EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

SAFETY REGULATION COMMISSION DOCUMENT (SRC DOC)

SRC DOCUMENT 46

SAFETY SCANNING

Edition	**:**	**1.0**
Edition Date	**:**	**14 June 2011**
Status	**:**	**Released Issue**
Distribution	**:**	**General Public**
Category	**:**	**SRC Document**

F.2 DOCUMENT CHARACTERISTICS

TITLE		
SRC Document 46 – Safety scanning		
Document Identifier	**Reference**	SRC Doc 46
srcdoc46_e1.0_ri_web	**Edition Number**	1.0
	Edition Date	14.06.2011

Abstract

This document provides an overview of the development of the safety scanning methodology and the Safety Scanning Tool. It provides a detailed overview of the activities conducted by the SRCCG TF, which was given the task for this development.

Safety scanning and thinking in terms of Safety Fundamentals aims to support competent authorities (EASA, NSAs) in the execution of their oversight task during development of changes to the Total ATM System and to prepare for approvals. The methodology supports Multi-Stakeholder thinking and enables Safety Planning from a Total System view.

Keywords

Safety scanning | Safety Fundamentals | Safety Regulation | Total System View

Contact Person(s)	Tel	Unit
Gary MORTON	+32 2 729 30 40	DSS/OVS/SAF

DOCUMENT INFORMATION					
Status		**Distribution**		**Category**	
Working Draft	☐	General Public	☑	Safety Regulatory Requirement	☐
Draft Issue	☐	Restricted EUROCONTROL	☐	Requirement Application Document	☐
Proposed Issue	☐	Restricted ESIMS	☐	ESARR Advisory Material	☐
Released Issue	☑	Restricted SRC	☐	SRC Document	☑
		Restricted SRCCG	☐	DSS/OVS Document	☐
		Restricted DSS/OVS	☐	Comment / Response Document	☐

COPIES OF SRC DELIVERABLES CAN BE OBTAINED FROM	
Oversight Division (DSS/OVS) EUROCONTROL Rue de la Fusée, 96 B-1130 Bruxelles	Tel: +32 2 729 51 38 Fax: +32 2 729 47 87 E-mail: sru@eurocontrol.int Website: www.eurocontrol.int/src

F.3 DOCUMENT APPROVAL

The following table identifies all management authorities who have approved this document.

Authority	Name and Signature	Date
Quality Control (DSS/OVS)	*« signed by Daniel Hartin »* (Daniel HARTIN)	14.06.2011
Head of Division (DSS/OVS)	*« signed by Juan Vazquez-Sanz »* (Juan VÁZQUEZ-SANZ)	14.06.2011
Chairman SCAN TF (SRCCG)	*« signed by Jos Nollet »* (Jos NOLLET)	14.06.2011
Chairman, SRC Co-ordination Group (SRCCG)	*« signed by Franz Nirschl »* (Franz NIRSCHL)	14.06.2011
Chairman, Safety Regulation Commission (SRC)	*« signed by Harry Daly »* (Harry DALY)	14.06.2011

(Space Left Intentionally Blank)

F.4 AMENDMENT RECORD

The following table records the complete history of this document.

Edition No.	Date	Reason for Change	Pages Affected
0.01	24-Nov-10	First draft in SRC format.	All
0.1	06-Dec-10	SRU quality review. Document sent for formal SRCCG consultation.	All
0.2	01-Feb-11	Document sent for formal SRC consultation.	All
0.3	06-Apr-11	Transfer of SMRT issues to a separate document (SRC DOC 48) and update on the basis of SRC formal consultation (RFC No. 1104). Document sent to SRC for approval.	All
1.0	14-Jun-11	Document formally released following SRC approval (RFC No. 1113).	References

(Space Left Intentionally Blank)

F.5 CONTENTS

F.6 EXECUTIVE SUMMARY

SES II, thinking in terms of “Total System” and “multi-stakeholder”, introduces a partial amendment in the way safety is considered for new Air Transport concepts and how competent Safety Oversight Authorities could consequently review these changes. This especially driven by a development to more integrated air ground systems with increasing interdependencies of related multi actor procedures and equipment performance in support of air navigation service provision.

To that regard it is noted that international regulations and related responsibilities are basically structured according to the specific aviation area with very limited cross-references in support of a safety review of changes with a multi actor approach.

Safety scanning is, in short, a moderated process that aims to provide an initial identification of essential safety aspects and relevant issues during the lifecycle of significant changes in air transport. These issues affect more than one actor. The SST process is intended to follow the E-OCVM life cycle principles.

The Safety scanning activities and structure of the Safety Scanning Tool (SST) have been based on a number of established Safety Fundamentals widely used in industry. The SST meets these fundamentals and is also be suitable for a wide range of changes, including the smaller ones.

SST can be used as guidance to the aviation industry for safety planning during the design, development and introduction of changes.

The SST guides the user in making well-informed decisions in the attainment of a declared goal, and supports the management during the development cycle by applying the SST more than once as appropriate.

The SCAN TF initially identified the needs of the NSA and EASA and developed the SST with support of a number of Member States and external R&D sources. After a feedback from NSAs, the methodology and Tool has been validated in a number of operational changes, resulting in “lessons learned”. SST has been amended in accordance with this feedback and practical experience as appropriate.

The SST will be suitable for use (1) independently by the service provider, designer or developer in the aviation industry to introduce a change to Air Transport as part of their safety considerations, to ensure that the safety is addressed in a satisfactory manner; and (2) by the competent oversight authorities as a benchmark in support of a moderator who subsequently collates the information to provide a view on the likely weaknesses in safety aspects from a multi actor perspective.

It is important that the SST will be compliant with the principles for safety management as adopted by EASA for multi actor safety review, in particular the “horizontal view”. It is recognized that such a horizontal view should allow for involvement during the Safety scanning process of all affected aviation disciplines at all levels of responsibilities in safety management.

The general observation by the participants was that the SST is a very useful tool due to the harmonised and structured approach, raising awareness and communication between the actors in a transparent way.

Where used so far, SST has provided input (i.e. things to do) to change projects (e.g. CCAMS, ICAO 2012, PBN, AFMU). As these “things to do” are presented in a Safety Register, they should allow Competent Safety Oversight Authorities to monitor the change as it goes forward and allow for preparation where approvals, endorsements or certification may be required.

In view of the need for harmonisation within the EU states it is important that EASA will sanction the need for SST and any attendant methodology, once it has determined the regulatory framework for Management of Changes in Air Transport Systems. The SRC supports the further refinement of the SST as part of their aviation safety policy and the integration of the Tool in the ICAO and EASA regulatory framework.

(Space Left Intentionally Blank)

1. INTRODUCTION

1.1 Occasion

Early concept development currently lacks effective tools for a systematic safety consideration process. Safety assessments do reveal possible safety deficiencies but more often they are only observed in incidents as so-called latent errors. Currently used tools often look at the development from the perspective of generating a specific safety case to identify and compensate for “what can go wrong” either by analysing faults in the system (failure case) or by analysing unwanted side effects of the functionality of a system within the overall system given (success case). This is not logical during concept development, since development, by nature, is a continuous process of change. Such a process is also only effective when it is known what the system is about (i.e. a stable concept and design proposal). System-refinements might lead to shortfalls in the elaboration of safety issues because achieved results prevent from continued questioning of potential safety issues.

The Safety Scanning Tool (SST) aims to provide an initial identification of safety relevant issues related to ATM changes and to improve safety by establishing formalized considerations in an ongoing design and development. The question therefore is not “what can go wrong”, the question is “what do I consider in my design to make it work as intended in a safe manner”.

- The SST uses the concept of “Safety Fundamentals”, which allows an investigation of essential safety aspects of a concept, namely:
- The structuring of hazard collection in early design stages;
- A first picture of the maturity of the safety design;
- Scooping for subsequent in depth analyses of safety cases;
- The management of safety including liability / responsibility issues;
- The amount of safety aspects related to the system change;
- An estimation of safety costs as contribution to cost benefit modelling (i.e. effort related to safety cases, rule making, review etc.).

The Tool encourages the designer to think about essential safety aspects and to generate a clearer picture about safety issues in the definition of the concept or design. Fundamentals can also be used for prioritisation of concepts or development-tasks.

By using the Tool, later stages of development are better informed about safety issues and safety assessments are more likely to meet the established safety ambitions. The transition from design and development to later safety assessment in pre-implementation and implementation phases is becoming smoother as well. This is a significant business benefit for any senior manager, especially in a time of constraint resources and budget, as it avoids late and possible expensive re-work or inefficient work-arounds.

1.2 Assignment SRCCG SCAN TF

According to the ToR [Appendix 2], endorsed by SRCCG13, the mission of the SRC CG SCAN TF is to participate in, and support, SRC’s work in the definition and the development of a SST to support the NSAs safety regulatory reviews.

Due to a lack of Human Resources and budget, SRCCG16 accepted an adjusted work break down in balance with the limited resources. However due to additional personal efforts is was possible to produce;

- A literature study of Human Automation Interaction and
- Easy to use guidance for executing a Safety scan for oversight officials.

The results of these studies / guidance will be available before the launch of SST.

1.3 The Way SCAN TF did the Job

1.3.1 Identification of the Needs of NSAs and EASA

The first attempt of getting a tool supporting the needs of NSAs was in SRC29. {Action A29/06 SRU to further develop the SESAR safety screening methodology}.

After a Dutch intervention in SRC32 NSA-NL, ASRO and CAA-UK took the initiative to organise an Information Day for NSAs on the 24th February 2009. Several NSAs were present and it was decided to propose SRC33 to develop a plan for identifying the needs of NSAs on the basis of SST. SRCCG12 accepted this proposal. In the follow up, an Information Paper 'What do Oversight bodies need?', written by ASRO, was discussed in an special meeting on the 4th March 2009. Besides NSA-NL, CAA-UK and ASRO, DGAC, D-CMAC and SRU were present.

On the basis of this meeting, SRCCG13 decided to install a SRCCG TF, supporting the work of SRC in the definition and the development of a SST to support the NSAs safety regulatory reviews. EASA suggested incorporating also the needs of EASA for such a Tool. The kick-off meeting of SCAN TF was on 30th March 2009.

1.3.2 Specification on the Basis of Preceding Experience

SST is based on the SESAR Safety Screening Tool and SAFMAC [see section 6.2.1]. This tool was built on request of EUROCONTROL SESAR officials, as a concerted action in the context of the SESAR definition phase, developed with support of NLR and Helios Ltd.

As ECAC [on initiative of MoT-NL] identified in A35-WP/220 and discussed in the 35th ICAO Assembly that there were no adequate methods to assess emerging major/multi-stakeholder concepts, the multi-stakeholder notion was at the same time also identified in the SESAR Definition phase discussions on the future of safety and safety regulation in a Total System View.

1.3.3 Development of Tool by External Outsourcing

In 2008, ASRO worked together with the University of Kassel describe the link of the Safety Fundamentals with aviation related EU regulations, entitled 'Safety Fundamentals for Safety scanning". During 2009 a Consortium of University of Kassel, NLR and Helios was awarded the assignment to develop the SST with the supporting documents.

MoT the Netherlands added work in kind with the development of a Safety Method Review Tool [SRC DOC 48, SMRT] and experiences from the Dutch TF 'National Approach for a Coordinated overall Validation Air Transport operations".

De facto Safety Fundamentals and Multi Stakeholder merged into Safety scanning.

1.3.4 Feedback from NSAs and Relevant Stakeholders

The NSAs and parties who are part of SCAN TF have reviewed all work. Also EASA has been involved in the review of the deliverable about Safety Fundamentals.

For the working paper 'Safety Fundamentals for Safety scanning' an SRCCG RFC procedure [RFC 916] has been followed which only resulted in positive feedback.

On the first of April 2010 all SRC-members were offered an Information package [including document "Safety Fundamentals for Safety scanning", SST, SMRT, and guidance material] for getting some real feeling of this toolset.

Besides the governmental track via the SRC, an External Review Group [CFMU, LVNL, NATS, LPS, Austro Control, Croatia Control, Skyguide, KLM-Air France, Amsterdam Airport Schiphol, TuD/Lund University, University of Kassel and NLR] is installed.

1.3.5 Validation of Methodology and Tool

The validation of the SST took place by doing two Safety scans: Conops Airspace Flow and Management Unit [AFMU] and Roadmap Performance Based Navigation [PBN]. Also the lessons learned of a Safety scan on a pan-European project [CCAMS under EUROCONTROL/CFMU with stakeholders] were used.

The Safety scans AFMU and PBN were funded by MoT-the Netherlands. A planned comparison with the results of SRC-reviews was not possible due to the non-availability of the SRC-reviews. However a method for comparison was developed by NLR. This method was also used for the validation of the SMRT.

1.4 What do we offer

This series consists of six documents:
SRC DOC 46;
SRC DOC 46 – Annex Book:

- Safety Fundamentals for Safety scanning;
- Guidance for moderating a Safety scanning session and interpreting the results;
- Guidance safety regulatory process.

SRC DOC 48;

Several SCAN TF Deliverables

- SST questions
- SMRT questions
- Further Work, to be published during the launch of the Tools (Spring 2011).

Note: *in 'Further Work' a detailed description of the Safety scanning process in a multi-actor environment', easy to use guidance for moderating and interpreting the results of a Safety scanning event, a literature review about Human Automation Interaction and a proposal for a new advanced version, based on the recommendations of the HAI literature review and the ideas of CAA-UK for making the Oversight Argument will be submitted.*

2. THE REGULATOR'S PERSPECTIVE

2.1 Benefits to the Regulator of the Current Tool

NSAs and EASA have the responsibility to act in the public interest to ensure that air navigation services provided through use of the functional ATM system are safe.

The current regulatory regime operates on the notion that (relevant) changes to the ATM functional system are presented to the competent authorities. Competent authorities have a very specific responsibility when accepting a change.

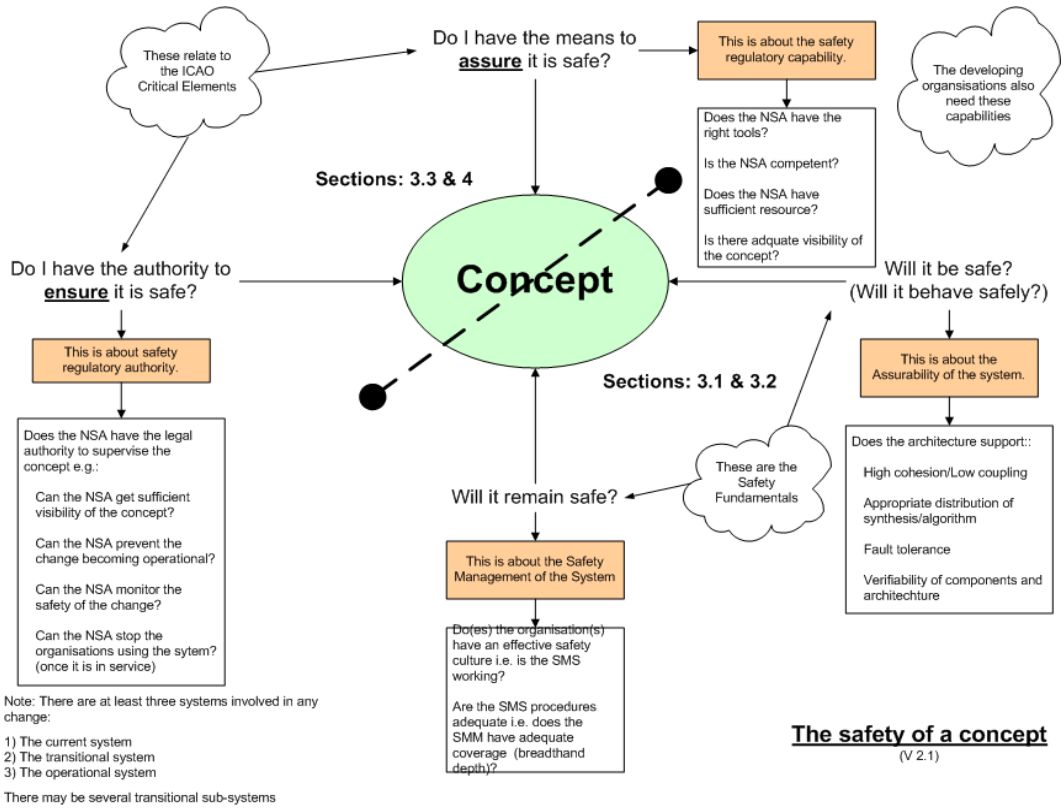
It is accepted, as a matter of principle, that an increase in the effectiveness with which the Competent Authorities discharge their responsibilities will have a positive impact on the safety of air transport.

Early application of the Safety Scanning Tool assists the Regulator in the systematic gathering of audit evidence and in doing so;

a) provides guidance in terms of 'what aspects' to audit to ensure the ATM system will (i) behave safely and (ii) remain safe

b) provides an early indication as to whether the Regulator will (i) continue to have the authority to ensure it is safe and (ii) continue to have the means to assure it is safe.

By way of summary, the following picture (Picture 1 - The safety of a concept) illustrates the relationship between the concepts discussed in the above, the Safety Fundamentals and the ICAO Critical Elements.



Picture 1: The safety of a concept

- In more detail and in order to increase the effectiveness of the competent authorities; the application of Safety scanning assists competent authorities to consider;
    - Application of (inter)national regulations, national policy applicable to the change;
    - Safety objectives and safety requirements;
    - Identification of all parties involved in the change;
    - Interfaces with other Service providers (neighboring states);
    - Coordination between safety authorities affected by the change (i.e. airworthiness, flight operations, aerodromes, MET, AIS, civil military);
    - Coordination between industry and authorities on safety validation;
    - Organisational structure of safety validation that meet the principles of an overall safety approach such as integral processes, multi actor etc (i.e. Project development board);
    - NSA approval process of the ANSP safety assessment procedures;
    - Transparency on (timely) information exchange;
    - Involvement and contribution of all parties that are affected by the change and involvement at all organisational levels;
    - Effective risk and safety communication between parties involved in the change;
    - Strengthen the safety culture in the total system perspective;
    - Technical and operational safety aspects related to the development of a change;
    - Etc.

2.2 Potential benefits to the Regulator following further development of SST

2.2.1 The Oversight Argument

The following introduces the concept of a 'risk-informed approach' to the audit of changes to promote more consistent and defensible decision-making on the part of the National Supervisory Authority (NSA).

European NSAs are committed to implementing the Single European Sky (SES) regulations. Extract from: COMMISSION REGULATION (EC) No. 1315/2007 of 8 November 2007 on safety oversight in air traffic management and amending Regulation (EC) No. 2096/2005[1].

> *"The role and functions of national supervisory authorities have been established in Regulation (EC) No 549/2004 of the European Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation), Regulation (EC) No 550/2004, Regulation (EC) No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation) and Commission Regulation. (EC) No 2096/2005 of 20 December 2005 laying down common requirements for the provision of air navigation services. These regulations include requirements on the safety of air navigation services. While the responsibility for the safe provision of service lies with the provider, the Member States should ensure effective supervision through national supervisory authorities."*

[1] *2096/2005 and 1315/2007 may be repealed during the course of 2011 as part of the changes resulting of the SES II package.*

Objective guidance on what aspects to audit, how deeply to audit and how much to audit in order to be able to demonstrate **effective supervision** does not exist. To provide objective guidance on this aspect of regulatory oversight, the notion of **regulatory risk** needs to be addressed.

Regulatory risk deals with the probability and consequences of a regulatory failure; e.g. the regulator has not noticed that a safety argument is incomplete or has not noticed the most risky part of an argument.

The dimensions of regulatory risk are likely to be related to: supplier competence, safety risk of change, novelty of change, size of change and complexity of change.

Without objective guidance, judgements of what and how deeply to audit to reduce the regulatory risk to a sufficiently low level are merely subjective. Consequently, this could leave the regulator open to criticism in the event that an accident or incident shows an audit to be insufficient.

The SST assists the Regulator in the systematic gathering of audit evidence and in doing so provides guidance in terms of 'what aspects' to audit. A second deliverable of SCAN TF, knows as SMRT[2] provides additional assistance in ensuring that these aspects are addressed by methods.

It should be noted that with further research into Regulatory Risk the tools have the potential to be extended to provide guidance on 'how deeply' to audit or 'how much' to audit commensurate with the previously mentioned dimensions of regulatory risk.

2.2.2 Additional Regulatory Needs

An important element of regulation for Air Traffic Management involves the Management of Changes. This specifically is important due to the intentions in Europe, but also in other regions of the world to improve the current system in a number of respects: Safety, Economics, Capacity and Environmental impact. This change however is even more important when we consider that the current systems are based on a fundament that was build decades ago and new technical options are available for a new architecture.

In this light and from a safety perspective an early involvement in management of projects is essential. The SST is an instrument that is specifically geared for this purpose and provides support to understand the safety implications of changes at a project level as well as at a regulatory level.

The European regulation (EU 2096/2005) details the requirements for Air Navigation Service Providers and determines the need for a well-structured management of changes to functional systems. This implies that before any change can be introduced the responsible partie(s) will have to determine the nature as well as the consequences of a change. For a change it will be needed to determine the required safety of the changed functional system. Mostly changes have various safety implications that need to be considered. Where safety risks do not meet the targets set, mitigating measures are needed. In an early phase of project development the SST can support management in understanding the nature of all important safety issues. This introduces the possibility for management to timely decide to adapt the project plan and prevent a late and possibly costly and time-consuming approach for the definition and introduction of mitigating measures.

[2] *SRC Document 48.*

3. APPLICATIONS

3.1 Aim of the Methodology

As presented previously to the SRCCG and SRC, Safety scanning constitutes a very advanced questionnaire (which can be used in an iterative approach) based on a well-defined set of Safety Fundamentals aimed to support competent safety oversight authorities in the exercise of their duties.

From the safety regulatory perspective, it is of great importance to gain confidence that essential needs for safety, in their widest sense, are identified in a structured and verifiable way and consequently managed in an effective manner.

The Safety Fundamentals subsume a list of regulatory requirements, which can be used for initial identification of safety and safety regulatory needs resulting from changes. These regulatory requirements are a compilation of ATM regulatory requirements on a global ICAO level and European SES and Eurocontrol level combined with knowledge of regulatory requirements from other risk critical and transport industries such as nuclear and rail.

The methodology focuses on application of these Safety Fundamentals during the design and development phases of changes to ATM.

As Safety scanning is intended to facilitate the discussion between competent safety oversight authorities and the aviation industry on relevant safety issues, the achievability and appropriateness of regulatory requirements related to safety achievement should be discussed in the relevant questions to the regulatory framework. Safety scanning provides **guiding** questions for such a discussion.

Using the SST may assist the competent safety oversight authorities in managing their safety and managerial risks. The application of Safety scanning is aiming to be a supporting tool and benchmark for NSAs in effectively meeting their safety oversight responsibilities as captured in ESARR 1 or EC1315/2007.

3.2 When to Use and by Whom

3.2.1 By Whom to Use

Safety scanning (including Safety method review) is intended as a methodology to be used by competent safety oversight authorities in their respective safety regulatory review process. The input to the Safety scanning is in general coming from designers, program managers or other stakeholders involved in the particular change (this may include the safety oversight authority). The safety oversight authority is on the receiving end of this information.

The consideration of appropriateness is left upon the scrutiny of the relevant NSAs, either individually or in working arrangements depending on the ongoing oversight activities concerned (e.g. national, supra-national, regional [FAB] or SESAR).

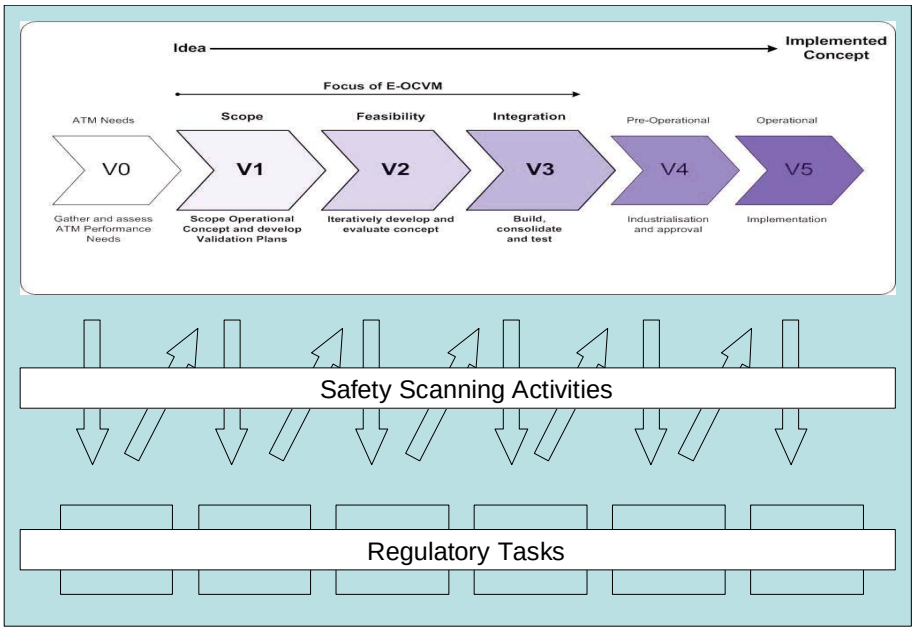
However, since the answers to the questions are to be provided by aviation stakeholders such as ANSPs, these stakeholders could use these questions as a reference baseline to improve upon their own processes as well.

3.2.2 When to Use

The questions of Safety scanning provide input in succeeding steps of a safety review. These inputs, called “Safety Considerations”, are the formalized result of a scanning activity. The results of Safety scanning also formulate the basis for the NSAs’ oversight argument.

If for example there are “interdependencies” concerning an operational change and it is concluded that further analytical safety assessment is needed then this can have implications for the selection of a specific safety assessment methodology. The choice of the methodology has in turn an impact on the quality of the safety argument. As this quality determines the level of assurance that an oversight authority can take from the argument, it may determine whether the oversight authority needs additional actions from the ANSP to make the argument acceptable.

Whether the oversight authority needs to ask additional argumentation of a licensee also depends on the position in the life cycle of a system development. This is illustrated in Picture 2, which depicts the life cycle stages according to the European Operational Concept Validation Methodology (E-OCVM).



Picture 2. Regulators’ follow-up activities according to the life cycle of a system development [E-OCVM, 2007]

If for instance interdependencies are an issue in the early life cycle stages, the regulator should express his expectations to deal with the interdependencies properly during the remaining development phase. If a regulator has the position that interdependencies are an issue, he has to request a safety argument that deals sufficiently with these interdependencies. It is then up to the ANSP to provide an argument that deals with the issue and where needed use safety assessment methods that can effectively address this.

Oversight authorities have a set of tasks and tools that enable the review or oversight of a development and the eventual acceptance of a change and post-implementation monitoring:

- Approval;
- Review;
- Oversight;
- Incident analysis.

Through the E-OCVM stages V0-V5 these regulatory activities need to be applied and considered iteratively. “Applied” refers to review while “considered” refers to approval, oversight and incident analysis. The Safety Scanning Tool helps in fulfilling these tasks:

In early development phases the change is still under design. This allows developers some degree of flexibility in changing the concept when needed (usually V0 to V2). In general, safety arguments are under development and possible safety management activities are not yet determined in full. Key interrelations, which need to be reflected in the safety management principles, can be clarified (especially when it comes to safety tasks and responsibilities). Also, the expectations for the content of safety arguments and basic design of the change can be identified. Through safety management and safety argument it should be identified whether changes in boundaries of the scope may change the safety performance.

Safety scanning provides useful information to have such scoping information right at the beginning of a project. An effective application of the SST and the SMRT Tool reveals the impact of the change and provides insights for an oversight authority, which can be used to scope and plan its own activities during the succeeding stages.

In later phases where the design of the operational change is accomplished and is about to be implemented (usually V4 to V5), usually safety arguments are developed and safety management systems are amended where needed. The SST provides insights in how well the development phase took up the results from early Safety scans (V0 to V3) and gives more detailed recommendations on certain issues that may come up in late stages (e.g., unconsidered side-effects of a change). Of particular importance in latter phases is the suitability of analytical safety assessment methods to the nature of risk involved in the system (cf. ISO 31010). For this particular issue the SMRT supports the assessment of the usefulness of a method subject to the safety considerations that were identified.

3.2.3 Safety Exercises the Tool is not Intended For

Following the Framework Regulation, the separation of Regulation and Service Provision, there is no intention of suggesting integration with methods that are currently applied by designers, developers or ANSPs, responsible for the safety of ATM.

This applies especially to methods intended as a mean of compliance to ESARR 4 or EC 2096/2005 equivalent as Safety scanning follows a different i.e. non-probabilistic and non-failure based approach for aviation.

It should however be noted that the Safety Fundamentals and the related questions in the Tool should be of equal interest for designers, developers or ANSPs if competent authorities would consider these questions worth asking[3].

3.2.4 Cost Benefit Using SST

The SST has undergone an extensive validation and elaboration in the development and application.

- The set of fundamentals were developed based on the review of existing global, EU and national regulations in safety relevant industries (in particular nuclear, maritime, chemical, rail, aviation);
- Applications to specific ATM studies were conducted systematically by a range of renown organisations in safety business (Eurocontrol, NLR, DNV);
- The first version of the Tool was endorsed as appropriate tool in the SESAR definition phase by all stakeholders and led to the SESAR safety register;
- The SST was applied to the evaluation of several conceptual developments in SESAR, EGNOS, Airport operations, ANSP, CFMU [ACID, CCAMS, ICAO 2012], Dutch MoT/CAA [AFMU, PBN], Australian CAA, German Rail, etc;

[3] *Which will be standard practice for NSA-NL*

- An investigation of enhancing safety understanding was applied in the context of PBN and CCAMS developments with positive results and a description of the link between the SST and the concepts of resilience and safety culture (which are important aspects highlighted in the SESAR development phase).

Comparing the experience of doing an SRC-review with the aims of Safety scanning. The following points can be made.

- Preliminary Safety case

  For executing an SRC-review a [preliminary] safety case is required. It should however be noted here that there is no formal requirement, nor an accepted format for such a safety case defined by the SRC or by a competent authority.

  For doing a Safety scan you don't need a [preliminary] safety case, only the program manager, the developers, operational and safety experts with their knowledge and idea's should be enough to allow (ICAO accepted) expert judgment on safety. However, the Safety scan must then record the information from the attendees to formally capture the argument presented and on which the Safety scan is based. It should be noted once again, that there is no formal requirement, nor accepted format for such information.

- "Repair time" / time to implement corrective measures

  By doing an SRC-review the detection for a need of new or revised regulations is parallel with the lifecycle of a general concept development. The SRC Review also allows the notion of "questioning" safety aspects in regulation. These aspects are supplemented by applying Safety scanning in earlier development phases.

- Time Spent

  According to SRC DOC 6 doing an SRC-review takes one or more cycles of 80 days. This takes account of the time in which the attendees to a review can fully coordinate with their organisations and allocate specific blocks of time to this task. The actual time allocated to the task is of the order of 3 days per attendee. After that SRCCG has to approve the opinion (which is not a binding safety regulatory position). For a scan there is less time required in preparation and collecting information. Although the Safety scanning event will be held in one day it is advised to do a preparatory scan some weeks before an extensive exercise, with the moderator, program manager and some key-persons [preferably inclusive some safety experts from the operational stakeholders].

- Stakeholders Involved ➔ Decrease of Assumptions

  With the execution of an SRC-review only the program manager, developer and NSAs are directly involved, however, the SRC Review will address the roles of additional stakeholders as appropriate to the subject. In case of a Safety scan all relevant stakeholders will be invited but at the risk of still missing some, and the risk of inviting attendees that are not required. Both approaches ensure there will be a reduction of assumptions in the end result especially when relating to what other stakeholders do (e.g. Airline Operators or Airports from an ANSP/ATC perspective). Both approaches address the notion of the Total System View as all affected stakeholders are envisaged to participate in the review.

- Usefulness of the Result

  A Safety scan and SRC Review both result in a number of safety considerations (i.e. things that need to be done to meet essential criteria for safe design and oversight). Depending on the time at which a SRC Review, or Safety scan is conducted, the identification of these safety considerations in the early stage of a concept lifecycle allows time for actual resolution. An SRC-review will come with not only an SRC-advice to NSAs, ANSPs and EASA but also with recommendations to improve the argument structure and details of the preliminary safety case so allowing integration into National Regulatory frameworks.

- Cost

  The costs of doing an SRC-review are unclear. An Indication of the total costs [including HR] of executing a Safety scan is, depending with or without external moderation, and the size of the change / number of stakeholders of the magnitude of €1,000 – €10,000.

- Responsibilities

  SRU has pointed out that some program managers see the SRC-review as a validation of their preliminary safety case. However, the SRU does make clear the roles of Safety Management and Safety Regulation in such a review. Similarly, in case of doing a Safety scanning it is the responsibility of the program manager to identify safety considerations and those stakeholders responsible for the respective resolution. This notion will allow a program manager actually to make safety planning as part of the general project management plan.

- Target group

  The Target group for an SRC-review could be all interested NSAs and ANSPs in the ECAC-area. Other target groups, as identified during the review, can be included to address the Total System View. The target group for the Safety scan is more or less the stakeholders involved in or affected by a topic, which is being scanned. This target group can, besides NSAs and ANSPs, include Airline Operators, Airports, Military, General Aviation, NAAs, manufacturers, and legislators etc. to address the Total System view.

There is insufficient data to conclude that a Safety scan has a better Cost Benefit-result than an SRC-review and vice versa. It should be considered that Safety scanning could be complementary to the SRC-review. It could be argued that executing a Safety scan before executing an SRC-review on the same topic will increase the Cost Benefit result of the SRC-review.

3.3 How to Use the Methodology

The objective of paper 'SST where does it fit' is to develop guidance for process and structure for the application of the Safety scanning methodology in the initial design phase prior to acceptance and implementation as a change[4] to the functional ATM system.

The paper defines the types of actors that need to be part of the Safety scanning process and suggests generic institutional structures that allow these actors to work together effectively.

[4] *At the time this paper was written and discussed by the SRC, the SRU was preparing EAM1 GUI4: "guidance for safety oversight of changes" which also may contribute to the management of changes from an NSA perspective.*

The key is that the methodology can be used in different manners by the competent authority;

- For the review of a change. I.e. the Safety Fundamentals become the benchmark for the review of a significant change, or
- As a means to ask the designer, developer or ANSP focused questions by using the Safety Fundamentals as the basis for discussion, or
- As a recommendation to the designer, developer or ANSP to use the Safety scanning (and Safety method review) as a basis for assuring the competent authority that safety is addressed in a satisfactory manner during the initial phases of a major change process. In this way, the Safety Register becomes a vehicle for verifiable evidence for the designer, developer or ANSP to show safety achievement.

It is important for designer, developer or ANSP to be made aware that the competent authority considers the Safety Fundamentals as a relevant benchmark for safe design. If the competent authority gives this clarity to the designer, developer or ANSP then he/she will be encouraged to use the Safety Fundamentals.

4. METHODOLOGY

4.1 Safety scanning process

Safety scanning as such is a relatively simple and straightforward activity. The main process is a moderated discussion by aviation experts putting their experience in a safety context.

This safety context is provided by the Tool where the answers to the, Safety Fundamental based, questions are noted during the discussion.

Although Safety scanning is intended as a methodology to be used by competent safety oversight authorities, the program manager could be seen as the owner of the Safety scanning process and especially the output (i.e. the Safety Register). This Safety Register is consequently used to identify actions that can be included into the project management plan as part of the Safety planning. Effectively, this inclusion in the Safety planning should cater for resolution of the identified safety Considerations.

Prior to the Safety scan the project manager should identify a moderator for the activity. Basic documentation such as a concept and/or design description should be collected and used to prepare for the moderated discussion with the aviation experts [including the safety oversight officials].

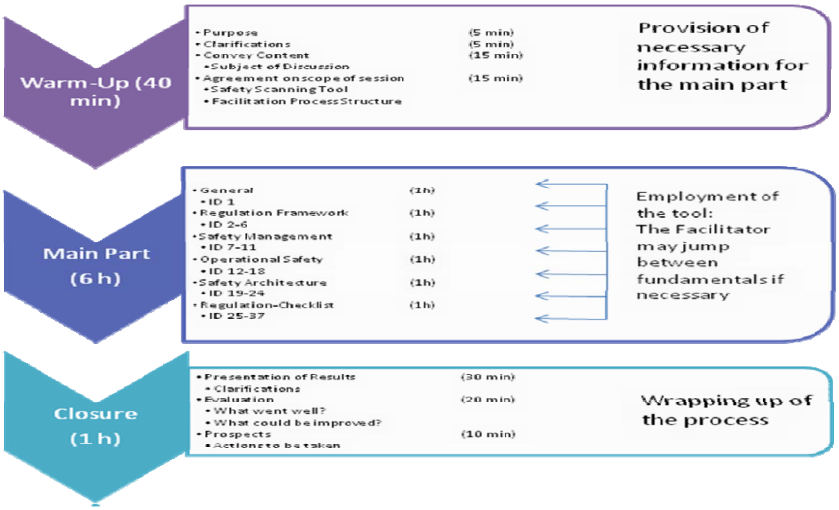
A first brainstorming on who should be involved in the Safety scanning event should take place here and invitations should be sent out.

The moderating process can be further divided into four detailed phases:

- The preparation phase concerns the necessary activities before the moderating discussion starts and is divided into the preparation of content that is to be presented and the preparation of the process structure. In the Netherlands there is good experience with intensifying the involvement of the program manager. Some weeks before the main scan event, the moderators with the program manager did a pre-scan to set the scene[5].

[5] *In Further Work additional guidance material will be developed*

- The main part consists of the warming up before the discussion starts, including the introduction of the change by the program manager, a short introduction to the Tool and the approach and the actual employment of the Tool.



- The closure consists of discussing on a high level the findings and a critical evaluation of the main part.
- Finally a rough report is composed according to guidelines (using the automated reporting function in the Tool) and is handed over to management and stakeholders.

4.2 Safety Scanning Tool

- The SST is built on a set of twenty-two ‘Safety Fundamentals’, which are basic design criteria for safe operations, anchored in European law. Examples of these fundamentals are:
  - Regulatory principles,
  - Safety policy,
  - Planning of safety assurance,
  - Competence,
  - Transparency,
  - Redundancy, and
  - Reliability.

The Tool guides the user systematically through these Safety Fundamentals, by asking for each fundamental between one and five related sub-questions [SCAN TF 2010, SST- questions] guiding to more detail. The answers to be given are multiple-choice (Yes, Partially, No), and a written justification of each choice is inserted in the tool while participants can see the input on a screen to ensure the correct representation of the discussion.

When all questions have been answered, the user receives a qualitative overview of the safety aspects that require further attention, as well as an automatically generated report of all answers and justifications provided. The SST is programmed in MS-Excel.

The Tool is ideally used iteratively in the course of a life cycle of an operational concept. It shows the gaps and loose ends that require further attention from concept development, regulatory issues [oversight, but also legislation & regulation] and safety management.

In initial phases, the Tool coordinates and communicates awareness and understanding of safety needs between stakeholders in a Total System View. [It gives also the oversight in an early stage a level of confidence of how safety is handled in this project]. In later phases it supports regulators in developing acceptance criteria for safety evidence.

4.3 Safety Method Review Tool

The SMRT^2 is built on a set of thirty-two 'Safety Validation Quality Indicators', which are indicators for measuring to what extent a given safety validation method can be used to develop a good safety case for a certain change.

5. EXPERIENCES FROM THE FIELD

5.1 Summary and Report of the Safety Scanning Events

5.1.1 Description of Changes Used for Validation of the Safety Scanning Tool

EGNOS (European Geostationary Navigation Overlay Service) is the European satellite-based augmentation service (SBAS) that complements the existing satellite navigation services provided by the US Global Positioning System (GPS) and the Russian Global Navigation Satellite System (GLONASS).

ConOps Airspace Flow Management Unit: Development of a civil military planning cell for an integrated approach of flow and airspace management [advanced Flexible Use of Airspace].

Roadmap implementation Performance Based Navigation: The Netherlands agreed to ICAO resolution A36-23 that urges all States to implement PBN. States are requested to produce a plan for the implementation. A Task Force PBN was established in 2008 within the Netherlands in which civil-military aviation stakeholders participated. The TF PBN provided a vision and roadmap up to 2020 for PBN operations in the Netherlands. The Roadmap describes the rationale for PBN, the potential benefits of PBN and defines milestones within the navigation domain taking into account airspace users.

CCAMS: A pan-European project named Central Code Assignment and management system. A centralized code management system is intended to be introduced to mitigate for emerging code changes in Europe. The multi-stakeholder setting mainly consisted of the ANSPs and the CFMU.

5.1.2 Impressions of People Present by the Safety Scanning Events

EGNOS: The general observations by the participants were that the [original] Safety Screening Tool is a very useful tool, due to the harmonised and structured approach, and because it raises awareness and encourages communication. The tool is a good starting point for structuring the following processes. The tool may not be exhaustive enough for formal application, e.g. certification problems. It was suggested that a better explanation is required on what the tool does and what it provides. The tool should be used in iterations, and an option is to use it per stakeholder group separately. The tool has definite use beyond NSAs.

ConOps Airspace Flow Management Unit: Most people found it a very interesting day with lots of fun. Some indicated that it was organised at the right moment, but on the other side some people found that this tool should have been used earlier, e.g. with every CONOPS development phase. The Tool clearly shows the issues that should be further addressed. Somebody was under the impression that the Subject could be ready for implementation tomorrow, but now this does not appear to be the case: "We as policy making have a lot to do". The next step will to document the safety goals, and revisit the checklist. Also the Dutch NSA declared to use SST within their 'Safety Management Audit and Review Team on a particular change.

Roadmap PBN: The Safety Scanning Tool is an interesting tool, which helps you to think in detail about a subject. Some questions appear to be difficult to translate to the scope of the PBN roadmap. Some people had some reservations about the tool and this session because the PBN roadmap is at a high level so not really suitable for such scan. But the Tool could still be useful for elements of the roadmap.

CCAMS: Stakeholders were actively participating in the moderated discussion. Approximately 40 actions (safety considerations) were identified in a 3,5 hour timeframe. The general notion was that the exercise was useful as it clearly indicated things to do to make CCAMS work safely as intended. 16 out of 18 participants indicated that the approach would be useful for their organisation with the 2 remaining stakeholders indicating that they would show the tool to their common safety manager.

5.1.3 Additional information about Safety scanning events done in 2010 en 2011

On the 6th December 2010, a Safety expert of CFMU moderated a Safety scan in support to the ICAO 2012 Task Force. Twenty-five stakeholders, including ICAO and NSAs, were present in this pan-European event. On the basis of the identified safety considerations the TF decided in her TF-meeting of 26th January 2011 that the magnitude of this change is major. A follow up scan is foreseen mid 2011.

In Q1-2011 NSA-NL has done a pilot on an interesting notified change 'runway extension of Groningen Airport Eelde'. The results of the scan led to some additional questions about the confidence level of the offered safety case.

The head of NSA-NL, as member of the SESAR regulatory review team, has used SST in the safety assessment of the SESAR test project 'Remote and virtual Tower'. In a session of two hours several points of attention were identified. The results of this scanning session offered to the SJU, as an attachment to the advice, are accepted by the SJU.

5.1.4 Follow up

In this section the follow up of the results of the Safety scanning events will be exploited:

EGNOS: the identified safety considerations have been provided to EC, DGCA and EGNOS provider.

Conops Airspace Flow Management Unit: Corrective actions are incorporated in the project plan. The WG AFMU decided to induce a follow up scan on a mature AFMU ConOps in 2012. Meanwhile the WG-AFMU had decided to develop a Safety register with the aim of improving the coordination for solving the identified safety considerations. A first edition has been accepted in the WG-meeting of 7 April.

Roadmap PBN: The identified safety considerations have been discussed in the next meeting of the TF PBN. The follow up is presented to the Air Traffic Commission.

CCAMS: A formal Safety Register has been created and presented to the CCAMS User Group for review and action. The project safety manager is supporting the CCAMS project manager in the follow-up.

Runway extension GAE: On the basis of a follow up Safety scan and additional safety argumentation requested on the basis of the first Safety scan NSA-NL will discuss the findings with NAA-colleagues [airport section] and ATC/Airport GAE with the aim to improve the safety case to a mature level.

5.1.5 Lessons Learned

Several lessons learned are identified and clustered to the following baskets:

- *Organisation and planning*
  - Intensify involvement program manager and or oversight officials;
  - Safety scanning should be part of the project plan;
  - It is efficient if the scanning starts with a pre-scan;
- *Promotion*
  - Explain what SST is and what it isn't.
- *Documentation*
  - Tailor made and easy to use;
- *Processing during the session*
  - Pre-fill general part and verify in session saves time;
  - Introduction by program manager is quite effective;
  - Order of cluster of identified gaps in pre-scan on or familiarly with subject;
  - End session with a high level discussion on the result [surprises found?].
- *Report*
  - Give also attention to the good stuff;
  - Option: make a Safety Register [list with actions to be take care of, including the responsible party of that action];
  - Report to management needs additional clarification.

Several of these lessons learned have resulted in actions, which have already been incorporated in the deliverables.

5.2 Report of Other Related Activities

5.2.1 Dutch TF NAVL

Over many decades the implementation at national level of major changes in air transport have been prepared and coordinated by the ANS provider in close cooperation with the user community and associated safety aspects monitored and/or reviewed by national authorities.

When future air navigation concepts (e.g. SES and FABEC) are being introduced by the Member States and implemented by the air navigation service providers and aviation industry, the interdependencies of operational processes between airports, aircraft, airline operational control centres, air traffic management and supporting facilities will be considerably higher than in the past.

Consequently safety responsibilities and safety accountabilities will change accordingly due to the increase of safety critical interfaces between organisations resulting in an increasing need to coordinate the associated safety management of the various organisations involved. Safety validation and safety review of changes in air transport will increasingly be considered as a “total and integral” activity, rather than a ‘sum of parts’ activity and will require close cooperation between the ANSPs and aviation parties involved in the change.

The classic organisational structure and associated tasks of national aviation supervisory authorities follows the international regulatory structure (ICAO Annexes) and (normally) results in an organisational structure of licensing and oversight functions in separated sections for flight operations, airworthiness & maintenance, air navigation services and airports. This organisational structure and the associated procedures do not sufficiently support a multi actor approach.

The work of this TF is an example of a national approach for describing the conditions and highlights the need to establish international agreed principles for safety validation and safety review in support of a multi actor approach during all phases of design, development and implementation of changes in air transport and a coordinated safety monitoring and review by the NSA and other competent authorities (CAA-OPS/AIR) that will be involved.

The Netherlands Civil Aviation Department had established a Task Force to reconsider the national safety validation and safety review process in a multi actor environment after a workshop with the aviation industry indicated that:

- Current scope of safety validation is limited;
- No (inter)national regulations to cover sufficiently multi actor safety validation;
- No mature validation methodologies to cover an overall safety validation;
- Unclear responsibilities in case of interdependencies and interfaces;
- Often not clear who will initiate and coordinate the safety validation of a multi actor change.

The need was identified to develop basic principles to be applied during an overall safety validation of future air transport operations to ensure active involvement of all actors involved in the change and a timely and integrated review by the national authorities. The TF has finalized its work December 2009 by delivering a number of basic principles in support of a “multi actor safety validation approach”. These principles were consistent with the ICAO Critical Elements for safety oversight (ICAO Doc 9734) and with Safety Fundamentals. Based on these principles generic structures were designed for validation processes and organisational structures to be used for multi-actor safety validation.

5.2.2 Dutch Pilot to Intensify the Involvement of the Program Manager

MoT the Netherlands sees SST as a good tool for “their” project management and therefore contracted NLR to handle the Safety scanning event of PBN also as pilot for intensifying the involvement of the program manager. The program manager was involved in the pre-scan, did the introduction of the change during the main scanning event and led at the end of the event the discussion of the safety considerations. This time, NLR wrote the report, but in future it could be the program manager who will take care off that. The program manager PBN expressed his good feelings and declared the intention to do a follow up scanning event with his TF or by himself. MoT the Netherlands will promote this way of using the Tool in project management by incorporating a development procedure in the manual.

5.2.3 FABEC

With respect to safety assessment for changes, the current views from FABEC NSAC and FABEC Standing Committee on Safety are aligned. These alignments include, amongst others, the potential applicability of the concept of Safety Fundamentals at an early phase, and the coordination activities by multiple actors in the notification procedure and subsequent safety assessment. AMRUFRA is the first FABEC change in which a multi actor approach for safety assessment has successfully been used.

6. ALIGNMENT TO REGULATIONS AND OTHER INITIATIVES

6.1 Regulations

6.1.1 EASA

The existence of EASA finds it basis in regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency. This Basic Regulation amended by Regulation (EC) No 1108/2009 entered into force on 14 December 2009, establishing EASA's competence for safety regulation in ATM/ANS and aerodromes.

The reason behind this Regulation is to reach at the end a high and uniform level of civil aviation safety through common action, effectively introducing the notion of "the Total System". The Aviation system behaves as a network, progressive harmonization of safety requirements across all fields. Within the EASA total aviation system view, borders between different aviation fields should become artificial and progressively disappear.

EASA will be responsible for:

- Development of implementing rules (to be issued by the European Commission)
- Creation of AMCs and guidance material for the implementing rules
- Standardisation of supervision/inspections by competent authorities
- Safety analysis for whole of ATM/ANS
- Certification of pan European providers
- Safety advisor to SES

The structure of rules under the EASA Basic Regulation is as follows:

- Essential Requirements (ER)
- Implementing Rules (technical requirements, requirements for organizations, requirements for authorities) (IR)
- Acceptable Means of Compliance (AMCs)
- Community Specifications (for H/W and S/W)
- Guidance Material (GM)

On 28 May 2010 EASA published an Opinion for a Commission Regulation on Common Requirements for the provision of air navigation services, and for a Commission Regulation on safety oversight in air traffic management and air navigation services. For the fast track but even more for the incorporation of the more significant changes of ATM-kind as prescribed by the EASA BR's ATM/ANS extension drafting groups have been installed: ATM.001 [requirements for organisations (ANSPs)], ATM.003 [requirements for ATCOs] and ATM.004 [authority requirements].

6.1.1.1 Essential Requirement of the Basic Regulation

Extra to the current SES-safety related requirements, the ATM/ANS extension introduces requirements on the following subjects:

- Transposition of ICAO SARPs in line with SERA,
- ATSEPs,
- Air traffic flow management and airspace management,
- Systems and constituents (for producers and ANSPs).

Furthermore, NSAs will eventually need to live up to the authority requirements (ARs) under the Basic Regulation-framework.

6.1.1.2 Total System View

The Total System View may mean many different things to many different people depending on where they are in the aviation chain (total view on regulation, total view from an oversight perspective, total view from performance etc.). There seems to be however already one clear relevant change coming from thinking in terms of "Total system".

The current regulatory regime (pre-Total System) allocates the safety responsibility for ATM exclusively to ANSPs. Although they are a key player in managing ATM they are not the sole user or operator of ATM but an important shackle in the aviation chain.

The Total System View seems to acknowledge this wider notion and seems to imply that safety is the result of common activities and coordination of individual safety activities. Safety scanning, with its essential criteria of safe design and multi stakeholder thinking introduces a first structured methodology for this new awareness.

6.1.1.3 SST-alignment to EASA-regulations

As the Safety Fundamentals are seen, as a list of regulatory requirements, which can be used for initial identification of safety and safety regulatory needs, EASA/SATF has asked UniKs to link the Safety Fundamentals to the Essential Requirements. The Tool supports this linkage by providing functionality to link Safety Fundamentals and related questions to specific phrases of existing regulations. Demonstratively this linkage is provided in SST for instance for EC 1315/2007 or 2096/2005.

Looking to the needs of EASA, Safety scanning has the potential to become an AMC for the Safety planning, identifying relevant stakeholders and loose ends to be solved during the development of the change. The use of SST could be incorporated in the Guidance Material EASA/SATF is developing at this moment. There is a clear notion here that SST is to be considered as a [pro-active] safety assessment tool and not a tool for risk assessment.

6.1.2 EC

Single European Sky regulations play an important role in the Management of Change. Beside the Framework Regulation 549/2004, the airspace Regulation 551/2004, the Service Provision Regulation 550/2004 and the Operability Regulation 552/2004 are 2096/2005 (Common Requirements) and 1315/2007 of high importance.

6.1.2.1 EC 2096/2005

2096/2005 lays down the common requirements for the provision of ANS.

6.1.2.2 EC 1315/2007

1315/2007 gives instructions to NSAs for safety oversight in ATM (ANS, ATFM and ASM).

6.1.2.3 SST-alignment to SES regulations

The questions in the SMS-part are aligned to 2096/2005 and 1315/2007. The Tool has a special function to show the relation with specific articles of these two regulations and the Safety Fundamentals, which need attention. For a more in depth analysis we refer to [SCR DOC 46 – Annex D, regulatory advice]

6.1.3 ICAO Critical Elements for the Oversight Program

ICAO has identified a number of Critical Elements based on the experiences over the last decade in applying the ICAO USOAP in Contracting States. These Critical Elements are intended as guidance to States to create an effective organisational structure of the safety oversight. The guidance material is contained in ICAO Doc 9734-2006 and describes the legislative obligations, basic responsibilities and tasks:

- Primary aviation legislation;
- Specific operational legislation;
- State civil aviation system and safety oversight functions;
- Technical personnel qualification;
- Technical guidance, tools and the provision of safety critical information**;**
- Licensing certification, authorization and approval obligations;
- Surveillance obligations;
- Resolution of safety concern.

- In each of these areas there is a relationship to safety validation of changes in air transport operations and the establishment of principles in support to structuring a multi actor validation process and validation organisation at national level.

6.2 Other Initiatives

6.2.1 SAFMAC

As a follow-up of the 35th ICAO Assembly (2004), in which the need was identified for a new approach to safety validation, The Netherlands took initiative to study new approaches to validate safety of (major) changes in air transport operations and the identification of associated risks

It was observed that there is no internationally agreed safety validation approach that could evaluate all components during the (early) design, system development, operational trials and implementation phase of these major changes in air transport. In close coordination with EUROCONTROL, The Netherlands developed a framework for a new safety validation approach (SAFMAC) with the objective to contribute to the establishment of an internationally agreed standard approach.

SAFMAC (Safety validation of Major Changes in Air Transport Operations) is a framework for safe development of air transport operations in which multiple stakeholders play a role. It consists of four interacting processes, i.e. Joint Goal Setting, ConOps Development, Stakeholder Allocations, and Validation, which are jointly executed from the earliest lifecycle stages of an operation onwards. These lifecycle stages are lined up with those of E-OCVM. The SAFMAC Validation process is supported by a set of 32 Safety Validation Quality Indicators, which provide guidance to the validation activities to be performed. The new safety validation approach will support the NSA or EASA in the validation of (major) changes of the ATM system and the acceptance of the safety assessment carried out by ANSPs.

6.2.2 SESAR

The SESAR (Single European Sky ATM Research) programme is one of the most ambitious research and development projects ever launched by the European Community. The programme is the technological and operational dimension of the Single European Sky (SES) initiative to meet future capacity and air safety needs.

Given the complexity of the programme, a legal entity was founded by the European Commission and Eurocontrol, to coordinate and concentrate all relevant research and development efforts in the Community.

The mission of the SESAR Joint Undertaking is to develop a modernised air traffic management system for Europe. This future system will ensure the safety and fluidity of air transport over the next thirty years, will make flying more environmentally friendly and reduce the costs of air traffic management.

Safety scanning is the successor of Safety screening which was developed specifically for SESAR during the definition phase (in the scope of WP1.6 Safety Regulation D3/D4).

As Safety scanning is designed for the early phases of design and development up to pre-industrialisation and deployment it should actually be considered as useful for SESAR.

This is in particular for two reasons; it allows SESAR project to have a safety benchmark for pre-implementation safety activities and it gives EASA and NSAs an easy reference to safety aspects related to SESAR developments allowing increased confidence in the feasibility of the proposed SESAR products. The latter should facilitate acceptance by competent authorities in the respective SESAR deployment phases.

6.2.3 SRC Review

The Safety Regulation Commission (SRC) carries out reviews to identify and address potential safety regulatory issues related to programmes coordinate at European level prior to their implementation.

The reviews are intended to assist those authorities (i.e. NSAs and progressively EASA) having approval and oversight responsibilities with regard to the subsequent implementation of those programmes. Position Papers are issued by the SRC for the benefit of the relevant authorities and to facilitate the application of a harmonised safety regulatory approach in relation to those programmes.

The reviews aim to anticipate, as far as possible, the potential safety regulatory impact of the Programmes concerned. More specifically, this SRC review process aims at facilitating the safety regulatory processes, notably those related to the implementation by NSAs of the safety oversight of changes established in ESARR 1 / EC 1315/2007.

6.2.4 Unsafe model

As part of the EASA activity on updating the 'Basic Regulation' to incorporate ATM/ANS, WG05, being a part of the ATM 001 project, and also known as the SATF, are developing a model to determine when a system change should be reviewed by the NSA. When this model is developed and finalised, the Safety Fundamentals will be reviewed to ensure consistent coverage.

7. A WAY FORWARD

7.1 Further Work

7.1.1 Improvements

According to the original work break down in WP3 a Safety scan of the EGNOS-change, with the original Safety Screening Tool was executed. During the validation phase several scans [AFMU, PBN, RESET, ACID/CCAMS] have been executed. All lessons learned are registered in official reports of these sessions and incorporated in a specification document. Some of them are solved in the update of the guidance material.

7.1.2 Work in Progress

In the deliverable ‘Further Work’ there will be easy to use guidance for the oversight officials and a literature study about Human Automation Interaction.

It should be noted that the notion of “Further Work” does not imply that Safety scanning is not a mature product. It actually is and it is, also referring to the positive responses from the field, working well. The notion of “Further Work” underlines the ambition of the people involved in the development to continuously improve. Without a doubt, this is consistent with the principles of safety thinking and safety management.

7.2 Implementation

7.2.1 National

The Netherlands aviation community sees SST as a good tool for project management and in that way the use will be incorporated in the national project procedures.

Following the pilot on an interesting notified change ‘Runway extension of Groningen Airport Eelde’, NSA-NL will to do some Safety scans in this field. The experience will be used for the further development of the guidance material for oversight officials.

In the Dutch policy paper “Beleidsagenda Luchtvaartveiligheid 2012-2014” (inter alia the Dutch State Safety Program] actions are described to redefine the organisation dealing with the decisions of changes in Dutch Airspace to incorporate this way of working.

7.2.2 Regional [FAB]

A FABEC Working Group consisting of combined [provisional] NSAC and [provisional] Standing Committee on Safety has finished their work, being the investigation of the idea of Safety scanning at an initial phase ('Initial Safety Impact Assessment') within the general safety assessment process. A proposal is accepted by the Standing Committee on Safety.

Also NEFAB NSAC has recommended this approach to their NEFAB-ANSPs.

7.2.3 Pan-European

Safety scanning is incorporated in the further development of the SMS of the EUROCONTROL Directorate Network Management. Upon assignment of the role of Network Manager to Eurocontrol it will become an active part of meeting the new Common Requirements for the Network Manager. In preparation of these future events, CFMU has conducted two Safety scans in the course of 2010 [CCAMS and ICAO 2012] and plans to do several scans in 2011.

EASA has the intention to use SST in determining if the rules under development for changes to functional systems and management of change incorporate the relevant fundaments of safety.

7.3 Rulemaking

During a meeting with EASA in spring 2010 The Netherlands offered EASA a proposal for amending EU-EASA regulations. The objective of that paper is to consider the current ICAO and EU regulatory framework on their adequacy to support a (multi actor) safety validation with safety critical interdependencies due to shared responsibilities by two or more aviation organisations involved during validation and review procedures related to:

- State responsibility on licensing, certification, authorization or approval processes;
- State responsibility for safety oversight and safety management systems;
- Impact of (major) changes in air transport operations on safety.

It was recommended that EASA takes note of the multi actor approach and consider the need that the current EU regulations be reviewed on their suitability to comply with the identified principles, as amended.

At this moment The EASA SATF is elaborating the Dutch proposal.

7.4 Contribution to SRC Reviews

During SRCCG 18, it was agreed that SST would be seamlessly incorporated into SRC DOC 6 in order to improve the SRC reviews. This incorporation is captured in the SRC 2011 Work programme (SRC WP40.07, action 10).

7.5 Work for the Longer Term

7.5.1 Extensions

7.5.1.1 Safety of Human Automation Interactions in a Highly Automated Environment

In the literature review of Human Automation Interaction additional Safety Fundamentals were identified. These Safety Fundamentals should be further elaborated to represent safety aspects related to human automation issues. This could lead to the development of an additional (fifth) set of Safety Fundamentals on Human Automation Interaction.

7.5.1.2 Tool for Assistance Drafting the Oversight Argument

The proposal for a third version of SST (SST3.0) looks beyond minor change to produce a tool that guides the user in making well informed decisions in the attainment of a declared goal.

For each goal it will be required to satisfy one or more lines of argument. Guidance on what information and how much information to gather is to be derived from the argument(s) thus ensuring the information is salient, necessary and sufficient.

Further detail is given in the Document proposing the specification for an advanced version [SPEC3.0, page 3].

7.5.2 Training and Organisational Issues

Courses: In the Dutch project Safety scanning of the PBN-roadmap an outline of a training program has been drafted. This will be used as the starting point for developing such a course e.g. under the auspices of EASA. UniKs and NLR are already jointly preparing a workshop for NSAs and regulators.

SST-Users Group: SST is good to use, however, given the fact that limited resources were available formally, it can still be improved. There are still lessons learned that are worth to be considered for incorporation in a future version of the Tool or improving the guidance material. The current tool is however very suitable for use as it stands.

As a first step to ensure future improvement, an agreement was made with the developers of SST [who can give support by moderating a Safety scanning event for ANSPs, EASA, States or NSAs] that the lessons learned from their work will be shared and collected on a central place.

This information can be used to improve the tool [e.g. in case the regulation part needs an update]. A second step can be the development of an user-network for the central collection of the lessons learned evolving to the install of a SST User Group e.g. under the EASA Umbrella.

Maintenance of the tool needs to be considered. The SMS section is currently based on EC No. 2096/2005, which will need to be updated with the release of “new Common Requirements” and future EASA Basic Regulation.

8. REFERENCES

8.1 Relevant Papers

- Paper by NLR in ISSC 2007 “Study of the Quality of Safety Assessment Methodology in Air Transport”
- Paper by NLR, MoT-NL and QSA in Safety Science “Developing a framework for safety validation of multi-stakeholder changes in air transport operations”, 2008

- Working paper “SRCCG 12.04 by CAA-NL “Development of a Safety scanning method and tool”, 2009
- Paper by MoT-NL to SRC workshop “Need for Safety Scanning Tool in support of NSAs”, 2009
- Paper by MoT-NL & EUROCONTROL/ASRO “Early involvement of NSAs in changes to air transport operations; SST where does it fit”, 2009
- Paper by MoT-NL “Relationship between Safety Fundamentals and Safety oversight Critical Elements”, 2009
- Paper by EUROCONTROL/ASRO “What do oversight bodies need? Linking Safety Scanning to Safety Review & Oversight”, 2009
- Paper by MoT-NL to EASA “Proposal for amending EU-EASA regulations”, 2010
- Paper by UniKs to INO-seminar 2010 “Measuring the possible increase of the Safety Understanding due the application of the Safety Scanning Tool”
- SRC Work Programme for 2011, SRC40.07

8.2 Documentation

- EUROCONTROL/DAS/SSM “Safety Screening Technique”, 2007
- NLR report CR 2007-378 “Establishing an Airspace and Flow Management Unit (AFMU) in the Netherlands; D2.2 High-level CONOPS validation”, 2007
- CAA-UK System Requirements Specification, 2008
- SCAN TF (2010, SST questions) SCAN Task Force, Development of a Set of Questions for the Safety Scanning Tool, Edition 1.0, 11 March 2010, M.H.C. Everdij, H. Korteweg, J. Penny, O. Straeter, T. Longhurst.
- NLR report CR 2010-205 “Evaluation of the AFMU Safety scan”, 2010
- Technical note to NLR-report CR2010-460 “Lessons learned from the PBN Roadmap Safety scan”, 2010
- Proposal for specifications for a advanced version SST3.0 “SPEC3.0”, 2011

These papers and documentation can be made available upon request.

8.3 Acknowledgements

As chairman of SCAN TF I thank all those who have given support to this initiative and in special the members of the External Review Group [LVNL {Roy Jansen}, NATS {Ian Parker}, LPS {Jana Kovarova}, Austro Control {Franz Nirschl, now MoT Austria and vice chairman SRC}, Croatia Control {Zoran Jacsik}, KLM {Arthur Dijkstra}, Amsterdam Airport Schiphol {Erik Lagerweij}, TuD / Lund University {John Stoop}, colleagues of NSA-NL {Jos Wilbrink, Niels Heijkoop, Frederik Demeyere, Jules Hermens, Rob van Dorp and Klaas Zwart} and MoT-NL {Rob van der Boom & Robin Valkenburcht} and those who have given specific support, like Henk Korteweg {Eurocontrol/CFMU}, Bert Kraan {QSA}, John Penny {CAA-UK}, Oliver Sträter {University of Kassel}, Marcus Arenius {University of Kassel}, Georgios Athanassiou {University of Kassel}, Mariken Everdij {NLR}, Job Smeltink {NLR}, Bart Klein Obbink {NLR} and Sybert Stroeve {NLR}. And last but not least Harry Daly formally as chairman of the SRCCG, now chairman of SRC, for his continues support and excellent promotion of this work.

APPENDIX – SCAN TASK FORCE

1. TF Members

Chairman: Jos W. Nollet [NSA -The Netherlands]

Contract manager [2009]: Henk Korteweg, formerly EUROCONTROL/ASRO

Administrative support SRU: [2009] Françoise Girard, [2010] Gary Morton

Members: Terry Longhurst, CAA-UK; Lt-col. Edgar Reuber, EUROCONTROL/CMAC; Arnoud Limousin, DSAC.

Specific support: Mariken Everdij, NLR; Henk Korteweg, EUROCONTROL/CFMU; Bert Kraan, QSA; John Penny, CAA-UK; Oliver Sträter, University of Kassel, Andrew Burrage, Helios Ltd.

2. Terms of Reference SCAN TF

The following tasks were defined:

- *Needs*
  - To draft a document identifying the NSA and EASA needs with regard the use of a Safety Scanning Tool supporting the safety regulatory reviews for validation at concept level and for new developments.
- *Specification*
  - To evaluate the current version of the Safety Scanning Tool on EGNOS as test case of a project where there are more than one NSA involved.
  - To review existing “specifications” of the safety scanning tool to take into account the NSA needs and the result of the evaluation of the current version on EGNOS.
  - To discuss the contents of the work packages of the project;
- *Work to be done*
  - To review the deliverables of the project;
  - To assist the assessment of the Safety Scanning Tool on a test case of a programme or project where there are more than one NSA involved at EU level (an Operational Improvement of SESAR will be chosen)
- *Acceptance*
  - To present to SRCCG a final report for approval.
  - Subject to the SRCCGs approval, to run the Safety Scanning Tool on the GNSS related projects identified at the last SRC meeting (i.e. “SBAS APV” and “APV Baro VNAV”) and to compare the findings against the GNSS Preliminary Safety Case (PSC).
  - To present to SRCCG a final report to discharge.

3. Content Annex Book

A Safety Fundamentals for Safety scanning
B Guidance for moderators
C Guidance for safety analysts, interpreting the results
D Advice for regulatory tasks