Strategic Safety Research Plan

for the

Eurocontrol Experimental Centre

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**Personal Statement from the EEC Director**

ATM R&D is the core activity of the EEC, but this is driven by a practical objective: to see development leading to implementation in an operational environment. Safety is a vital element of every implementation and in order to succeed at this phase, safety needs to have been built into the whole process.

We at the EEC are faced with the challenge of identifying and addressing the potential safety issues emerging from our research into future ATM systems.

Our role is, through a methodological approach, to anticipate the safety implications of everything we do. Our aim is to ensure that safety is given appropriate priority at every phase from initial concept to a final implementation in the Operations Room.

We firmly believe that Safety is our number one priority.

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**Message from the EEC Operational Director**

One of the main strategic orientations of the current EEC Business Plan is to position safety as the first priority at the EEC.

The re-organisation at the beginning of 2003 has seen the replacement of the Safety Business Area by a Safety Co-ordination Function. This will lead to better integration of safety in the projects and clearer ownership of safety by projects and Business Areas. This will also increase the awareness, understanding, and safety competence of EEC staff and provide a focal point for safety assessment activities.

These changes, when realised, are designed to deliver significant enhancements to the safety culture at the EEC, underpinning the research that will lead to real safety improvements in ATM. This Strategic Safety Research Plan sets out the roadmap to achieve this.

*Pierre Andribet*
Foreword

Air Traffic Management (ATM) has always been concerned with safety, and ATM has been one of the safest industries on record. However, recent tragic events, and the challenges of capacity and complexity increases in European ATM, mean that safety cannot be assumed. Rather, safety must be assured: it must be planned, integrated into new concepts, assessed, and verified. Part of this overall safety assurance process relies on safety research. This document explains the role of safety research in maintaining and increasing safety in ATM and, in particular, the role of safety research at the Eurocontrol Experimental Centre (EEC).

The activities of the EEC are about the future of ATM. The final realisation of future systems may not occur here, but the visualisation, conceptualisation, and the testing of that future vision often has a starting point, and significant development, at the EEC. Although safety is usually thought of as a property of an existing system and how it is operated, the roots of safety, and the roots of disaster, are often in the early design phases. It is therefore imperative that safety is built into the design of future systems. This requires a structured process that fits into a design and development culture in terms of methods, data and understanding that can lead to more robust designs and future concepts. This Strategic Safety Research Plan outlines how the EEC can support the design and evaluation of safer future systems and play a significant role in achieving high levels of safety in ATM. In order to show how this can be done, this document explains how safety will ‘work’ at the EEC, supporting its various projects and Business Areas, integrating safety into EEC activities as well as carrying out specific safety R&D projects.

The Strategic Safety Research Plan also aims to put the EEC safety activities into the larger context, showing how they connect with a more general safety research strategy, aimed at supporting other parts of the Agency, and the Safety Team and Member States in Europe. In this way, staff at the EEC can see how their activities contribute to ATM safety in practice, and people outside the EEC can see how the EEC safety activities may help them.

This document is not a Safety R&D Plan – that is a separate and more externally-focused document detailing the individual R&D projects, their time-scales and deliverables. Rather, it aims to interpret the Agency Safety Policy and more general statements about ‘putting safety first’, to show what these will mean in practice for an organisation carrying out research and conceptual design work for ATM.

On behalf of the management of the EEC and the Safety Research Team, it is hoped this document will be useful and explain the commitment to safety. If you have any comments or questions, all such feedback is welcome.
1 The Current Safety Research ‘Landscape’ in ATM

Background

ATM Safety has become of increasing interest recently. Firstly, and tragically, there have been two major accidents (the mid-air collision at Lake Constance, and the Milan Linate runway collision) where ATM has played its part. Secondly, there are the demands being placed on the commercial aviation industry to simultaneously increase capacity, whilst reducing delays and costs. Against this background, there are a number of concerted efforts to improve safety via effective and focused Research & Development (R&D).

The European High Level Action Group on ATM Safety (AGAS) produced a report of actions needed to maintain safety in the industry, and this action plan includes safety R&D activities. This report was accepted by the Provisional Council, and the development of a detailed work plan is now in progress, with some of the activities already started. The ACARE (Advisory Council for Aerospace Research in Europe) initiative has also raised certain safety issues, some of which relate to ATM and associated safety research. Also in preparation is the European R&D Master Plan (ERDMP), which will include high-level safety research needs. There is a new FAA-Eurocontrol Action Plan on Safety (AP 15) designed to tackle key safety issues common to US and European ATM and finally, there are various member states’ own safety research programmes and initiatives, tackling a range of issues. With all these initiatives it is clear that there is a need for co-ordination and alignment of safety R&D strategies to optimise exchange of knowledge and to ensure that research is not duplicated. In view of these major initiatives, this Strategic Safety Research Plan (SSRP) sets out a strategy for helping to maintain and increase operational safety in European ATM.

Figure 1 shows the roles of the main actors in the development cycle for new ATM systems. The role of the EEC is mainly in concept development. There is some EEC involvement in programme work although this is primarily run from EHQ. Actual implementation of new systems or system changes, whether based on Eurocontrol concepts or not, is the domain of the Air Navigation Service Providers (ANSP’s), as is the running of ATC systems and their operational and safety management.

Figure 1 also shows that a Safety Assessment Methodology exists for all stages of the development process, although it is principally aimed at programmes up to implementation. European regulations (ESARR 2) demand that data on operational incidents of safety significance are collected and analysed, suggesting a safety learning process.

The white boxes show the aim of the EEC’s safety R&D efforts, with the italicised text giving the short titles of the projects themselves. The first area, building safety into design, is EEC-focused, and aims to ensure that all EEC studies give appropriate consideration to safety aspects. The second area supports EHQ’s safety activities, and also those EATM projects based at EEC, but also gives good feedback in any case to EEC ‘concept studies’. A particular area of concern for example, is that of Human Reliability, and how to deal with human error potential in safety cases. There is also the general question of how to assess hazard potential in future systems, as has been raised also in the ACARE report. Many assessments tend to focus on the local impact on the ATM system, rather than considering potential unintended ramifications on other parts of the ATM system. This requires some new ways of identifying hazards across normal intended ‘boundaries’ of systems, and ways of integrating many small sub-system risk assessments into an overall integrated ‘risk picture’.

1 http://www.eurocontrol.be/activities/safety/agas.html
2 www.acare4europe.org
The third area concerns the operational end of the system design life cycle. Firstly tackling some real issues, particularly those identified by AGAS, and secondly ensuring that we collectively learn from past and present events. Currently identified key risk areas include ‘short-term’ concerns such as level busts and runway incursions, and the added safety value of TCAS (Traffic Alert & Collision Avoidance System) RA (Resolution Advisory) Downlink to controllers. As well as short-term issues, there are some longer-term ones raised by AGAS such as the increasing complexity of airspace, traffic, and operational procedures, and their potential impact on controller performance and safety. AGAS also raised the need for a better understanding of why many incidents occur in ‘low vigilance periods’, when the controller’s ‘guard’ may be down. This needs to be better-understood and preventive measures developed.

The EEC has been involved for several years in developing tools to collect more comprehensive data on near misses and other safety-related events. In accordance with the AGAS recommendation and European regulations, ASMT (Automatic Safety Monitoring Tool) helps collect data on safety-related events, and SHIELD provides an interface between different European database system. Several member states now have ASMT, and several more are currently exploring its potential implementation. The ACAS (Airborne Collision Avoidance System) Monitoring Cell at EEC reviews TCAS events from around Europe and distils lessons from them, useful for enhancing safety.

This emphasis on safety recording and monitoring can help member states better understand their own safety at a local level, and has opened the way to ‘Safety Learning’ (see Figure 2). This means...
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that safety events are analysed and information is not only fed back to Operations, but also fed forward to designers, so that they can determine how to avoid current ‘error-forcing’ conditions for controllers, when designing future systems and interfaces. Additionally, information can also be used for safety analysis purposes, so that safety assessments are based on good knowledge of how current systems are failing or experiencing problems. In fact, without Safety Learning, projects such as SAFBUILD and SAFMOD could become ‘detached’ from reality, with the risk that we might repeat current mistakes in future designs, and assess systems as safe when they are not.

A major consideration concerns the need to increase safety significantly in line with the forecast increases in traffic if overall safety levels are to remain unchanged. A doubling of capacity by 2015 will necessitate a doubling of safety in the same period. The question is not only how to achieve this, but how to measure whether an effective safety increase has actually occurred. The European R&D Master Plan and the FAA-Eurocontrol Action Plan on Safety (AP-15) are addressing this question and it will be the focus of R&D work planned for 2004. Although the question is high-level, it is of prime importance and must be addressed. We cannot simply assumed that the safety target will be somehow reached.

In summary, there is much happening at present in the world of ATM safety R&D, and there are many new and good safety initiatives. Accidents have focused attention on some key risk areas, and there has been a realisation of the need for new techniques, the need to make systems safe at the design stage, and the need for feedback cycles to ensure we don’t keep repeating the same mistakes in new systems. There is also clearly a need for co-ordination of safety R&D activities given the complexity of the European ATM system, the diversity of the ATM development programme, and limited resources. The following sections focus on the EEC’s role in assuring a safer future ATM.

Figure 2: A key learning process for ATM Safety
2 The EEC’s role in safety

The Mission of the EEC is to carry out research and development in order to improve Air Traffic Management in Europe. In the last version of the EEC’s Business Plan, one of the main strategic orientations was to re-position Safety as the first priority at the EEC. This section helps to explain what this means in practice.

2.1 The Agency Perspective

The role of the Agency is defined in Annex 1 to the Revised Convention: the Statute of the Agency [Article 1.5]:

- Co-ordinate Research, Development, Trials and Evaluation programmes of national air traffic management organisations, including the collection and dissemination of results;
- Conduct common studies, tests and applied research as well as other technical developments.

The Agency is clearly entrusted with both the execution of research and the co-ordination of ongoing research within the EUROCONTROL Organisation. Furthermore, most stakeholders see EUROCONTROL as the unique pan-European organisation that should co-ordinate ATM/CNS Research.

As the R&D centre of the EUROCONTROL Agency, and along the lines defined in the ATM 2000+ Strategy, the “Raison d’être” of the EEC is thus to conduct and co-ordinate research in all fields relevant to the safe, efficient, and environment-friendly management and operation of the air transport system. The EEC should act as a catalyst through interactive research, involving technology suppliers from conception to field evaluation. Focussed on ATM whilst recognising both present and future needs of society, the EEC should promote global solutions to European problems. The EEC should therefore either lead or at least co-ordinate R&D in key areas such as ATM safety.

2.2 The EEC & Safety – from past to present, from implicit to explicit

The Eurocontrol Experimental Centre (EEC) was officially established as an external service of Eurocontrol Agency on the 10th June 1963, and its responsibilities were defined as:

- operational research and the testing of ATC methods
- operational demonstration of the validity of ATC system proposed
- operational and technical evaluation of control centre equipment

Within a stable public service environment context the scope of the EEC responsibilities has been gradually increased over the years and the EEC became a leader in the provision of ATM simulation services and a major ATM R&D centre.

From its origin, Safety has always been an EEC priority but this was not explicitly stated.

> During the last few years the EEC environment has changed, reflecting general changes in ATM and specifically a move to more explicit safety assessment. The EEC is now evolving in a new environment where more systematic and structured processes need to be developed to prove the safety levels achieved by all the EEC’s ‘products’. (J-P. Zabka, Ops)
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So, whilst safety has always been considered in EEC activities, in the design and concept work, and in the simulations, the rate of change and complexity of current and future ATM demands more systematic and sophisticated safety approaches. By moving from implicit to explicit Safety, the EEC clearly indicates that Safety is not treated as a ‘given’, and that the EEC is ready to apply more powerful safety methods, and ready to set and meet safety targets. This change in ATM and in the EEC is effectively a culture change. Such changes take time, and require structured approaches to maintain the momentum of change. This document therefore also later outlines the organisational structure supporting these changes from implicit to explicit safety consideration.

2.3 Safety Objectives for the EEC

The following system safety principle dictates that safety is built into systems, and this means that design and research efforts such as those at the EEC need to integrate safety into their projects and activities.

**EATM principle:** within the overall safety objective of maintaining and if possible minimising the ATM contribution to the risk of an aircraft accident, specific safety objectives and requirements shall be specified for all systems and their components. Wherever practicable, safety levels should be derived and maintained.

With regard to the foregoing sections therefore, the safety objectives for the EEC itself can be summarised as follows:

- **All EEC projects will know what they need to do to ensure safety, and the tools, frameworks, training and support to carry out these activities will be made available.**
- **EEC will foster the development of safety learning in the ATM industry, feeding lessons learned back into operations and forward into design.**
- **The EEC will carry out R&D to support the resolution of key near-term and short-term safety issues.**
- **The EEC will help to co-ordinate safety research and development in Europe.**

The following sections show how these objectives are to be realised.

3 Managing safety in research

The EEC does not produce final products or tools for implementation. Its primary role is the development of concepts and ideas, although it is also involved in developing tools to evaluate concepts. It is tempting to consider that safety is not a problem when working in research, as one is not dealing with hazardous materials or processes that can lead to direct harm to the researchers. Also, the researchers may feel far away from the real operational implementation of the concepts, and so do not know how it may ultimately be locally adapted and used. However, many accidents have their root causes in design, and it is therefore the responsibility of design and concept work to consider how safety problems could arise, and also how the work could overcome existing or future safety problems. Design and concept developments should aim to be ‘resilient’ against accidents.

Furthermore, even if some EEC projects are never intended for implementation, the work we do here on such projects may be taken up later on by others outside Eurocontrol and developed further. Additionally, insights may arise from such projects that are nevertheless useful for other projects or operational developments. Therefore it is important to capture safety insights from EEC projects, so that potential future developers will understand the safety issues that have already been identified. Safety should be an explicit ‘property’ of our work. This section therefore explains a safety management approach for research carried out at the EEC.
To help States develop their own safety management systems, EATM has developed a common Safety Policy statement and principles, reflecting best safety practices in three 'pillars': safety achievement, safety assurance and safety promotion. Assuming that this framework is equally applicable for safety research, the same three pillars are needed for management of safety at the EEC. These 'pillars' are therefore described below. In several cases, relevant safety management principles are highlighted (in boxes) to help see the connection between safety at the EEC and safety in operational ATM.

### 3.1 Safety achievement

#### Safety occurrences:
**ANS operational or technical occurrences that are considered to have significant safety implications should be investigated immediately and any necessary corrective action taken.**

#### 3.1.1 Learning from mistakes and near misses

The importance of Safety Learning is widely acknowledged in the ATM community as a high priority activity. Through a process of safety-related event data gathering (e.g. operational incidents), investigation, analysis and exchange, safety professionals are able to build up knowledge and understanding of safety problems. This creates a safety learning cycle:

- learning from incidents and safety-related events feeding back to operations and forward to design;
- assessment of design feeding forward to operations, in terms of how to operate more safely and how safe the system should be.

This safety learning cycle (see earlier Figure 2) is not yet fully developed in ATM. A key program at the EEC is to develop a Safety learning approach, developing suitable analysis methods to extract the lessons learnt from the collected data. In some industries, design projects can access databases of previous incidents to see what has happened before, that is related to a particular design project. The SAFLEARN project will aim to develop such a capability to support EEC design and concept work, although the priority for such analyses will always be Operations, where lessons need to be learned very quickly before an accident happens.

#### 3.1.2 Building Safety into Design

There is already a great deal of guidance on design, e.g. in the area of human factors, but such information tends often to be piecemeal, and can result in difficult trade-offs for designers who are trying to develop a coherent system and operational concept of use. Safety should be specified at the start of a project, and embedded in all design phases, (architecture, functions, roles, software, HMI and working practices). However, few projects are able to achieve this, and so safety is often only partially considered or added on later. The SAFBUILD project aims to develop better 'Safety-in-Design' practices and processes, including 'cascading' of high level safety design principles into lower level specifications of design and intended operation of the system. Certain projects in the EEC and at the FAA have already begun to explore how to do this, and SAFBUILD will aim to develop practicable processes to achieve safer design processes.

A sub-project of SAFBUILD is also looking at how to get more explicit safety insights from our simulations (SAFSIM). This will enable project teams to be able to make more explicit and comprehensive statements about the safety properties and adequacy of new systems or tools based on the results of their simulations. This will also address certain key validation issues related to safety.
3.1.3 Safety Support in ATM key risk areas

Safety research at the EEC is part of the more general 'Safety Team', mediated by EUROCONTROL HQ’s (EHQ) Safety Enhancement Unit (SAF), and including safety representation from many European member state ANSPs. SAF in EHQ aims to help member states directly, supporting them with their safety issues and safety assessments. The Safety Research Team (SRT) at the EEC supports these shorter-term safety research needs, such as those already mentioned earlier (e.g. level busts, TCAS RA Downlink, Complexity). This work ensures that the EEC stays connected with the real safety issues that the Member States’ Safety Managers are concerned with. Key findings will be passed rapidly through the SAFLEARN and SAFBUILD projects to EEC concept projects, so they can benefit from the insights gained.

3.1.4 Safety Assessment Methodology Development

The development of new approaches for safety assessment and safety assurance, for use both externally and by EEC projects, fits into a project area called SAFMOD (Safety Modelling). Two safety assessment tools, HAZOP and TRACER (hazard and human error identification tools respectively) have recently been tested for use at the EEC, and other new tools are also being evaluated. Work is planned on methods of human error quantification, as well as integrated risk assessments of entire future ATM architectures, rather than piecemeal assessments.

3.1.5 Safety R & D Co-ordination

Managing Safety research is also about managing knowledge and expertise. In Europe there are several research centres carrying out safety-related research, so there is a real need for at least a basic level of European Safety R&D co-ordination. One accident will affect not merely one airline or one country, but all of ATM, so there is much to be gained from a co-ordinated approach. The EEC is aiming to lead a safety co-ordination initiative in Europe, to develop a framework of ongoing research in the ECAC region. This will prevent researchers going down fruitless paths, and should lead ultimately to better sharing of resources and competencies to answer complex safety problems. Such co-ordination activities will also be useful for EEC, as the Safety Co-ordinator will be able to keep individual Business Areas and EEC projects up to date with relevant safety initiatives and developments across Europe.

3.2 Safety assurance

3.2.1 Safety Assessment Method for EEC Projects

| System safety assessment (1): All new systems, and changes to operational systems, shall be assessed for their safety significance. The assessment shall address the three types of system components: people, procedures and equipment … |

| Risk management process: A risk management process should be specified and implemented. This process should define criteria for assessing the acceptability and tolerability of identified risk, identify points of responsibility for reviewing, accepting and controlling identified risk and define the precedence policy for the mitigation of identified risk. |

Not all EEC projects need a detailed safety assessment, but they do all need to be addressed to see what their safety requirements might be, even if it turns out to be none. The regulator for
EATMP projects has developed, together with the Safety management Unit (SMU) in Brussels, a Safety Assessment Methodology (SAM), in line with ESARR4. All EATMP projects have to carry out a formal safety assessment, and indeed several projects at the EEC are in the process of doing this. However for concept projects, such extensive analysis may be inappropriate. A 'lighter' form of assessment might be required. Such considerations are being developed in SAND (Safety Assessment for New Designs), which aims to give each project a basic Safety Plan, and help the project decide what level of safety assessment is needed.

SAND will deal with a number of high priority projects in 2003, and then extend to all projects during 2004 and 2005. Thus all projects will have a safety plan. Some projects will also have a degree of safety assessment (e.g. hazard identification and severity classification), a form of 'hazard logging', so that any identified hazards are not forgotten and are addressed, and a safety conclusion at the end of the project. In this way every project will know what it should be doing about safety. SAND will also help projects to identify any quantitative safety requirements, and to put in place a mitigation plan against significant safety threats.

3.2.2 Safety monitoring & recording

Safety monitoring: Methods should be in place to detect changes in systems or operations which may suggest any element is approaching a point at which acceptable standards of safety can no longer be met and corrective actions should be taken.

Safety records: Appropriate safety records should be maintained in order to provide evidence and arguments that demonstrate the continuing ability to provide safe services.

This will be part of the Project Review Process. Safety-related concerns as identified in the hazard log should be reviewed periodically to see how safety is being managed for the project. Where simulations are being carried out for an EEC project, measurement of safety via the measures being developed in the SAFSIM project will allow a more objective form of safety monitoring. In some cases, it may even be possible to use ASMT during real-time simulations to gain better and more complete safety information. The safety logging system for projects will enable safety concerns to be tracked throughout the project to see how they are being dealt with. Such safety records should form part of the final documentation for EEC projects, and may be included in the Validation Data Repository (VDR).

3.3 Safety promotion

3.3.1 Training for Safety

Competency: Staff shall be adequately trained, motivated and competent for the job they are required to do.

There will be three levels of safety training:

- general safety awareness (how safety works and can fail in ATM),
- how safety fits into projects and what projects need to be aware of,
- practitioner level training for actually doing safety analysis.

The first priority is to train the Safety Research Team in safety assessment methods for EEC and EATM project-related support. EEC Project leaders will also be given basic training in these assessment methods at an overview level, and a selection of project team members (both operational and non-operational experts) will be provided with more extensive training.
3.3.2 Lesson dissemination

The lessons arising from safety occurrence investigations and other safety activities should be disseminated widely within units and passed up to the management chain to enable wider dissemination as appropriate.

This will happen via the SAFLEARN project. There will be twice-yearly seminars on safety lessons learned, documentation disseminated directly to projects, and general documentation available on the web and through ad hoc ‘Weekly Information Corner’ (WIC) presentations.

3.3.3 Improving Safety: EEC Safety culture maturity

Safety improvement: All staff should be actively encouraged to propose solutions to identified hazards, and changes should be made to improve safety where they appear needed

It is important that all staff at the EEC are aware of the safety implications of their activities and decisions on the design of safe systems. Safety awareness needs to be actively promoted at the EEC with the goal of developing a ‘safety culture’. Safety culture has been defined as: “the set of beliefs, norms, attitudes, roles and social and technical practices that are concerned with minimising the exposure of employees, managers, customers and members of the public to conditions considered dangerous or injurious”. It has also been defined as ‘the way we do safety round here’.

Most ATM organisations collect information about ‘reactive’ indicators of safety, such as loss of aircraft separation. However, information from such occurrences can be limited. One challenge for the EEC has been to develop a method that can be applied at the research and design stage, in order to identify safety critical issues early on. The EEC recognises safety as an essential aspect of ATM research and design and is striving for higher levels of safety awareness and commitment to safety from its staff. Thus it was decided to measure safety culture in the EEC.

How do you measure safety culture?

The Safety Culture Maturity Model (SCMM) has already been used in high-reliability organisations, including ATM. SCMM contains 5 iterative stages of maturity (Figure 3), where organisations can progress sequentially by building on their strengths and removing their weaknesses.

![Figure 3: Safety culture maturity model](image)

The first Safety Culture measurement of the EEC took place in March 2003, and it was found that the EEC has a reasonable degree of safety culture, but that there is plenty of room for improvement. The following five issues (already addressed in the present document) were found to require action:
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- training and involvement in safety activities
- risk assessment and management
- auditing safety
- implementation of cross-company teams to address particular high-level company wide safety issues (such as SAGE, the Safety Awareness Group in the EEC),
- development of a Safety management system

A focal group will therefore be put in place to determine the priorities for improvement and thereafter a suitable action-plan based on the items above. Safety culture will be measured again late-2004, to see if any change (positive or negative) has occurred.

### 3.3.4 Development of an EEC Safety Management System (SMS)

There now exists a European regulation for all ANSPs to have a Safety Management System in place. Clearly, if the EEC is committed to safety, then the EEC should also develop a SMS. This is also in line with a recent Agency decision to develop a SMS for the Agency itself.

The EEC SMS, to be developed in 2004, should be seen as a formalisation of our means to achieve safety in our work. The link between the SMS and 'local' EEC tasks and processes needs to be developed and should be transmitted to, and understood by, EEC staff. Initially, information on SMS (in the form of discussions and workshops) and how this could impact their projects will be provided to project core teams.

The above subsections may now be summarised as a safety management framework for the EEC, using the three pillars concept raised earlier:

![Safety Management Framework Diagram](image)

**Figure 4: EEC Safety management framework**

Safety management functions should be established at the EEC for ensuring the development and the maintenance of the SMS. The Safety Co-ordinator, irrespective of other responsibilities, should report to the top management on the performance of the SMS including needs for improvement. He should also ensure awareness throughout the EEC on safety management issues. The major
objective of safety management is to contribute to continuous safety improvement. Therefore, overall safety performance should be measured. Appropriate data should be analysed for identifying where improvements can be made and for evaluating effectiveness of the safety management system.

4 Organising for Safety at the EEC

This section describes the EEC organisational structure and how Safety interfaces within that structure. The CoE are responsible for people management and for the development of expertise and methodology in their respective domains. The role and responsibilities of the Heads of Centre of Expertise include:

- career development of staff,
- participation in skill and staff plan management,
- decision making on staff allocation,
- recruitment (post description, selection jury and interview board),
- production of Individual Training Plans as well as the EEC Training Plan,
- appraisal of their staff’s performance.

The SAS Centre of Expertise (‘Safety, Analysis and Science’), is home to the scientific staff, which is in particular developing expertise in safety, validation and experimental methods. It is here that the administrative centre for Safety R&D lies.

4.1 Safety and the EEC Organisation

The EEC (Core Business and Support Services) is organised as a matrix with the Centres of Expertise (CoEs) on the horizontal axis and the Business Areas (BAs) and Business Enablers (BE) on the vertical axis. The BA represent the Core Business and the set of BE correspond to the Support functions. Responsibility for projects and enabling services lies with the Business Areas and Business Enablers. BA and BE Managers are entirely responsible for:

- achieving the objectives of their BA/BE in accordance with the EEC Business Plan,
- the internal organisation of their organisational unit,
- the management of their budgets.
Discussions have taken place between SAS and each Business Area to determine safety R&D needs of each BA, their priorities, and resources available to support safety activities. It is the intention that most safety activities, including safety R&D projects, become aligned with relevant Business Area interests, so that they ‘reside’ in the BAs. This will help truly embed the safety activities into the central work of the EEC, rather than having safety R&D as a set of activities isolated from the ‘Core’ work of the EEC. This alignment and re-orientation will take some time, but is already in process. Projects developing new tools and methods, or otherwise involving studies of general interest to several BA, will be managed from the SAS CoE e.g. ACAS Monitoring, Safety Learning, etc.

The matrix organisation ensures an efficient use of available skills through all projects. Staff with a required skill (e.g. Safety) can be temporarily assigned to projects for the duration of a task, then becoming free again for a new assignment afterwards, ensuring a dissemination of the know-how in all EEC activities. Non-safety staff can also join Safety for a period to learn new skills.

4.2 The Safety Research Team (SRT)

A Safety Research Team has been set up comprising a Safety Co-ordinator and experts in domains such as ATC operations, general and avionics safety, and human/organisational factors. SRT members belong to the SAS CoE, with the exception of the operational experts who remain in the OPS CoE, which helps the dissemination of safety work and insights.

The main tasks of the SRT consist in:

- acting to raise safety awareness of all EEC members
- assisting project teams in addressing and managing safety throughout their projects,
- developing and running specific projects aimed at supporting maintenance and improvement of operational safety in ATM.
The SRT currently has a complement of thirteen personnel (target is fifteen), who work on specific safety projects and Business Area related projects. These people ‘animate’ safety within the EEC, and also work with member states on specific safety issues. The activities of the SRT and of the EEC are led by a Safety Co-ordinator who works together with the Head of SAS, the BA managers and the Core Management.

Figure 6: The SRT team

4.3 Safety Responsibilities at EEC

Safety is the responsibility of everyone working at the EEC. Those working on EEC projects are responsible for raising and channelling any potential safety concerns or insights within the project.

The EEC Operational Director sets the overall EEC internal budget for safety research, within the confines of the overall EEC budget allocations. The Safety Co-ordinator is responsible for the SSRP and the Safety R&D Plan and for providing inputs to the European R&D Master Plan. He aims to balance the various needs of Business Areas and other non-EEC requirements (EHQ, MUAC (Maastricht Upper Airspace Centre), CRDS (CEATS Research Development Simulator), Safety Team, etc.) with the resources available, and is responsible for determining Delegation Agreements from EHQ for R&D support to EHQ safety initiatives. The Head of the SAS CoE ensures that sufficient staff resources (people and competencies) are available for the activities identified, and jointly these two work with the Business Area managers to determine the level of project safety support required. Members of the SRT are responsible for running the various Safety R&D projects which embody the SSRP and the Safety R&D Plan. Other project managers are responsible for identifying safety needs either with their BA managers or with the SRT.

5 Safety Interfaces

Safety at the EEC needs to interface with other Eurocontrol units, in particular EHQ’s Safety Enhancement (SAF: Programme) and Safety & Security Management’s developing safety programme (SSM: Domain). These two units support Member States and EATM Programmes respectively with safety issues. The Safety Regulatory Unit (SRU) oversees the development and appropriateness of safety assessment methodologies and so also interfaces with the EEC. EEC SRT also work closely
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on certain projects with Human Resources Unit (HUM) in HQ and at the EEC (e.g. via the Human Factors Lab), as human performance issues are key to maintaining and improving safety in future ATM. Good links also exist with Maastricht Upper Airspace Centre (MUAC), and is developing links with CRDS in Budapest. Additionally, there are good working relationships with IANS (Institute of Air Navigation Services) in Luxembourg. IANS, along with SAF, are helping to train EEC staff in the area of safety assessment.

Additionally, there are growing links between the EEC and European Commission (EC), FAA, ICAO, IATA, and IFATCA, and with the member states themselves, all of which help to maintain a clear understanding of key safety issues.

6 Safety Targets for the EEC

A strategic safety research plan must have targets for its activities. Although the detail of the work and its resources and planning will be provided by the updated Safety R&D Plan, it is worth specifying the main goals.

Ten major targets are envisaged as follows over the next three years:

- EEC projects will have the safety assessment support they need in the short term. The SAND project will develop a safety assessment and safety planning approach for EEC projects. A subset of projects will be supported in 2003, and all projects will have a safety plan in place by end 2005, with most projects by that time also carrying out an appropriate level of safety assessment work.
- Safety learning will demonstrate the ‘safety learning cycle’ by analysing incident reports and deriving useful lessons for operational, safety assessment, and in particular, design environments. Initial lessons will be presented at the EEC in 2004, in what will become a once or twice-yearly ‘digest’ of lessons extracted from analysis of ATM safety experience.
- Training in safety at the EEC will continue with a range of general and specific safety courses to help EEC staff improve their awareness of safety issues and acquire skills in practical safety analysis where appropriate. The aim is for all staff to have received at least some general safety training by 2005.
- An annual safety culture review will assess the degree to which improvement has occurred compared to the baseline derived in 2003.
- During 2003/4, methods will be put in place to derive more explicit safety information, which can be used as part of safety cases, from simulation studies.
- Key safety risk target areas such as level busts will be investigated to identify new means to reduce the risk of such accidents (2004).
- Research on complex issues, such as controller interaction with safety nets, and controller performance in low-vigilance periods, will be undertaken in 2004/5. Such work will aim to identify mitigation against human error in such situations.
- Longer-term issues, such as how controllers will manage increased complexity in future air traffic scenarios, will be analysed in 2004 - 2005.
- A Design Safety Information database will be developed through the SAFBUILD project in 2005. This will help new EEC projects gain timely access to relevant safety information from other projects.
- A Safety Management System (SMS) will be developed for the EEC, in line with the Agency’s developing SMS.

7 Conclusions

This Strategic Safety Research Plan has outlined what safety activities are needed and the role of Safety at the EEC in supporting those needs. It has also shown how Safety will be managed and
organised at the EEC, how such work connects with safety activities outside of the EEC, and has
given an indication of the main strategic targets over the next few years. However, safety
management is an ongoing process and a new accident possibly could shift the focus of safety R&D.
Nevertheless, the basic approach outlined in this document and the fundamental questions are
unlikely to change in the short term. Therefore, the strategy has sufficient stability to yield sustainable
results that will help improve European ATM safety. The EEC’s role in this strategy is thus established
by this SSRP.
This document is a starting point for understanding what the EEC is doing about safety. Hopefully it
will generate some discussion, since safety is never just about words written on paper. Safety is
instead about what is built into systems and their procedures, and it is about what is in the minds of
those people developing, assessing, operating, maintaining and managing those systems. A safe
culture is one where people are thinking and talking about safety.
8 Glossary

ACARE: Advisory Council for Aerospace Research in Europe
ACAS: Airborne Collision Avoidance System
AGAS: Action Group on ATM Safety
ANSP: Aviation Navigation Service Provider
ASMT: Automatic Safety Monitoring Tool
ATC: Air Traffic Control
ATM: Air Traffic Management
BAs: Business areas
BE: Business Enablers
CoE: Centre of expertise
CRDS: CEATS Research Development Simulator
EATMP: European Air Traffic Management Programme
EC: European Commission
ECAC: European Civil Aviation Conference
EEC: EUROCONTROL Experimental Centre
EHQ: EUROCONTROL Headquarters
ERDMP: European R&D Master Plan
ESARR (2/4): Eurocontrol safety Regulating Requirements
FAA: Federal Aviation Administration
IANS: Institute of Air Navigation Services
IATA: International Air Transport Association
ICAO: International Civil Aviation organisation
IFATCA: International Federation of Air Traffic Controller’s Associations
MUAC: Maastricht Upper Airspace Centre
R&D: Research & Development
RA: Resolution Advisory
SAF: Safety Enhancement Unit
SAFBUILD: Building Safety into “Design”
SAFLEARN: Learning about safety from operational experience
SAFMOD: Safety modelling
SAFSIM: Simulation for Safety insights
SAGE: Safety Awareness Group in EEC
SAM: Safety Assessment Methodology
SAND: Safety Assessment for New Designs
SAS: Centre of Expertise “Safety Analysis & Science”
SCMM: Safety Culture Maturity Model
SMS: Safety Management System
SMU: Safety Management Unit
SRT: Safety Research Team
SRU: Safety Regulatory Unit
SSM: Safety Security Management
SSRP: Strategic Safety Research Plan
TCAS: Traffic Alert & Collision Avoidance System
VDR: Validation Data Repository
WIC: Weekly Information Corner