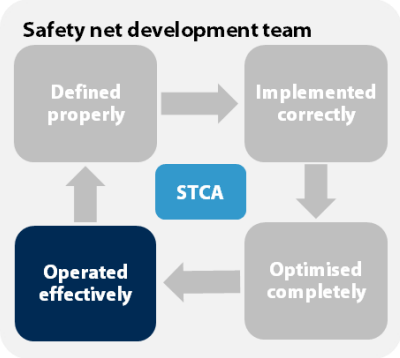


If safety nets are externally procured, the initial optimisation may be performed by the supplier. However, optimisation is not a one-off activity. It is therefore essential that transfer of ownership is preceded by appropriate staff training and familiarisation. For example, the number of nuisance and false alerts must be reduced to a minimum to ensure air traffic controllers feel adequately supported by the system.

Since optimisation is a recurring process, investment in a safety net "testbed" is worthwhile. A complete "testbed" will include tools to capture relevant encounters from surveillance data, encounter categorisation tools, an accurate fast-time simulation model of the relevant safety net, and tools to capture and visualise relevant metrics from fast-time simulations.

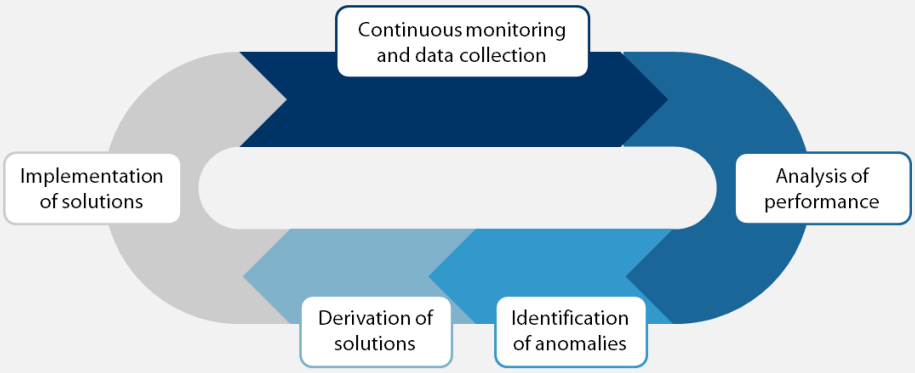
Note that encounter categorisation in particular will always be a labour-intensive activity that requires active involvement of operational users.

Operating safety nets



Before starting first operations, air traffic controllers must receive training aimed at creating an appropriate level of trust in the safety net. The time-criticality of alerts and the need for immediate attention or action must be well understood, as should the situations in which safety nets are less effective.

Throughout the day-to-day operation of the system, air traffic controllers should be encouraged to report unexpected and unwanted safety nets behaviour. Feedback on the actions taken to resolve these issues should always be provided. This supports the continuous improvement of safety nets, ensuring that they remain effective and are used to their maximum potential.



How do we measure their effectiveness?

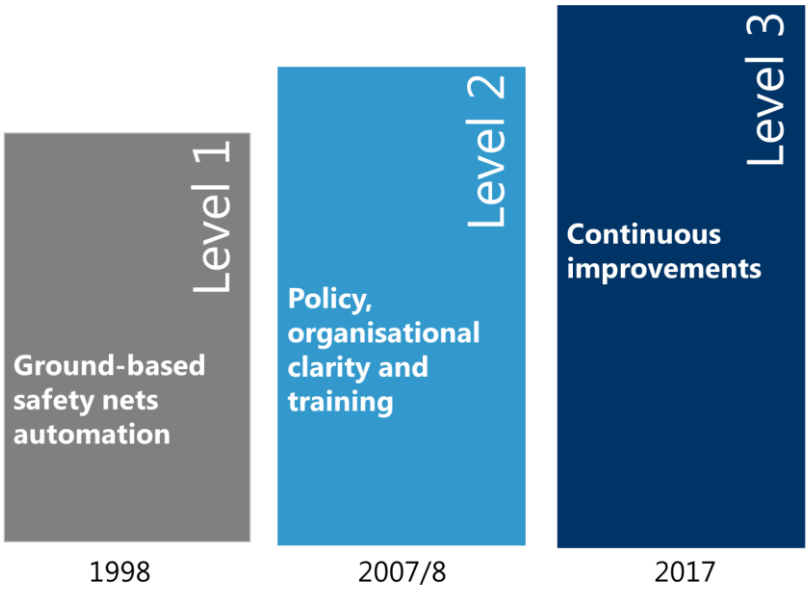
Measuring the effectiveness of safety nets follows a well-defined process, summarised in the figure above.

Firstly, the performance of safety nets needs to be continuously monitored. This can be achieved by regularly inspecting safety nets log files. However, as this can be very time consuming, it is likely to require the use of automated monitoring tools alongside feedback on safety net performance from active controllers.

Subsequently, any detected anomalies or degradation in safety nets performance will need to be addressed. This often requires retuning of the safety net and may also be used to identify other safety improvement opportunities. For example, "hot spots" could be identified and removed by making changes to airspace structure or procedures.

SAFETY NET GUIDELINES

For decades EUROCONTROL has been producing guidelines to support ANSPs with the implementation of safety nets. The latest edition of the guidelines, referred to as the Level 3 documentation, was released in January 2017. This section provides an overview of the contents of the guidelines and highlights its key messages, both those re-emphasised as well as new ones.



Safety nets guidelines at a glance

Since 1998, EUROCONTROL has produced safety net guidelines to support the implementation of safety nets in the ECAC area. These specify the minimum requirements and provide guidance for the definition, implementation, optimisation and operation of STCA, MSAW, APW and APM.

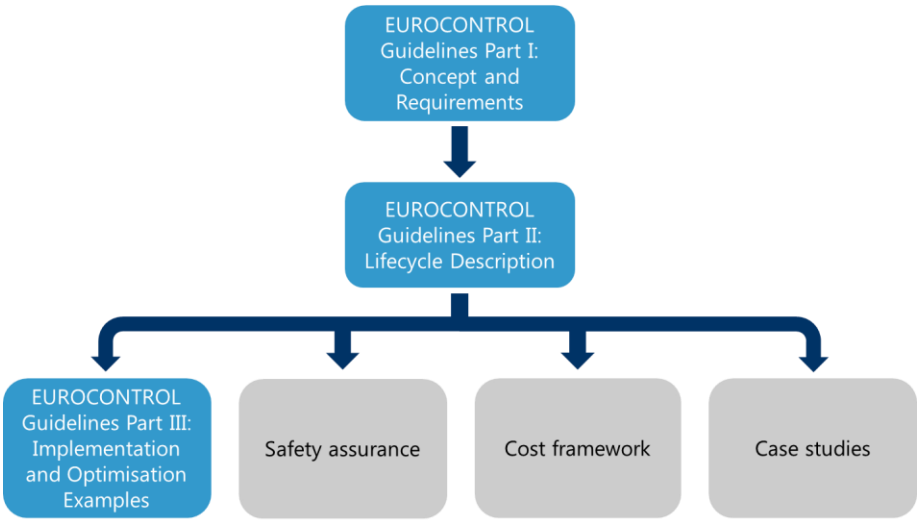
Over the years the safety nets community has accumulated a significant amount of practical experience which is captured in the latest *Level 3* documentation. Updating the material also became necessary to ensure it remained up-to-date with future advances in Air Traffic Management. The incorporation of Area Proximity Warning into the Free Route Airspace (FRA) concept was a particular catalyst for the update. The evolution of the guidelines is described below:

- *Level 1* – documented in the EUROCONTROL Operational Requirement Document for EATCHIP Phase III ATM Added Functions (Volume 2), published in 1998 with emphasis on automation.
- *Level 2* – documented in EUROCONTROL Specifications and Guidance Material for STCA, MSAW, APM and APW, published in 2007-2008 providing a broader context than automation alone, e.g. pointing out the importance of policy, organisational clarity and training.
- *Level 3* – documented in EUROCONTROL Guidelines for STCA, MSAW, APM and APW, published in 2017 incorporating the results of SESAR I as well as lessons learned.

It is also important to note that the *Level 3* documents are *guidelines* as opposed to the mandatory *Level 2 Specifications* they replace. This allows ANSPs to adopt a more flexible approach towards implementing safety nets that meets their needs. The guidelines also complements other recognised documentation such as ICAO provisions.

Between 2005 and 2006, a European Task Force developed and validated EUROCONTROL Specifications and comprehensive guidance material for each of the four ground-based safety nets.

In 2008 the need for a more permanent working arrangement was recognised and the Task Force was transformed into the Safety nets Performance Improvement Network (SPIN), which was tasked with maintaining the documentation for STCA, MSAW, APW and APM. The same group serves as an expert forum for sharing experience and for initiating further improvements to safety nets.



Documentation packages

The diagram above illustrates the documentation packages that are developed and maintained for each of the ground-based safety nets.

The core *Level 3* document is the **EUROCONTROL Guidelines Part I** which describes the concept of operations as well as the specific requirements for each safety net. This is supported by the following *Level 3* documents:

- **EUROCONTROL Guidelines Part II**: a comprehensive overview of the safety net life cycle. It provides guidance for the activities to be performed in each life cycle phase, and points at more detailed information in Appendices (for convenience published as separate documents).
- **EUROCONTROL Guidelines Part III**: a generic implementation example and detailed guidance for optimisation and testing of a particular safety net. These guidelines are an update of *Appendix A: Reference System* in the Level II documentation.

Other supporting documents that are not updated with the *Level 3* guidelines are the following:

- **Appendix B: Safety Assurance**: a set of three documents that can be used to get a head start with the required safety assurance activities in an implementation project. These are: i) safety argument ii) generic safety plan and iii) outline safety case.
- **Appendix C: Cost Framework**: a checklist of activities and guidance regarding required resources in all life cycle phases. It can serve as a planning tool.
- **Appendix D: Case Study**: an illustration of how the guidance material can be applied in practice.

Key messages from the Level 3 guidelines

The graphic below describes the key points of note in the *Level 3* guidelines and distinguishes between those messages that have been re-emphasised and those that are new.

Supporting SESAR

In recent years work has continued on adapting ground-based safety nets to emerging technology and operations. The achievements to date and future plans are summarised below.

In the 2008 to 2016 timeframe, SESAR1 has achieved the following:

- Mature concept and V3 validation of enhanced ground-based safety nets using existing down-link aircraft parameters (DAPs) in TMA and en-route (work area 1).
- V2 validation of enhanced ground-based safety nets adapted to future TMA and en-route environments with enhanced 3/4D trajectory management (work area 2). Further work continues into SESAR2020.

SESAR2020 continues to build on previous achievements and also focuses on the development of ATM evolutions necessary to safely handle increasing traffic demand.

In parallel, the ATM Master Plan 2015 identifies the following objectives to be realised by ANSPs for civil operations by 2020:

- New essential operational changes to further enhance STCA through the use of aircraft-derived data (ADD) and address the use of safety nets for specific TMA operations.
- Research and development activities include enhancing ground-based safety nets adapted to future operations. This encompasses ground-based safety nets for SESAR future trajectory management and new separation modes through the use of wider information sharing.

ANNEX: TERMS AND DEFINITIONS USED IN THE EUROCONTROL GUIDELINES

	STCA	MSAW	APM	APW	Source
Alert. Indication of an actual or potential hazardous situation that requires particular attention or action.	✓	✓	✓	✓	-
Altitude. The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).		✓	✓		Doc 4444
Approach path monitor. A ground-based safety net intended to warn the controller about increased risk of controlled flight into terrain accidents by generating, in a timely manner, an alert of an unsafe aircraft flight path during final approach.			✓		Change proposal for Doc 4444 §15.7.4 Note 1
Area proximity warning. A ground-based safety net intended to warn the controller about unauthorised penetration of an airspace volume by generating, in a timely manner, an alert of a potential or actual infringement of the required spacing to that airspace volume.				✓	-
ATS surveillance service. Term used to indicate a service provided directly by means of an ATS surveillance system.	✓	✓	✓	✓	Doc 4444
Conflict. Converging of aircraft in space and time which constitutes a predicted violation of a given set of separation minima.	✓				Derived from Doc 9426
Elevation. The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.		✓	✓		Doc 4444
False alert. Alert which does not correspond to a situation requiring particular attention or action (e.g. caused by split tracks and radar reflections).	✓	✓	✓	✓	-
Final approach. That part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified, a) at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified; or b) at the point of interception of the last track specified in the approach procedure; and ends at a point in the vicinity of an aerodrome from which:			✓		Doc 4444

	STCA	MSAW	APM	APW	Source
1. a landing can be made; or 2. a missed approach procedure is initiated.					
Flight level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1 013.2 hecto-pascals (hPa), and is separated from other such surfaces by specific pressure intervals. Note 1.– A pressure type altimeter calibrated in accordance with the Standard Atmosphere: a) when set to a QNH altimeter setting, will indicate altitude; b) when set QFE altimeter setting, will indicate height above the QFE reference datum; c) when set to a pressure of 1 013.2 hPa, may be used to indicate flight levels. Note 2.– The terms "height" and "altitude", used in Note 1 above, indicate altimetric rather than geometric heights and altitude.		✓	✓		Doc 4444
Ground-based safety net. A ground-based safety net is a functionality within the ATM system that is assigned by the ANSP with the sole purpose of monitoring the environment of operations in order to provide timely alerts of an increased risk to flight safety which may include resolution advice.	✓	✓	✓	✓	-
Height. The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.		✓	✓		Doc 4444
Human performance. Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.	✓	✓	✓	✓	Doc 4444
Level. A generic term relating to the vertical position of an aircraft in flight and meaning variously, height, altitude or flight level.		✓	✓		Doc 4444
Minimum safe altitude warning. A ground-based safety net intended to warn the controller about increased risk of controlled flight into terrain accidents by generating, in a timely manner, an alert of aircraft proximity to terrain or obstacles.		✓			Change proposal for Doc 4444 §15.7.4 Note 1
Nuisance alert. Alert which is correctly generated according to the rule set but is considered operationally inappropriate.	✓	✓	✓	✓	-
Separation. Spacing between aircraft, levels or tracks.	✓				Doc 9426

	STCA	MSAW	APM	APW	Source
Short term conflict alert. A ground-based safety net intended to assist the controller in preventing collision between aircraft by generating, in a timely manner, an alert of a potential or actual infringement of separation minima.	✓				Derived from Doc 4444 §15.7.2 Note 1
Warning time. The amount of time between the first indication of an alert to the controller and the predicted hazardous situation. Note.– The achieved warning time depends on the geometry of the situation. Note – The maximum warning time may be constrained in order to keep the number of nuisance alerts below an acceptable threshold.	✓	✓	✓	✓	-

ANNEX: ACRONYMS

ACAS	Airborne Collision Avoidance System	MP	Master Presentation
ADD	Aircraft Derived Data	MSAW	Minimum Safe Altitude Warning
ANSP	Air Navigation Service Provider	MSL	Mean Sea Level
APM	Approach Path Monitor	QFE	Atmospheric pressure at aerodrome elevation *(or at runway threshold)*
APW	Area Proximity Warning	QNH	Altimeter sub-scale setting to obtain elevation when on the ground
ATC	Air Traffic Control	SAM	Safety Assurance Methodology
ATM	Air Traffic Management	SESAR	Single European Sky ATM Research
ATS	Air Traffic Service	SFL	Selected Flight Level
EATCHIP	European ATC Harmonisation and Integration Programme	SPIN (2005)	Safety nets: Planning Implementation and eNhancements (Task Force)
ECAC	European Civil Aviation Conference	SPIN (2008)	Safety nets Performance Improvement Network (Sub-group)
(E)GPWS	(Enhanced) Ground Proximity Warning System	SRC	Safety Regulation Commission
ESSIP	European Single Sky ImPlementation	TAWS	Terrain Awareness and Warning System
FRA	Free Route Airspace	TCAS	Traffic alert & Collision Avoidance System
FUA	Flex ible Use of Airspace	TMA	Terminal control area
ICAO	International Civil Aviation Organization		

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